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Medicare Beneficiaries Hospitalized With COVID-19 Experienced a Wide Range of Serious, Complex Conditions

Key Takeaways

- Medicare beneficiaries hospitalized with COVID-19 were treated for a wide range of complex conditions such as acute respiratory failure, kidney failure, and sepsis.
- More than half of hospitalized Medicare beneficiaries with COVID-19 received intensive care or mechanical ventilation.
- Dually eligible, Black, Hispanic, or older beneficiaries were disproportionately hospitalized with COVID-19.

Coronavirus disease 2019 (COVID-19) has affected millions of Americans, resulting in more than 600,000 deaths.[1] Medicare beneficiaries have been particularly affected and remain vulnerable to new variants and additional surges of the virus. Clinicians and researchers are still working to fully understand the damage to the body from the disease and what underlying chronic conditions potentially lead to more severe complications or hospitalization.

Understanding the types of conditions for which Medicare beneficiaries with COVID-19 are being treated and who was more likely to be hospitalized with COVID-19 can help hospitals and health officials better prepare for and address the wide-ranging and extensive needs of COVID-19 patients, particularly in the event of localized surges of cases. Such knowledge will also assist in the Federal, State, and local response to the pandemic by providing a better picture of the needs of these hospitalized beneficiaries.

This report describes the complex care needs of beneficiaries hospitalized with COVID-19. It focuses on surges in COVID-19 hospitalizations in six localities and builds upon prior OIG work that describes the extent to which hospitals have been strained by COVID-19.[2] As we noted in the 2021 report about hospital experiences during the pandemic, hospitals have been operating in "survival mode" for an extended period of time. They have also experienced difficulty balancing the complex and resource-intensive care needed for COVID-19 patients with efforts to resume routine hospital care.

How OIG Did This Review

We reviewed hospital inpatient claims and enrollment data to identify all Medicare beneficiaries who were hospitalized in a short-term acute-care hospital at any point from April 1 through July 31, 2020. We then identified six localities that experienced a surge in hospitalizations of Medicare beneficiaries with COVID-19 over a 3-week period.[3] We analyzed the diagnoses on the claims of beneficiaries hospitalized with COVID-19 in those six selected localities to identify the conditions for which they were treated during their hospital stays. The percentages presented in this report represent averages among the six localities.

What OIG Found

During surges in hospitalizations, hospitals in the six localities treated Medicare beneficiaries with COVID-19 for a wide range of serious, complex conditions. Almost all of these beneficiaries were treated for acute respiratory issues, such as viral pneumonia. Many of these beneficiaries were also treated for other types of serious conditions including:

- almost half were treated for acute kidney failure,
- almost half had acute circulatory issues,
- almost two-thirds were treated for significant endocrine, nutritional, or metabolic issues, and
- more than one-third had sepsis.

More than 50 percent of Medicare beneficiaries hospitalized with COVID-19 received intensive care or mechanical ventilation. Additionally, dually eligible, Black, Hispanic, or older beneficiaries were disproportionately hospitalized with COVID-19 relative to the Medicare population in these localities.

What OIG Concludes

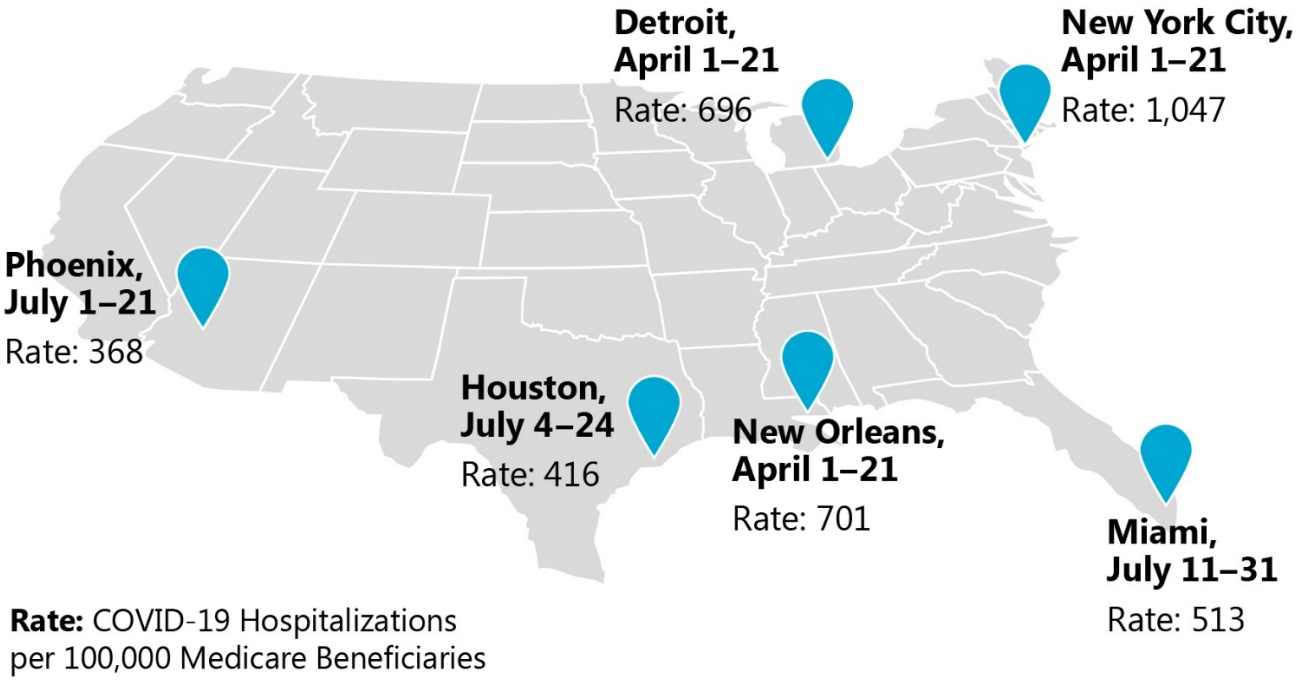
The complex needs of hospitalized Medicare beneficiaries—combined with surges in hospitalizations—may create substantial challenges in meeting the needs of these patients, particularly in light of the staffing and other problems that hospitals have reported. Gaining a better understanding of Medicare beneficiaries hospitalized with COVID-19—including the conditions for which they were being treated and demographic characteristics—can assist Federal, State, and local efforts during the COVID-19 pandemic and may be used to provide additional guidance to hospitals. This information can also help hospitals, physicians, and other practicioners better prepare for the complex and resource-intensive care needs of Medicare beneficiaries with COVID-19, which may be particularly important during continued surges of the virus. CMS can also use this information to identify beneficiaries who are particularly vulnerable to hospitalization as well as to understand the needs of these beneficiaries during their hospitalizations. In addition, this analysis shows that Medicare claims data can be used to enhance knowledge of the treatment of COVID-19 and help inform additional research efforts.

Primer on hospitalizations of Medicare beneficiaries with COVID-19

Many localities experienced extremely high rates of hospitalizations of Medicare beneficiaries with COVID-19.[4] From April through July 2020, more than 274,000 Medicare beneficiaries were hospitalized with COVID-19; however, these hospitalizations were not evenly distributed across the Nation. For additional information about how localities across the Nation were affected over time, see the interactive map at the HHS-OIG Geo Hub.[5]

This report focuses on 55,000 beneficiaries hospitalized with COVID-19 in six localities. These localities stood out as each having a high rate of COVID-19 hospitalizations that was concentrated within a relatively short period of time. (See Exhibit 1 below.) These six selected localities—Detroit, Houston, Miami, New Orleans, New York City, and Phoenix—each experienced a surge of COVID-19 hospitalizations over a 3-week period.[6] Notably, during the surge in New York City, more than 1 out of every 100 Medicare beneficiaries were hospitalized with COVID-19—with almost 35,000 such hospitalizations within just 3 weeks. When there are marked surges in hospitalizations, hospitals may be challenged in meeting the resource-intensive needs of Medicare beneficiaries. This report describes the complex care needs of beneficiaries hospitalized with COVID-19 during these surges in hospitalizations. Note that unless otherwise specified, the figures and percentages presented in this report represent the average across the six localities. See Appendix A for more information on COVID-19 hospitalizations by locality.

Exhibit 1: Six localities experienced a surge of Medicare COVID-19 hospitalizations over a 3-week period.



Source: OIG analysis of Medicare data, 2021.

RESULTS

Hospitals needed to treat Medicare beneficiaries with COVID-19 for a wide range of serious, complex conditions

Medicare beneficiaries who were hospitalized with COVID-19 suffered from a multitude of acute conditions that require significant medical attention. They also had a number of chronic conditions that may have put beneficiaries at risk for severe outcomes of COVID-19 or may have been exacerbated by the virus.[7]

Although it is well understood that COVID-19 commonly results in significant respiratory conditions for hospitalized patients, COVID-19 can extend to many other organ systems including the heart, kidneys, and endocrine system. In some cases, it may also lead to sepsis.[8] Hospitals treated beneficiaries with COVID-19 for these serious, complex conditions during surges in hospitalizations in the six localities.[9]

> **"The complexity of the disease is high and requires a lot of clinical attention.... You can't keep up."**
>
> *- Infectious Disease Specialist*

Often these serious and complex conditions resulted in longer lengths of stay in the hospital. The average length of stay for Medicare beneficiaries diagnosed with COVID-19 was 12 days, with 13 percent of stays lasting longer than 3 weeks. This compares to an average length of stay of 8 days for beneficiaries without COVID-19. Additionally, 90 percent of these hospitalizations were emergency admissions, which involve immediate medical intervention as a result of severe, life-threatening, or potentially disabling conditions. See Appendix B for more information on lengths of stay and hospital admissions by locality.

Almost all Medicare beneficiaries hospitalized with COVID-19 were treated for acute respiratory issues, such as viral pneumonia

On average, 91 percent of beneficiaries hospitalized with COVID-19 during a surge were treated for common acute respiratory conditions. Specifically, 86 percent were treated for viral pneumonia. A smaller proportion of beneficiaries were treated for pneumonia due to a secondary infection, such as bacterial pneumonia. According to one expert, this is likely due to a complication of the inflammatory response or damage to lung tissue.

Almost two-thirds of beneficiaries were treated for acute respiratory failure while an additional 11 percent were treated for a more severe type of respiratory failure—acute respiratory distress syndrome (ARDS). ARDS occurs when fluid builds up in the lungs, often depriving other organs of the oxygen they need to function; it typically occurs in people who are already critically ill or who have significant injuries.

Common Acute Respiratory Ailments for Beneficiaries Hospitalized With COVID-19

86% were treated for viral pneumonia
60% were treated for acute respiratory failure
11% were treated for ARDS
8% were treated for pneumonia due to secondary infection

Twenty-five percent of Medicare beneficiaries hospitalized with COVID-19 also had chronic respiratory issues. An average of 18 percent of beneficiaries had a diagnosis of chronic obstructive pulmonary disease (COPD) and 6 percent had asthma. Five percent of Medicare beneficiaries had a diagnosis of chronic respiratory failure.

1 in 4 had **chronic lower respiratory conditions** or **chronic respiratory failure.**

Almost half of Medicare beneficiaries hospitalized with COVID-19 were treated for acute kidney failure

Medicare beneficiaries who were hospitalized with COVID-19 during a surge were frequently treated for acute diseases of the renal system. On average, 47 percent of beneficiaries were treated for acute kidney failure. Early research suggests that COVID-19 can cause severe damage to many organs and that kidney damage from COVID-19 can be severe enough to require dialysis.[10] Kidney or other organ failure may also be a warning sign of severe sepsis.

Common Acute Kidney Ailments for Beneficiaries Hospitalized With COVID-19

47% were treated for acute kidney failure
15% were treated for urinary tract infections

Beneficiaries hospitalized with COVID-19 were also often treated for urinary tract infections (UTIs). UTIs are one of the most common infectious diseases in adults age 65 and older and can have serious complications including fever and diminished cognitive function.

While some beneficiaries with COVID-19 were treated for acute kidney injury, a large number were treated for chronic kidney conditions. An average of 12 percent of beneficiaries with COVID-19 had a diagnosis of chronic kidney disease and an additional 8 percent had a diagnosis of end-stage renal disease. End-stage renal disease is the final stage of chronic kidney disease in which permanent damage to the kidneys causes a complete loss of function and a dependence on dialysis or transplant.

1 in 5 were treated for **chronic kidney failure** or **end-stage renal disease**.

Almost half of Medicare beneficiaries hospitalized with COVID-19 were treated for acute circulatory issues, such as heart attack or stroke

On average, 44 percent of beneficiaries hospitalized with COVID-19 during a surge were treated for acute circulatory conditions. Specifically, an average of 24 percent of beneficiaries with COVID-19 were treated for irregular heart rates (known as atrial fibrillation or cardiac arrhythmia), 14 percent were treated for acute heart failure, 8 percent were treated for a heart attack (also known as an acute myocardial infarction), and 7 percent were treated for blood clotting issues such as coagulopathy, embolism, or thrombosis. Additionally, 3 percent of beneficiaries on average were treated for stroke or transient ischemic attacks (TIAs).

Common Acute Circulatory Ailments for Beneficiaries Hospitalized With COVID-19

24% were treated for irregular heart rates
14% were treated for acute heart failure
8% were treated for heart attacks
7% were treated for blood clotting issues
3% were treated for stroke or TIAs

Almost all Medicare beneficiaries hospitalized with COVID-19 also had chronic circulatory issues. On average, 83 percent of beneficiaries were treated for chronic hypertensive diseases such as high-blood pressure and 25 percent were treated for chronic ischemic heart diseases. Fifteen percent of beneficiaries were treated for chronic heart failure. Hypertension and chronic heart conditions can increase the risk of severe illness from COVID-19.[11]

More than **4 in 5** were treated for **chronic circulatory issues**.

Almost two-thirds of Medicare beneficiaries hospitalized with COVID-19 had significant endocrine, nutritional, or metabolic issues

Medicare beneficiaries hospitalized with COVID-19 during a surge were commonly treated for significant acute endocrine, nutritional, or metabolic issues such as dehydration. On average, 65 percent of beneficiaries were treated for these conditions. Most commonly, this included treatment for both low and high sodium levels in the blood (hyposmolality/hyponatremia and hyperosmolality/hypernatremia, respectively), excess acid in the blood (acidosis), and both low and high potassium in the blood (hypokalemia and hyperkalemia, respectively). Hyposmolality and hyponatremia can be caused by systemic inflammation from an infection. Hyperosmolality and hypernatremia can be caused by several different factors, including dehydration and loss of water. Acidosis is caused by an excess of carbon dioxide in the blood and can be due to poor lung function. Similarly, excess potassium in the blood can be due to poor kidney function and kidney disease.

Common Acute Endocrine, Nutritional, and Metabolic Ailments for Beneficiaries Hospitalized With COVID-19

24% were treated for low sodium
21% were treated for excess acid
20% were treated for high sodium
19% were treated for low potassium
17% were treated for dehydration
15% were treated for high potassium

Additionally, many Medicare beneficiaries hospitalized with COVID-19 also had chronic endocrine, nutritional, and metabolic issues. Almost half of Medicare beneficiaries hospitalized with COVID-19 were treated for diabetes.[12] On average, 48 percent of beneficiaries hospitalized with COVID-19 had type 2 diabetes. This included 20 percent who had type 2 diabetes with chronic kidney disease, 17 percent who had type 2 diabetes with hyperglycemia, and 14 percent of beneficiaries who had type 2 diabetes without complications. Research suggests having type 2 diabetes increases the risk of severe illness from COVID-19.[13]

1 in 2 were treated for **diabetes**.

See Appendix C for a list of conditions for which Medicare beneficiaries hospitalized with COVID-19 were commonly treated.

More than one-third of Medicare beneficiaries hospitalized with COVID-19 were treated for sepsis

Sepsis is an extreme, life-threatening reaction to an infection causing a systemic inflammatory response and organ dysfunction in severe cases. On average, 36

percent of beneficiaries hospitalized with COVID-19 during a surge were diagnosed with sepsis.

More than **1 in 3** were treated for **sepsis**.

Severe sepsis is organ dysfunction caused by the extreme host response to infection. Severe sepsis can occur with or without septic shock. On average, 53 percent of the COVID-19 beneficiaries with sepsis had severe sepsis. These beneficiaries require extra management and medical resources.

The proportion of hospitalized beneficiaries with COVID-19 who were diagnosed with sepsis varied across the six localities, ranging from 28 percent in Miami to 41 percent in Detroit and Houston. The proportion of beneficiaries with severe sepsis also varied across the six localities. Notably, Miami and New Orleans had the highest proportions of severe sepsis among beneficiaries with sepsis (55 percent and 60 percent, respectively).

See Appendix D for the proportion of beneficiaries with sepsis and severe sepsis by locality.

Medicare beneficiaries hospitalized with COVID-19 often received intensive care or mechanical ventilation

Because COVID-19 can cause severe damage to multiple organ systems, a significant proportion of beneficiaries may require care in an intensive care unit (ICU) or need mechanical ventilation. On average, 51 percent of beneficiaries hospitalized with COVID-19 during a surge received either care in an ICU or mechanical ventilation. These beneficiaries use significant hospital resources and often have longer stays in the hospital.

Almost half of beneficiaries hospitalized with COVID-19 received care in the ICU

On average, 49 percent of beneficiaries hospitalized with COVID-19 during a surge received care in the ICU. Hospitals with a high proportion of beneficiaries requiring care in the ICU may be particularly strained, as beneficiaries who receive care in the ICU typically require the highest levels of care available.

Beneficiaries requiring care in ICUs often had longer stays in the hospital, staying an average of 7 days longer than beneficiaries not receiving care in the ICU.[14] Certain conditions were more common among beneficiaries receiving care in the ICU, including sepsis and severe sepsis with septic shock, ARDS, and endocrine, nutritional, and metabolic issues such as hyperkalemia and acidosis.

Interestingly, there was significant variation in the percentage of COVID-19 beneficiaries receiving care in the ICU. Localities ranged from 26 percent in New York

City to 71 percent in Phoenix. This may be due to certain hospitals being able to expand capacity with new or temporary units. One expert in quality and patient safety noted an example of a hospital that tripled its ICU capacity during a surge in hospitalizations. However, as another expert noted, hospitals may experience difficulty staffing these units with trained critical care nurses and physicians. Without enough appropriately trained doctors and nurses, hospitals cannot provide appropriate care to such a high number of critically ill patients.

Conversely, some localities may not have been able to expand their ICU capacity during a surge in beneficiaries with COVID-19. This may have resulted in the hospitals providing higher levels of care to patients in other areas of the hospital. For example, mechanical ventilation is typically administered in the ICU, but capacity limitations may require a hospital to keep patients in other units. This was the case for 31 percent of beneficiaries in New York City compared to only 2 percent in Phoenix. See Appendix E for more information on ICU utilization by locality.

> **In normal times, a patient who needs a ventilator is sick enough to probably be in the ICU…. In COVID times, we've seen a lot of hospitals have to use ventilators or other breathing support throughout the hospital.**
>
> *- Hospital Professional in Quality and Patient Safety*

More than one-fifth of beneficiaries hospitalized with COVID-19 required the assistance of a ventilator

Because COVID-19 can damage the respiratory system and impair lung function, some patients may require use of a ventilator.[15] On average, 22 percent of beneficiaries hospitalized with COVID-19 during a surge received mechanical ventilation. There was little variation in use of mechanical ventilation in the localities that experienced a surge at different times despite discussion in the medical literature about changing practices regarding mechanical ventilation.[16]

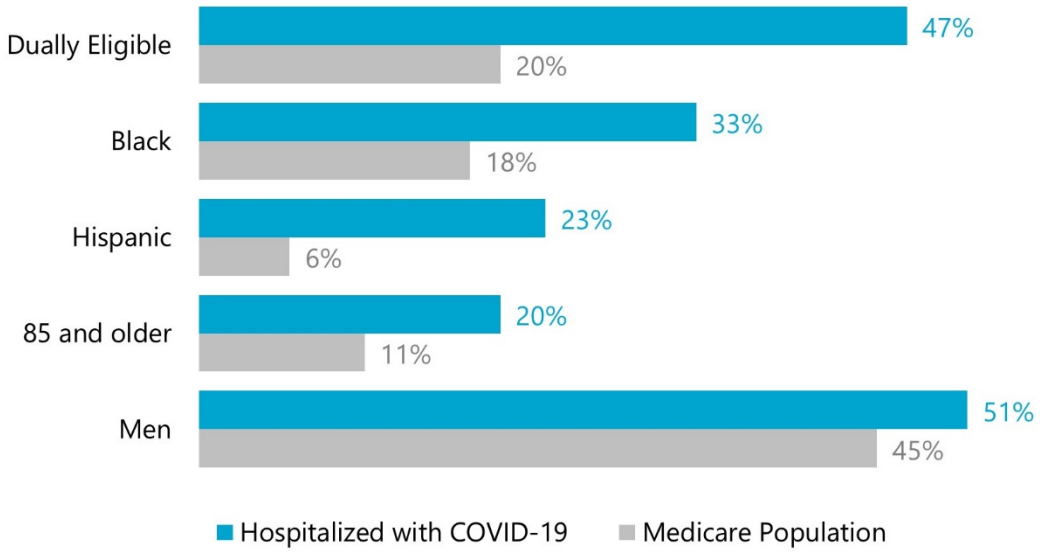
Beneficiaries who received mechanical ventilation often had longer stays in the hospital, staying an additional 10 days on average, compared to beneficiaries with COVID-19 who did not receive mechanical ventilation.

Certain conditions were more common among beneficiaries with COVID-19 who received mechanical ventilation such as sepsis and severe sepsis with septic shock, ARDS, and acute kidney failure.

Dually eligible, Black, Hispanic, or older beneficiaries were disproportionately hospitalized with COVID-19

Medicare beneficiaries in certain demographic groups were disproportionately hospitalized with COVID-19 during a surge relative to the total Medicare population in these six localities. Longstanding health and social inequalities may have resulted in certain groups having an increased risk of illness and an increased risk of hospitalization with COVID-19.[17] Differences in wealth, health care access, and race and ethnicity are interrelated and influence a wide range of health and quality-of-life outcomes and risks.[18] See Exhibit 2 for additional information about beneficiary characteristics in the six localities and Appendix F for more information on beneficiary characteristics for each locality.

Exhibit 2: Medicare beneficiaries in certain demographic groups were disproportionately hospitalized with COVID-19 compared to the Medicare population.



Source: OIG analysis of Medicare data during a surge in six selected localities, 2021.

Dually eligible beneficiaries—those enrolled in both Medicare and Medicaid—were disproportionately hospitalized with COVID-19 during a surge. Dually eligible beneficiaries include beneficiaries who are eligible due to age or disability and low income. These beneficiaries are typically poorer and sicker than other Medicare beneficiaries.[19] On average, 47 percent of beneficiaries who were hospitalized with COVID-19 were dually eligible. In comparison, dually eligible beneficiaries represent, on average, only 20 percent of Medicare beneficiaries in the six localities.

Beneficiaries from certain racial and ethnic groups were also disproportionately hospitalized with COVID-19 during a surge. On average, 33 percent of beneficiaries hospitalized with COVID-19 were Black and 23 percent were Hispanic. This is much

higher than the Medicare population in the 6 localities, where on average 18 percent of beneficiaries are Black and 6 percent are Hispanic.

In addition, older beneficiaries were disproportionately hospitalized with COVID-19 during a surge. On average, 31 percent of beneficiaries who were hospitalized with COVID-19 were between 75 and 84 years of age. In comparison, beneficiaries in this age group represented an average of 25 percent of the Medicare population in the six localities. Similarly, beneficiaries who were 85 years and older were also disproportionately hospitalized with COVID-19. On average, 20 percent of beneficiaries who were hospitalized with COVID-19 were 85 and older, while they represent only 11 percent of the population.

Men were also disproportionately hospitalized with COVID-19 during a surge. On average, 51 percent of beneficiaries who were hospitalized with COVID-19 were men; however, men represented 45 percent of Medicare beneficiaries in the six localities.

CONCLUSION

This report provides insights into the care needs of beneficiaries with COVID-19 and the disproportionate hospitalization rates for beneficiaries in certain demographic groups. Beneficiaries hospitalized with COVID-19 were treated for a wide range of serious and complex conditions. Although it is well understood that COVID-19 commonly results in significant respiratory conditions for hospitalized patients (affecting an average of 91 percent of hospitalized beneficiaries), COVID-19 can also extend to many other organ systems including the heart, kidneys, and endocrine system. Medicare beneficiaries experienced a number of potentially life-threating acute conditions in addition to a number of chronic conditions that were potentially exacerbated by the virus. For example, almost half of beneficiaries with COVID-19 were treated for acute circulatory issues such as acute heart failure, heart attack, or stroke. Perhaps even more concerning, more than one-third of hospitalized beneficiaries developed sepsis, which is a serious reaction to an infection causing a systemic inflammatory response, resulting in organ failure in severe cases. Additionally, on average 51 percent of Medicare beneficiaries received intensive care or mechanical ventilation. We also found that dually eligible, Black, Hispanic, or older beneficiaries were disproportionately hospitalized with COVID-19 during these surges.

Gaining a better understanding of Medicare beneficiaries hospitalized with COVID-19—including the conditions for which they were being treated and demographic characteristics—can assist Federal, State, and local efforts in the COVID-19 pandemic and may be used to provide additional guidance to hospitals. This information can also help hospitals, physicians, and other practicioners better prepare for the complex and resource-intensive care needs of Medicare beneficiaries with COVID-19, which may be particularly important during continued surges of the virus. Furthermore, this report expands on CMS's analysis of Medicare beneficiaries with COVID-19.[20] CMS can use this information to identify beneficiaries who are particularly vulnerable to hospitalization as well as understand the needs of these beneficiaries during their hospitalizations. In addition, this analysis shows that Medicare claims data can be used to enhance knowledge of the treatment of COVID-19 and help inform additional research efforts.

METHODOLOGY

We reviewed hospital inpatient claims and enrollment data for all beneficiaries who were hospitalized in a short-term acute-care hospital at any point from April 1, 2020, through July 31, 2020. We included Medicare fee-for-service claims data and Medicare Advantage encounter data from CMS's National Claims History file and Medicare enrollment information. We conducted our analysis in mid-2021 to allow time for claims to be finalized.[21]

Analysis of Hospitalized Medicare Beneficiaries With COVID-19 by Locality

We first determined the extent to which Medicare beneficiaries were hospitalized with COVID-19 in each locality across the country. For the purposes of our analysis, we considered a locality to be a Core-Based Statistical Area (CBSA).[22] We focused our analysis on the 831 of 939 CBSAs that each had a short-term acute-care hospital.

We analyzed all Medicare inpatient hospital claims to identify the number of beneficiaries who were hospitalized with COVID-19 in each locality from April 1, 2020, through July 31, 2020. We excluded claims from hospitals that were not paid under the Inpatient Prospective Payment System (IPPS), such as long-term care hospitals and critical-access hospitals.[23] We considered beneficiaries with a diagnosis code of U07.1 to be diagnosed with COVID-19.[24]

Selection of Six Localities With Surges in COVID-19 Hospitalizations

We determined the extent to which hospitalization rates changed over time. To do this, we used the number of Medicare COVID-19 hospitalizations for each day from April 1, 2020, through July 31, 2020, for each locality and the total number of Medicare beneficiaries who were enrolled in Medicare in that locality.[25] Using the data from all localities, we selected a purposive sample of six localities that each had a high rate of Medicare COVID-19 hospitalizations concentrated within a short period of time. For each of the 6 localities, we identified a surge that represented the 21 consecutive days with the highest rate of Medicare COVID-19 hospitalizations. We included three localities that experienced a surge in hospitalizations in April and three localities that experienced a surge in hospitalizations in July.[26]

Analysis of Hospitalizations in Six Localities

For each of the six localities, we analyzed the Medicare inpatient claims for all Medicare beneficiaries hospitalized during the 3-week surge. Using these claims, we

determined the proportion of all hospitalized Medicare beneficiaries who had a diagnosis of COVID-19 in each of the six localities. We analyzed the claims data to determine the average lengths of stay among beneficiaries hospitalized with COVID-19.[27] We also determined the proportion of beneficiaries with COVID-19 who had an emergency admission to the hospital.

We determined the average proportion across the six localities by summing the proportion for each locality and dividing by six. Each locality was given equal weight in determining the average. Unless otherwise indicated, the percentages presented in this report represent the average among the six localities. We highlighted the specific numbers in the individual localities when there were notable differences.

Beneficiary Conditions

We determined the extent to which Medicare beneficiaries hospitalized with COVID-19 during a surge in these in six localities were treated for key conditions. To identify these conditions, we analyzed the ICD-10-CM diagnosis codes on the claims. ICD-10-CM codes are broadly grouped according to the organ system that the disease or condition affects. We relied on these groupings to identify beneficiaries with conditions related to the circulatory system, the respiratory system, the genitourinary system (which includes conditions such as kidney ailments and UTIs), and the endocrine system.

Within each of these organ systems, we identified the most common diagnoses and conditions for which beneficiaries were being treated. We also used ICD-10-CM diagnosis codes to identify beneficiaries with certain chronic conditions, such as beneficiaries with a diagnosis of chronic obstructive pulmonary disease, or other notable conditions, such as beneficiaries treated for sepsis.

In addition to identifying the most frequent conditions, we also consulted with medical experts and coding professionals to review the codes and help group them into relevant categories. We also asked them to identify diagnoses that were likely linked to COVID-19 or were common chronic diagnoses that increased the risk of severe outcomes for COVID-19.

Types of Care

Next, we determined the types of care received by hospitalized Medicare beneficiaries with COVID-19, such as whether the beneficiaries received intensive care or mechanical ventilation. To determine whether Medicare beneficiaries received intensive care, we relied on the revenue center codes listed on the hospital claims. These codes correspond to various hospital departments that furnished services to the beneficiary. We reviewed the ICD-10-PCS procedure codes on the claims to determine the extent to which beneficiaries received mechanical ventilation.[28]

Analysis of Beneficiary Characteristics

We analyzed data from the Medicare Enrollment Database for all beneficiaries who were hospitalized with COVID-19 in the six localities during the 3-week surge period. We used this information to describe key characteristics including age, sex, race and ethnicity, and eligibility status (e.g., whether a beneficiary was dually eligible for Medicare and Medicaid). To serve as a comparison and to determine the extent to which beneficiaries with certain characteristics were disproportionately hospitalized with COVID-19, we analyzed enrollment data for all Medicare beneficiaries within each locality. We analyzed the data across each locality to note the extent to which the beneficiary characteristics vary by locality.

The race and ethnicity information is based on data collected from the Social Security Administration and an algorithm developed by the Research Triangle Institute.[29] This algorithm attempts to improve the quality of the Social Security Administration's data by amending the race data for certain groups based on name and geography, as well as requests made by individuals for certain government materials to be provided in Spanish.

Limitations

This study is based on the diagnosis and other information on the Medicare claims; it is not based on a review of the medical records. The diagnosis information on the claims should reflect the beneficiary's conditions. However, the accuracy of diagnoses on the claims may be influenced by the information recorded by the clinician (e.g., an information omission) as well as the medical coder (because experience and training can influence precision in coding).

The Social Security Administration's data on race and ethnicity upon which Medicare enrollment data are based have known limitations. Although this information is currently the best available for the entire Medicare beneficiary population, comparisons to self-reported data (available in certain, limited circumstances) show that race and ethnicity is still misclassified for some beneficiaries. In particular, Medicare beneficiaries with a race and ethnicity of American Indian/Alaska Native, Asian/Pacific Islander, or Hispanic are more likely to be misclassified.[30]

Standards

We conducted this study in accordance with the *Quality Standards for Inspection and Evaluation* issued by the Council of the Inspectors General on Integrity and Efficiency.

APPENDIX A

Hospitalizations of Medicare Beneficiaries With COVID-19 in Six Selected Localities During a Surge

	Total number of beneficiaries hospitalized with COVID-19	Number of beneficiaries hospitalized with COVID-19 per 100K beneficiaries	Percentage of all hospitalized beneficiaries who had COVID-19
Detroit	5,889	696	46%
Houston	3,687	416	26%
Miami	5,794	512	32%
New Orleans	1,668	701	44%
New York City	34,690	1,047	67%
Phoenix	2,929	368	25%
Average		623	40%

Source: OIG analysis of Medicare data, 2021.

APPENDIX B

Lengths of Stay and Emergency Admissions Among Medicare Beneficiaries Hospitalized With COVID-19 in Six Selected Localities During a Surge

Exhibit B-1: Average length of stay in the hospital for Medicare beneficiaries by locality, in days

	Average length of stay for beneficiaries with COVID-19	Average length of stay for beneficiaries without COVID-19
Detroit	10	7
Houston	11	7
Miami	13	8
New Orleans	13	7
New York City	11	9
Phoenix	12	7
Average	12	8

Source: OIG analysis of Medicare data, 2021.

Exhibit B-2: Emergency admissions among Medicare beneficiaries hospitalized with COVID-19

	Percentage of hospitalizations among Medicare beneficiaries with COVID-19 that were emergency admissions
Detroit	90%
Houston	92%
Miami	88%
New Orleans	93%
New York City	96%
Phoenix	79%
Average	90%

Source: OIG analysis of Medicare data, 2021.

APPENDIX C

Common Conditions Among Medicare Beneficiaries Hospitalized With COVID-19 in Six Selected Localities During a Surge

Exhibit C-1: Average percentage of beneficiaries hospitalized with COVID-19 who were treated for common conditions

Respiratory Conditions	
Acute respiratory failure	60%
ARDS	11%
Asthma	6%
Chronic respiratory failure	5%
COPD	18%
Pneumonia due to secondary infection	8%
Viral pneumonia	86%
Kidney and Urinary Conditions	
Acute kidney failure	47%
Chronic kidney disease	12%
End-stage renal disease	8%
UTI	15%
Circulatory Conditions	
Acute heart failure	14%
Acute myocardial infarction	8%
Atrial fibrillation and cardiac arrhythmia	24%
Chronic hypertensive diseases	83%
Chronic ischemic heart diseases	25%
Coagulation/embolism/thrombosis	7%
Stroke or TIA	3%
Endocrine, Nutritional, and Metabolic Conditions	
Dehydration	17%
High acid (acidosis)	21%
High potassium (hyperkalemia)	15%
High sodium (hyperosmolality and hypernatremia)	20%
Low potassium (hypokalemia)	19%

Low sodium (hyposmolality and hyponatremia)	24%
Type 2 diabetes with chronic kidney disease	20%
Type 2 diabetes with hyperglycemia	17%
Type 2 diabetes without complications	14%

Note: Across the six localities, the percentages of beneficiaries with COVID-19 treated for these conditions were relatively similar for most conditions. There were large differences in the percentages of beneficiaries hospitalized with COVID-19 treated for ARDS. The respective percentage of beneficiaries hospitalized with COVID-19 who were treated for ARDS was 4 percent in Miami and 18 percent in New York City.

Source: OIG analysis of Medicare data, 2021.

APPENDIX D

Sepsis and Severe Sepsis Among Medicare Beneficiaries Hospitalized With COVID-19 in Six Selected Localities During a Surge

	Percentage of beneficiaries hospitalized with COVID-19 treated for sepsis	Percentage of beneficiaries with sepsis treated for severe sepsis
Detroit	41%	48%
Houston	41%	55%
Miami	28%	55%
New Orleans	34%	60%
New York City	36%	53%
Phoenix	37%	44%
Average	36%	53%

Source: OIG analysis of Medicare data, 2021.

APPENDIX E

Medicare Beneficiaries Hospitalized With COVID-19 Who Received Intensive Care and Mechanical Ventilation in Six Selected Localities During a Surge

	Percentage of beneficiaries hospitalized with COVID-19 receiving care in ICU	Percentage of beneficiaries hospitalized with COVID-19 receiving mechanical ventilation	Percentage of hospitalized beneficiaries with COVID-19 receiving mechanical ventilation outside ICU
Detroit	50%	23%	6%
Houston	50%	21%	4%
Miami	57%	18%	8%
New Orleans	38%	25%	8%
New York City	26%	23%	31%
Phoenix	71%	20%	2%
Average	49%	22%	10%

Source: OIG analysis of Medicare data, 2021.

APPENDIX F

Characteristics of Medicare Beneficiaries Hospitalized With COVID-19 in Six Selected Localities During a Surge

Exhibit F-1: Percentage of Medicare beneficiaries by eligibility status

		Dually eligible	Medicare only
Detroit	Hospitalized with COVID-19	43%	57%
	Total Medicare Population	*16%*	*81%*
Houston	Hospitalized with COVID-19	36%	64%
	Total Medicare Population	*15%*	*82%*
Miami	Hospitalized with COVID-19	58%	42%
	Total Medicare Population	*29%*	*69%*
New Orleans	Hospitalized with COVID-19	51%	49%
	Total Medicare Population	*23%*	*74%*
New York City	Hospitalized with COVID-19	52%	48%
	Total Medicare Population	*23%*	*73%*
Phoenix	Hospitalized with COVID-19	39%	61%
	Total Medicare Population	*15%*	*82%*
Average	Hospitalized with COVID-19	47%	53%
	Total Medicare Population	*20%*	*77%*

Note: The numbers presented in the table do not sum to 100 percent because some beneficiaries were missing information about eligibility status.

Source: OIG analysis of Medicare data, 2021.

Exhibit F-2: Percentage of Medicare beneficiaries by race and ethnicity

		Asian/ Pacific Islander	Black/ African American	Hispanic	White
Detroit	Hospitalized with COVID-19	2%	55%	1%	40%
	Total Medicare Population	*1%*	*21%*	*0%*	*73%*
Houston	Hospitalized with COVID-19	3%	26%	35%	33%
	Total Medicare Population	*5%*	*18%*	*7%*	*64%*
Miami	Hospitalized with COVID-19	1%	23%	45%	26%
	Total Medicare Population	*1%*	*15%*	*16%*	*61%*
New Orleans	Hospitalized with COVID-19	1%	59%	4%	35%
	Total Medicare Population	*1%*	*33%*	*1%*	*62%*
New York City	Hospitalized with COVID-19	6%	26%	23%	41%
	Total Medicare Population	*6%*	*16%*	*7%*	*63%*
Phoenix	Hospitalized with COVID-19	2%	6%	28%	55%
	Total Medicare Population	*2%*	*5%*	*4%*	*84%*
Average	Hospitalized with COVID-19	2%	33%	23%	38%
	Total Medicare Population	*3%*	*18%*	*6%*	*68%*

Notes: The numbers presented in the table do not sum to 100 percent because 4 percent of beneficiaries hospitalized with COVID-19 were identified as American Indian/Alaska Native, Other, Unknown, or had missing race and ethnicity data. Information for these beneficiaries is not included in the table because of limitations with the data. Furthermore, although Hispanic is an ethnicity, Medicare's data combine race and ethnicity and limit beneficiaries to one category.

Source: OIG analysis of Medicare data, 2021.

Exhibit F-3: Percentage of Medicare beneficiaries by age

		Under 65	65 to 74	75 to 84	85 and older
Detroit	Hospitalized with COVID-19	14%	36%	29%	21%
	Total Medicare Population	*18%*	*48%*	*24%*	*10%*
Houston	Hospitalized with COVID-19	17%	40%	28%	15%
	Total Medicare Population	*14%*	*54%*	*24%*	*8%*
Miami	Hospitalized with COVID-19	11%	32%	34%	23%
	Total Medicare Population	*10%*	*47%*	*29%*	*14%*
New Orleans	Hospitalized with COVID-19	13%	33%	31%	22%
	Total Medicare Population	*19%*	*49%*	*22%*	*9%*
New York City	Hospitalized with COVID-19	11%	33%	33%	23%
	Total Medicare Population	*13%*	*48%*	*26%*	*13%*
Phoenix	Hospitalized with COVID-19	16%	38%	31%	15%
	Total Medicare Population	*13%*	*51%*	*27%*	*9%*
Average	Hospitalized with COVID-19	14%	35%	31%	20%
	Total Medicare Population	*15%*	*50%*	*25%*	*11%*

Source: OIG analysis of Medicare data, 2021.

Exhibit F-4: Percentage of Medicare beneficiaries by sex

		Female	Male
Detroit	Hospitalized with COVID-19	52%	48%
	Total Medicare Population	*55%*	*45%*
Houston	Hospitalized with COVID-19	48%	52%
	Total Medicare Population	*54%*	*46%*
Miami	Hospitalized with COVID-19	49%	51%
	Total Medicare Population	*56%*	*44%*
New Orleans	Hospitalized with COVID-19	52%	48%
	Total Medicare Population	*55%*	*45%*
New York City	Hospitalized with COVID-19	46%	54%
	Total Medicare Population	*56%*	*44%*
Phoenix	Hospitalized with COVID-19	48%	52%
	Total Medicare Population	*54%*	*46%*
Average	Hospitalized with COVID-19	49%	51%
	Total Medicare Population	*55%*	*45%*

Source: OIG analysis of Medicare data, 2021.

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ENDNOTES

[1] CDC, "COVID Data Tracker." Accessed at https://covid.cdc.gov/covid-data-tracker/#datatracker-home on July 29, 2021.

[2] OIG, *Hospital Experiences Responding to the COVID-19 Pandemic: Results of a National Pulse Survey March 23-27, 2020*, OEI-06-20-00300, April 2020. OIG, *Hospitals Reported That the COVID-19 Pandemic Has Significantly Strained Health Care Delivery*, OEI-09-21-00140, March 2021.

[3] For the purposes of this report, we considered a "locality" to be a Core-Based Statistical Area (CBSA) as defined by the U.S. Office of Management and Budget (OMB). We based our analysis on 831 CBSAs that each had at least one short-term acute-care hospital.

[4] Generally, Medicare is available for people age 65 or older, younger people with disabilities and people with End Stage Renal Disease (permanent kidney failure requiring dialysis or transplant). For more information, see https://www.hhs.gov/answers/medicare-and-medicaid/who-is-elibible-for-medicare/index.html

[5] For additional geospatial applications, Story Maps, and reports, see https://geohub.oig.hhs.gov/.

[6] The full titles of the selected CBSAs are Detroit-Warren-Dearborn, MI; Houston-The Woodlands-Sugar Land, TX; Miami-Fort Lauderdale-Pompano Beach, FL; New Orleans-Metairie, LA; New York-Newark-Jersey City, NY-NJ-PA; and Phoenix-Mesa-Chandler, AZ.

[7] CDC, "People with Certain Medical Conditions." Accessed at https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html on July 20, 2021.

[8] Note that we did not include all acute or chronic conditions that Medicare beneficiaries with COVID-19 were treated for. We identified certain conditions that were both common and may have been related to the course of disease for COVID-19 or related to risk of severe outcomes for COVID-19.

[9] For many conditions, a similar percentage of beneficiaries was diagnosed with that condition across the six localities. We note when there are large differences in the localities.

[10] C. John Sperati, "Coronavirus: Kidney Damage Caused by COVID-19." Accessed at https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-kidney-damage-caused-by-covid19 on July 20, 2021.

[11] CDC, "People with Certain Medical Conditions." Accessed at https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html on July 20, 2021. American Heart Association, "Coronavirus precautions for patients and others facing higher risks." Accessed at https://www.heart.org/en/coronavirus/coronavirus-covid-19-resources/coronavirus-precautions-for-patients-and-others-facing-higher-risks on July 20, 2021.

[12] For the purposes of this report, we refer to diabetes mellitus as diabetes.

[13] CDC, "People with Certain Medical Conditions." Accessed at https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html on July 20, 2021. American Diabetes Association, "How COVID-19 Impacts People with Diabetes." Accessed at https://www.diabetes.org/coronavirus-covid-19/how-coronavirus-impacts-people-with-diabetes on July 20, 2021.

[14] Length of stay refers to the number of days between the start and end of an inpatient hospital admission. An admission ends with a beneficiary's discharge or death.

[15] Carrie Macmillan, "Ventilators and COVID-19: What You Need to Know," *Yale Medicine*. Accessed at https://www.yalemedicine.org/stories/ventilators-covid-19 on July 20, 2021.

[16] In the three localities that faced a surge in April, on average 24 percent of beneficiaries received mechanical ventilation. In the three localities that faced a surge in July, on average 20 percent of beneficiaries received mechanical ventilation. Physicians learned that giving high-flow oxygen and positioning patients in a prone position resulted in better outcomes than mechanical ventilation. For more information, see Alison E. Thompson, Benjamin L. Ranard, Ying Wei, et al., "Prone Positioning in Awake, Nonintubated Patients With COVID-19 Hypoxemic Respiratory Failure," *JAMA Internal Medicine,* Vol. 180, No. 11, November 2020. Accessed at https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2767575 on July 20, 2021. See also Columbia University Irving Medical Center, "Proning COVID-19 Patients Reduces Need for Ventilators." Accessed at https://www.cuimc.columbia.edu/news/proning-covid-19-patients-reduces-need-ventilators on July 20, 2021.

[17] CDC, *Health Equity Considerations and Racial and Ethnic Minority Groups*. Accessed at https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html on July 20, 2021.

[18] Ibid.

[19] CMS, *People Dually Eligible for Medicare and Medicaid*. Accessed at https://www.cms.gov/Medicare-Medicaid-Coordination/Medicare-and-Medicaid-Coordination/Medicare-Medicaid-Coordination-Office/Downloads/MMCO_Factsheet.pdf on July 20, 2021. CMS, *Medicare-Medicaid Coordination Office FY 2019 Report to Congress*. Accessed at https://www.cms.gov/files/document/mmco-report-congress.pdf on July 20, 2021. Medicare Payment Advisory Commission, *Data Book: Beneficiaries Dually Eligible for Medicare and Medicaid—January 2018*, p. 3. Accessed at http://medpac.gov/docs/default-source/data-book/jan18_medpac_macpac_dualsdatabook_sec.pdf on July 20, 2021.

[20] CMS, "Preliminary Medicare COVID-19 Data Snapshot." Accessed at https://www.cms.gov/research-statistics-data-systems/preliminary-medicare-covid-19-data-snapshot on July 20, 2021.

[21] We based our analyses on data from the National Claims History File as of May 11, 2021.

[22] CBSAs are areas defined by OMB based on Census Bureau data. Each CBSA consists of at least one urbanized area or urban cluster with a population of at least 10,000 plus adjacent counties with a high degree of social and economic integration. See Census Bureau, "Core-Based Statistical Areas." Accessed at https://www.census.gov/topics/housing/housing-patterns/about/core-based-statistical-areas.html on July 20, 2021.

[23] Although hospitals in Maryland are not paid under the Inpatient Prospective Payment System, we included short-term acute-care hospitals in Maryland in our analysis.

[24] For beneficiaries diagnosed with COVID-19, hospitals add the ICD-10-CM code U07.1 to the claim. The United States adopted this code effective April 1, 2020. Prior to the addition of this new code, health care providers were instructed to use a diagnosis code of B97.29. See: CDC, *ICD-10-CM Official Coding and Reporting Guidelines April 1, 2020 through September 30, 2020*. Accessed at https://www.cdc.gov/nchs/data/icd/COVID-19-guidelines-final.pdf on July 20, 2021.

[25] We considered all beneficiaries enrolled in Medicare Fee-for-Service or Medicare Advantage in each locality as of April 1, 2020.

[26] We also considered each locality's geography and the total number of hospitalized Medicare beneficiaries, as well as the total Medicare enrollment within each locality.

[27] We used claim-from-date and claim-through-date to calculate the length of each stay. We excluded outliers from the length of stay calculation. Beneficiaries who had at least 1 day of their hospital stay within the 3-week surge period were included.

[28] Mechanical ventilation is identified by the ICD-10-PCS codes 5A1935Z, 5A1945Z, and 5A1955Z. We did not consider other types of noninvasive respiratory support such as continuous positive airway pressure.

[29] Celia Eicheldinger and Arthur Bonito, "More Accurate Racial and Ethnic Codes for Medicare Administrative Data," *Health Care Financing Review*, Vol. 29, No. 3, Spring 2008. Accessed at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4195038/pdf/hcfr-29-03-027.pdf on July 20, 2021.

[30] Note that the data combine race and ethnicity and allow for only one response, whereas Federal guidelines recommend capturing race and ethnicity data separately and allowing respondents to make multiple selections. For a fuller discussion about the data, please see our forthcoming report, *Medicare Data on Race and Ethnicity*, OEI-02-21-00100.