

COVID-19-Related Hospitalizations in 13 States, by Patient Location, 2020

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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 patient location from April to September 2020 are compared with all hospitalizations for the same months in the prior year. 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.^{1,2} All information contained in this Statistical Brief (except age-adjusted in-hospital mortality rates) can be found in the [HCUP Summary Trend Tables](#).³ 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

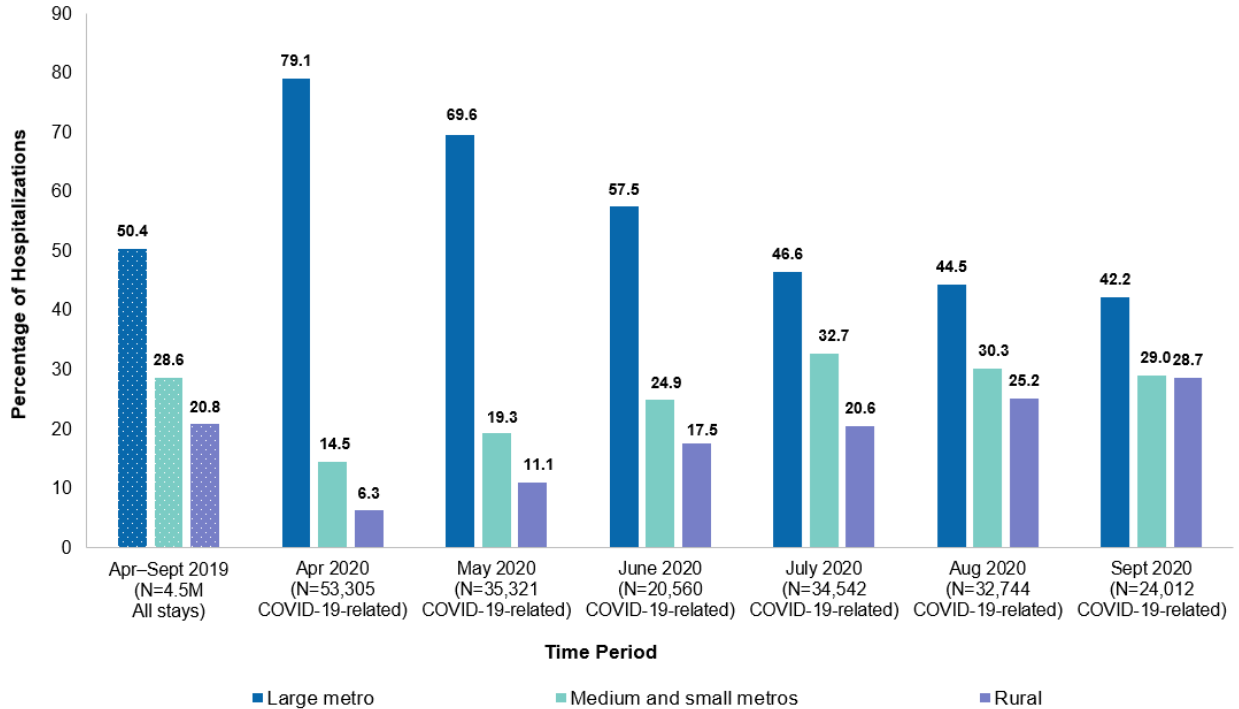
Differences in COVID-19-related hospitalizations, by patient location, April–September 2020

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 patient location (large metro, medium/small metro, and rural). As a reference, the distribution of all hospitalizations in the same States during April–September 2019 is also shown.

Highlights

- In April 2020, across 13 States, almost 80 percent of COVID-19-related hospitalizations were for patients from large metro areas, whereas only 6 percent were for patients from rural areas. By September 2020, 42 percent of COVID-19-related hospitalizations were for patients from large metro areas, whereas 29 percent were for patients from rural areas.
- Between April and September 2020, the monthly observed (unadjusted) COVID-19-related in-hospital mortality rate decreased 57 percent for patients from large metro areas and 35 percent for patients from rural areas.
- In April 2020, after adjusting for age, the COVID-19-related in-hospital mortality rate for patients from large metro areas was higher than the rate for patients from other areas.
- In June 2020, the COVID-19-related age-adjusted in-hospital mortality rate was highest for patients from rural areas compared with patients from other areas.
- Across the time period, age-adjusted in-hospital mortality rates varied by month, patient location, 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 patient location, 13 States



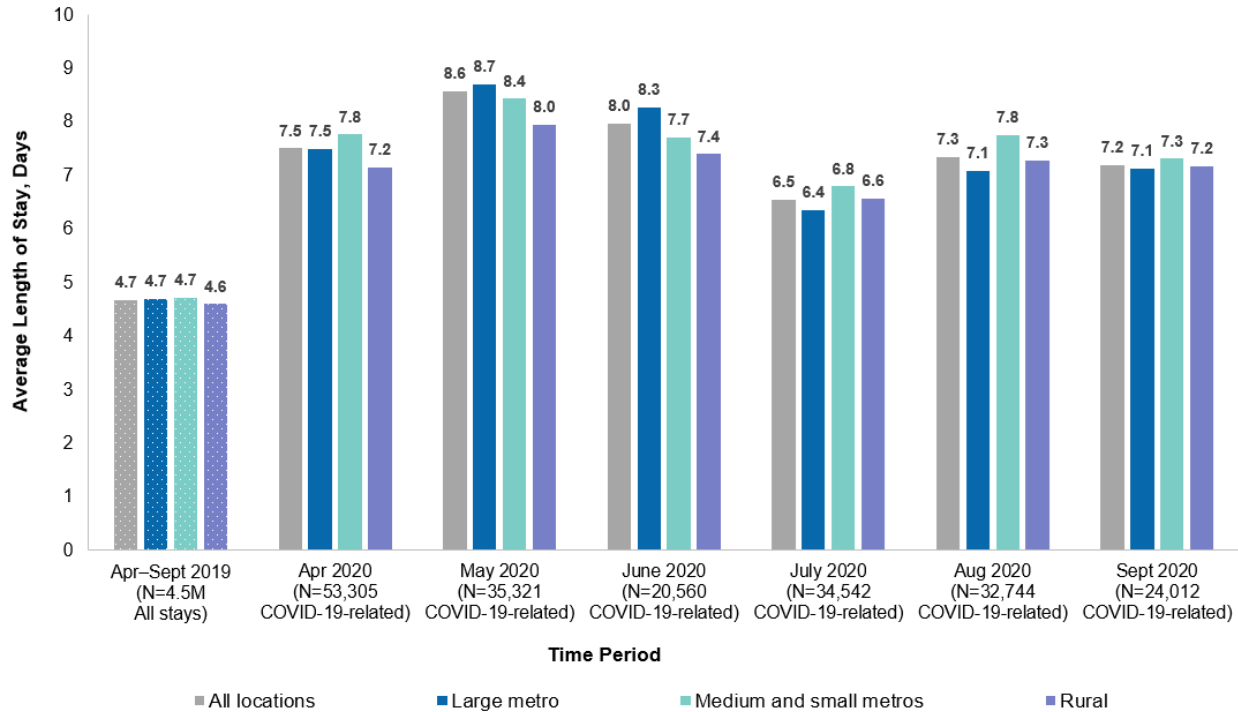
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- Using the distribution of all hospitalizations in 2019 as a reference, patients from large metro areas in this set of 13 States accounted for a larger share of COVID-19-related hospitalizations in April, May, and June 2020 than they did for all hospitalizations in April through September of the prior year. Patients from medium/small metro and rural areas (combined) accounted for a disproportionate share of COVID-19-related hospitalizations in July, August, and September 2020 than they did for all hospitalizations in April through September 2019.
- The share of COVID-19-related hospitalizations for patients from large metro areas decreased from almost four out of five (79.1 percent) in April 2020 to about two out of five (42.2 percent) in September 2020.
- Patients from rural areas accounted for an increasing percentage of COVID-19-related hospitalizations over this period, ranging from 6.3 percent in April 2020 to 28.7 percent in September 2020, a nearly fivefold increase.

Differences in average length of COVID-19-related hospitalizations, by patient location, April–September 2020

Figure 2 presents the average length of COVID-19-related hospitalizations in April–September 2020 across these 13 States, by patient location (large metro, medium/small metro, rural). 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 patient location, 13 States



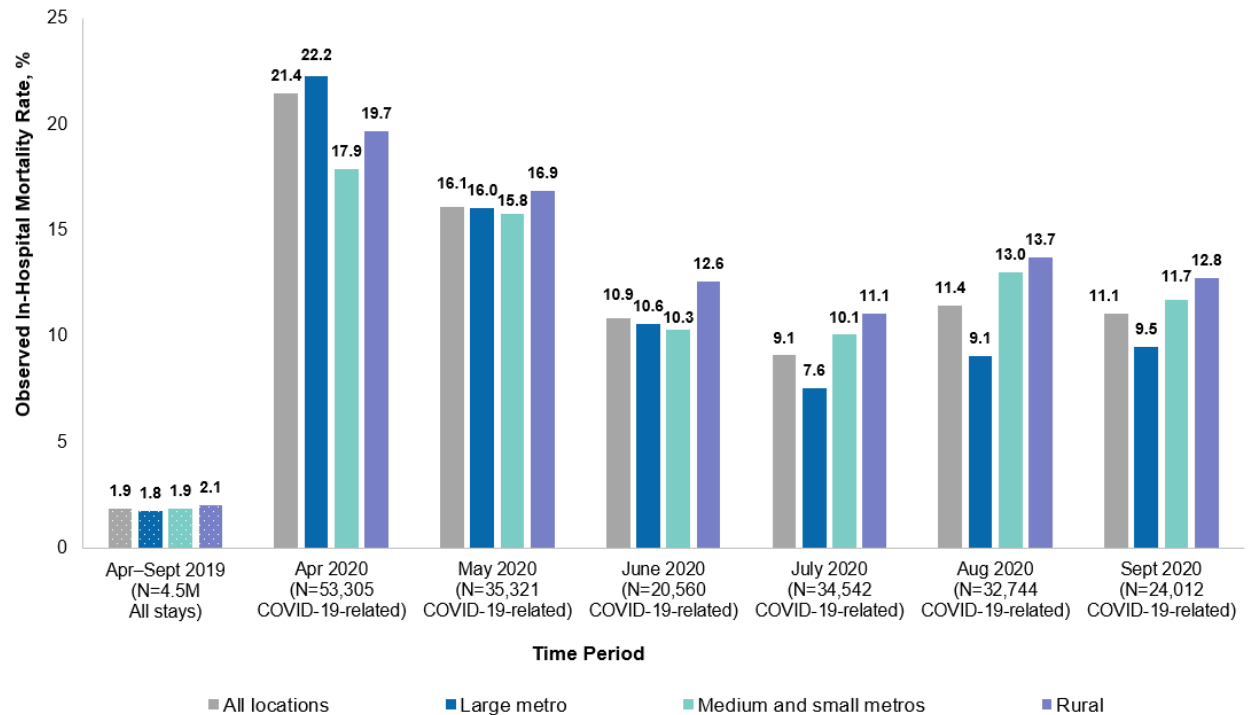
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- The average length of stay for COVID-19 hospitalizations was higher for each location in every month over this 6-month period compared with overall hospitalizations for the same period in 2019.
- COVID-19-related hospitalizations for patients from large metro areas were longer in May and June 2020 and shorter in July 2020 than these same hospitalizations in any other month (8.7, 8.3, and 6.4 vs. 7.1–7.5 days, on average, respectively).
- On average, the lengths of COVID-19-related hospitalizations for patients from medium and small metro areas were shorter in July 2020 than these same hospitalizations in any other month (6.8 vs. 7.3–8.4 days, respectively).
- COVID-19-related hospitalizations for patients from rural areas were 18 percent longer in May than in July 2020 (8.0 vs. 6.6 days, on average, respectively).

Differences in in-hospital mortality for COVID-19-related hospitalizations, by patient location, 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 patient location (large metro, medium/small metro, rural). 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 age distribution across population subgroups.

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 patient location, 13 States

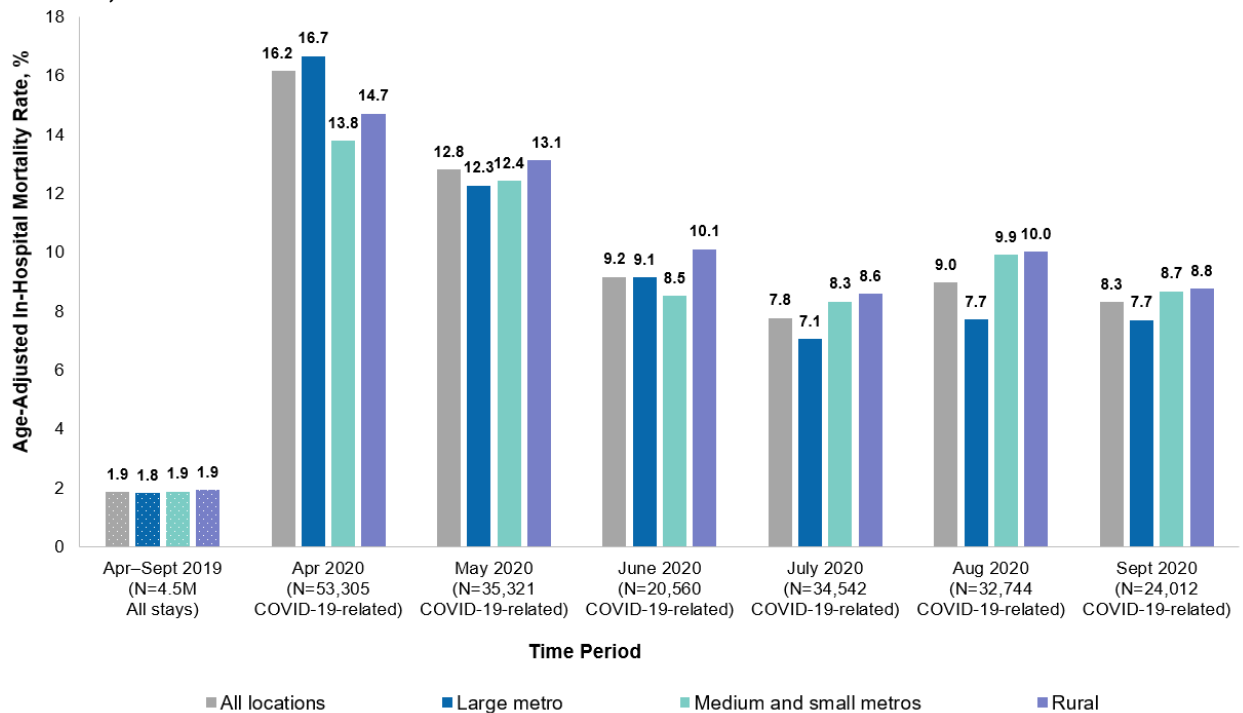


Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- The observed (unadjusted) COVID-19-related in-hospital mortality rate for patients from large metro areas decreased 57 percent, from 22.2 percent in April 2020 to 9.5 percent in September 2020.
- Similarly, the observed (unadjusted) COVID-19-related in-hospital mortality rate for patients from rural areas decreased 35 percent, from 19.7 percent in April 2020 to 12.8 percent in September 2020.

To account for the differences in in-hospital mortality due to age, Figure 4 displays the age-adjusted in-hospital mortality rate for COVID-19-related hospitalizations in April–September 2020 across the 13 States, by patient location (large metro, medium/small metro, rural). The magnitude of the rates presented in this figure is dependent on the standard population used to adjust for age. In this case, we used the nationwide standard 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 patient location, 13 States



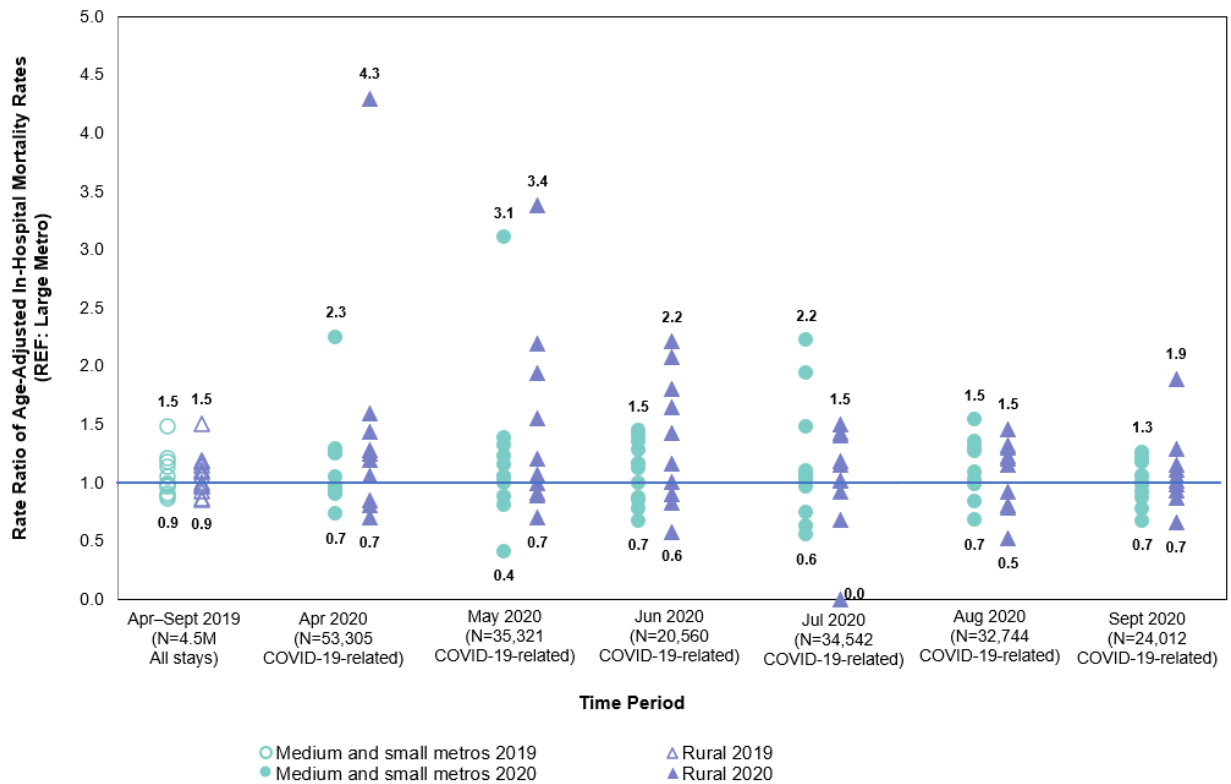
Note: In-hospital mortality rates were adjusted for age based on the national age distribution of hospitalizations for patients in the 2018 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS).

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)

- After adjusting for age, the COVID-19-related in-hospital mortality rate for patients from large metro areas was highest in April 2020 compared with every other month (16.7 vs. 7.1–12.3 per 100 standard hospitalized population). In April 2020, the rate for patients from large metro areas was higher than the rate for patients from other areas (16.7 vs. 13.8 and 14.7 per 100 standard hospitalized population). In every other month, the age-adjusted COVID-19-related in-hospital mortality rate for patients from large metro areas was similar to or lower than the rate for patients from other areas.
- Between April and July 2020, the COVID-19-related age-adjusted in-hospital mortality rates declined 57 percent for patients with COVID-19 from large metro areas (16.7 to 7.1 per 100 standard hospitalized population), 40 percent for those from medium/small metro areas (13.8 to 8.3), and 41 percent for those from rural areas (14.7 to 8.6).
- In June 2020, the COVID-19-related age-adjusted in-hospital mortality rate was highest for patients from rural areas compared with patients from other areas (10.1 vs. 8.5–9.1 per 100 standard hospitalized population, respectively).
- In August and September 2020, the COVID-19-related age-adjusted in-hospital mortality rate was higher for patients from medium/small metro and rural areas compared with patients from large metro areas (August: 9.9 and 10.0 vs. 7.7; September: 8.7 and 8.8 vs. 7.7 per 100 standard hospitalized population, respectively).

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 patient location. 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 location category (i.e., age-adjusted in-hospital mortality rate for a specific location category in a State divided by the age-adjusted in-hospital mortality rate for patients from large metro areas in the same State). If there were fewer than 30 discharges in a State-specific patient location 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 patient location, 13 States



Abbreviation: REF, reference group

Note: If there were fewer than 30 discharges in a State-specific patient location 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 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- State-specific COVID-19-related age-adjusted in-hospital mortality RRs varied by patient location and across time.
- Using April–September 2019 as a reference (and accounting for the outliers), the variation in State-specific COVID-19-related age-adjusted in-hospital mortality RRs in May–June 2020 were comparatively larger among patients from rural areas (reference group: those from large metro areas).

References

¹ 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. Accessed March 1, 2021.

² 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. Accessed March 1, 2021.

³ 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. 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.^{1,2} 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.

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,^a 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.

Location of patients' residence

Place of residence is based on the urban-rural classification scheme for U.S. counties developed by the National Center for Health Statistics (NCHS) and based on the Office of Management and Budget (OMB) definition of a metropolitan service area as including a city and a population of at least 50,000 residents. For this Statistical Brief, we collapsed the NCHS codes into the following three categories:

Large metropolitan (metro) area:

- Large Central Metropolitan: Counties in a metropolitan area with 1 million or more residents that satisfy at least one of the following criteria: (1) containing the entire population of the largest principal city of the metropolitan statistical area (MSA), (2) having their entire population contained within the largest principal city of the MSA, or (3) containing at least 250,000 residents of any principal city in the MSA
- Large Fringe Metropolitan: Counties in a metropolitan area with 1 million or more residents that do not qualify as large central metropolitan counties

Medium/small metro area:

- Medium Metropolitan: Counties in a metropolitan area of 250,000–999,999 residents
- Small Metropolitan: Counties in a metropolitan area of 50,000–249,999 residents

Rural area:

- Micropolitan: Counties in a nonmetropolitan area of 10,000–49,999 residents
- Noncore: Counties in a nonmetropolitan and nonmicropolitan area

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.

^a 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. Accessed February 10, 2021.

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.

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:

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

Mississippi State Department of Health
Missouri Hospital Industry Data Institute
Montana Hospital Association
Nebraska Hospital Association

Washington State Department of Health
West Virginia Department of Health and Human
Resources, West Virginia Health Care
Authority
Wisconsin Department of Health Services
Wyoming 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. 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.

For additional HCUP statistics, visit:

- HCUP Fast Stats at 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/
- HCUP Summary Trend Tables at 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/.

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. 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 or send a letter to the address below:

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