


## BRIEF REPORT

## Half of Rural Residents at High Risk of Serious Illness Due to COVID-19, Creating Stress on Rural Hospitals

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### Abstract

**Purpose:** During the COVID-19 epidemic, it is critical to understand how the need for hospital care in rural areas aligns with the capacity across states.

**Methods:** We analyzed data from the 2018 Behavioral Risk Factor Surveillance System to estimate the number of adults who have an elevated risk of serious illness if they are infected with coronavirus in metropolitan, micropolitan, and rural areas for each state. Study data included 430,949 survey responses representing over 255.2 million noninstitutionalized US adults. For data on hospital beds, aggregate survey data were linked to data from the 2017 Area Health Resource Files by state and metropolitan status.

**Findings:** About 50% of rural residents are at high risk for hospitalization and serious illness if they are infected with COVID-19, compared to 46.9% and 40.0% in micropolitan and metropolitan areas, respectively. In 19 states, more than 50% of rural populations are at high risk for serious illness if infected. Rural residents will generate an estimated 10% more hospitalizations for COVID-19 per capita than urban residents given equal infection rates.

**Conclusion:** More than half of rural residents are at increased risk of hospitalization and death if infected with COVID-19. Experts expect COVID-19 burden to outpace hospital capacity across the country, and rural areas are no exception. Policy makers need to consider supply chain modifications, regulatory changes, and financial assistance policies to assist rural communities in caring for people affected by COVID-19.

**Key words** access to care, COVID-19, health care utilization, rural health, serious illness.

In the United States, rural populations are older and sicker than urban populations, and thus at greater risk of hospitalization and death during the COVID-19 pandemic. The response to the epidemic in the United States has been hampered because of limited capability to test and identify positive cases of the virus, and this has increased the opportunity for community spread. Epidemiologists estimate the novel COVID-19 will infect between 30% and 70% of the population, and it is critical to understand how the need for hospital care in rural areas aligns with the capacity across states.

The US coronavirus epidemic originated in cities, and the early news coverage of “hot spots” has highlighted experiences in metropolitan areas and large health systems. As a result, rural residents may feel the threat is distant and less relevant for their communities. Communicable diseases often have a larger impact in urban areas due to the population density, social lifestyles, and use of mass transit. To some extent, social distancing is a way of life for many rural families given the landscape and geography, as well as personal choice. President Trump has said, “You go out to the Midwest, you go out to other locations,

and they're watching it on television but they don't have the same problems. They don't have by any means the same problem."<sup>1</sup>

Despite this, cases are growing in rural areas. In North Carolina and Oklahoma, early instances of community spread were in rural counties.<sup>2-4</sup> Even in low-density populations, the spread of COVID-19 infections across communities occurs very quickly for multiple reasons: (1) as a novel virus, there is no prior immunity in the population; (2) people may be infectious before they experience symptoms; and (3) the virus transmits easily even without person-to-person contact.<sup>5,6</sup> Grocery stores, pharmacies, and gas stations, wherever visitors and locals pass through, may be opportunities for the spread of the virus in rural communities.<sup>7</sup>

Rural communities need to prepare for the impact COVID-19 will have on their residents and health infrastructure. We present nationally representative data on the population at risk of serious illness due to infection, estimated infection numbers, and health system capacity for inpatient care in metropolitan, micropolitan, and rural areas for each state.

## Methods

We analyzed data from the 2018 Behavioral Risk Factor Surveillance System (BRFSS) to estimate the total number of adults who have an elevated risk of serious illness if they are infected with coronavirus in metropolitan, micropolitan, and rural areas for each state.<sup>8</sup> BRFSS is an ongoing, state-based, random-digit-dialed telephone survey of noninstitutionalized civilian adults. BRFSS uses the National Center for Health Statistics (NCHS) Urban-Rural Classification scheme (URC) for counties to define metropolitan (URC <5; over 50,000 population), micropolitan (URC = 5; 10,000 to 50,000 population), and rural (URC = 6; less than 10,000 population). The 4 urban categories were combined into the metropolitan category for linkage to the 2017 Area Health Resource Files for data on hospital beds (defined as staffed acute inpatient or swing beds), aggregated by state and metropolitan status.

We recognize the list of known risk factors will continue to evolve as the Centers for Disease Control and Prevention gains more data about the outcomes of the disease in different populations. Similar to other recent studies, our definition of high risk includes older adults (ages 60 or older) and younger adults between the ages of 18 and 59 with heart disease, cancer (excluding skin cancer), chronic obstructive pulmonary disease (COPD), or diabetes.<sup>9,10</sup> Current evidence has not confirmed asthma to be a risk factor.<sup>11</sup> We were unable to include hypertension as a risk factor because it is not tracked by the sur-

vey. Data represent adults who report ever being told by a doctor that they have one of the listed conditions. The survey weighted number and proportions at high risk were aggregated to summarize metropolitan, micropolitan, and rural subgroup data for each state.

Estimates of the eventual infection rate of COVID-19 range from 30%-70%, reflecting a high degree of uncertainty.<sup>12,13</sup> We present estimates for low (30%) and high (70%) spread scenarios. Hospitalizations were calculated as the product of the infection rate, the hospitalization rate among infected, and the population. We assumed hospitalization rates of 10% and 30% for those infected who are at low or high risk for serious illness, respectively.<sup>14,15</sup> We assumed the average COVID-19 hospital stay to be 11 days.<sup>16</sup>

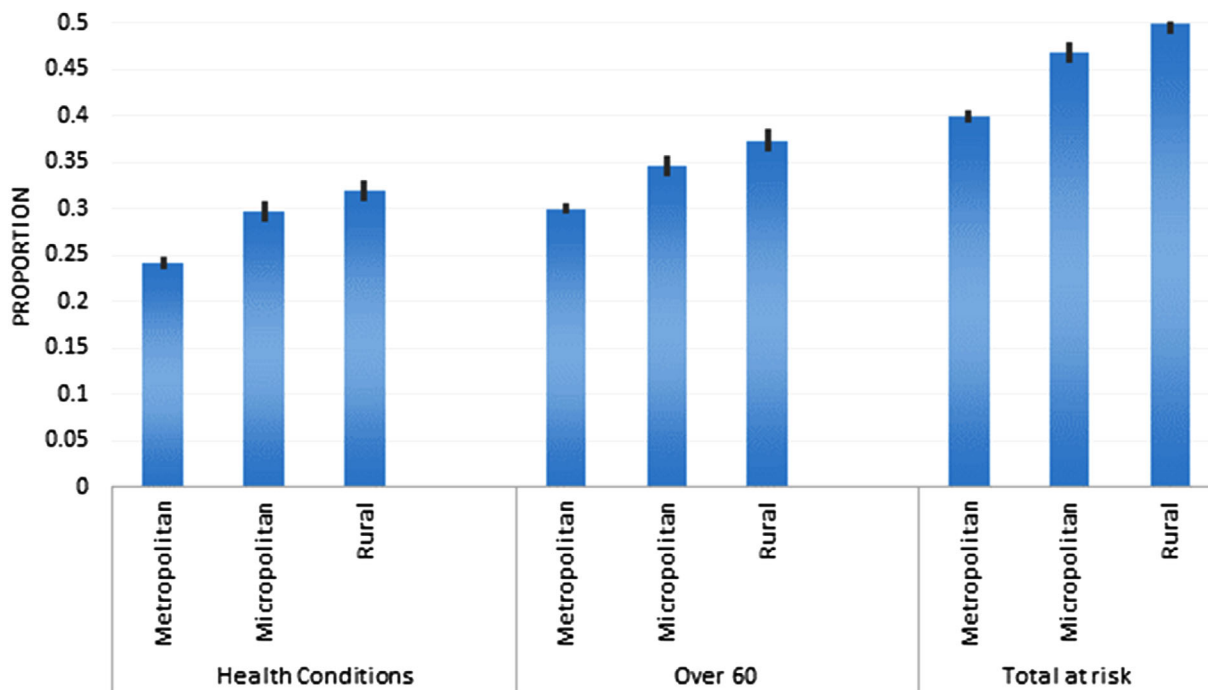
## Results

Study data included 430,949 survey responses representing over 255.2 million noninstitutionalized US adults in 50 states. Rural respondents represented 16.7 million rural residents nationally. We included 7 states that had no rural respondents (Connecticut, Delaware, Hawaii, Massachusetts, New Hampshire, New Jersey, and Rhode Island) because they do have metropolitan and micropolitan observations.

Among rural residents, 50.0% (95% confidence interval [CI] = 49.1%-51.0%) of noninstitutionalized adults are at high risk for hospitalization and serious illness if they are infected with COVID-19, compared to 46.9% (CI = 46.0%-47.7%) and 40.0% (CI = 39.6%-40.3%) in micropolitan and metropolitan areas, respectively (Figure 1). Compared to metropolitan areas nationally, rural and micropolitan areas have higher proportions of patients at high risk due to health conditions and being over age 60. About one-third (32.0%, CI = 31.1%-32.8%) of rural residents are at high risk due to health conditions and 37.3% (CI = 36.5%-38.2%) are at high risk to due age over 60 (19.3% being high risk for both factors).

Variation exists in the portion of the population at risk across states' rural and micropolitan areas (Figure 2). Between 20%-40% of rural populations have health conditions associated with increased risk, 25%-45% are over age 60, and 40%-60% total are at high risk of serious illness if infected with COVID-19 due to age or health conditions. State micropolitan distributions are similar to rural, although rural populations have a greater prevalence of health conditions. In 7 states, more than 50% of both rural and micropolitan populations are at high risk for serious illness if infected (Alabama, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia), all in the South Census region. In another

**Figure 1** Mean Proportion of Residents at High Risk Nationally Due to COVID-19 by Metropolitan Status.  
 Source: Authors' analysis of 2018 Behavioral Risk Factor Surveillance System data.



12 states, more than 50% of the rural population is at high risk for serious illness if infected (Arkansas, Florida, Illinois, Louisiana, Maine, Michigan, Missouri, Montana, New Mexico, Oklahoma, Oregon, and Pennsylvania), representing all 4 Census regions (Figure 3).

The COVID-19 hospitalization rate per capita is estimated to be higher in rural than micropolitan and metropolitan populations given equal infection rate of the virus. On the low estimate of spread (30%), hospitalization rates per capita are estimated at 5.4, 5.7, and 6.0 per 100 in metropolitan, micropolitan, and rural populations, assuming 10% of low-risk and 30% of high-risk infected individuals are hospitalized. On the high end of spread estimates (70%), hospitalization rates per capita are estimated at 12.6, 13.5, and 13.9 per 100 in metropolitan, micropolitan, and rural populations. In the low spread scenario, metropolitan areas have 7.7 hospital beds on average for every 100 COVID-19 hospitalizations compared to 6.3 in micropolitan areas and 5.4 in rural areas (Figure 4).

**Policy Implications**

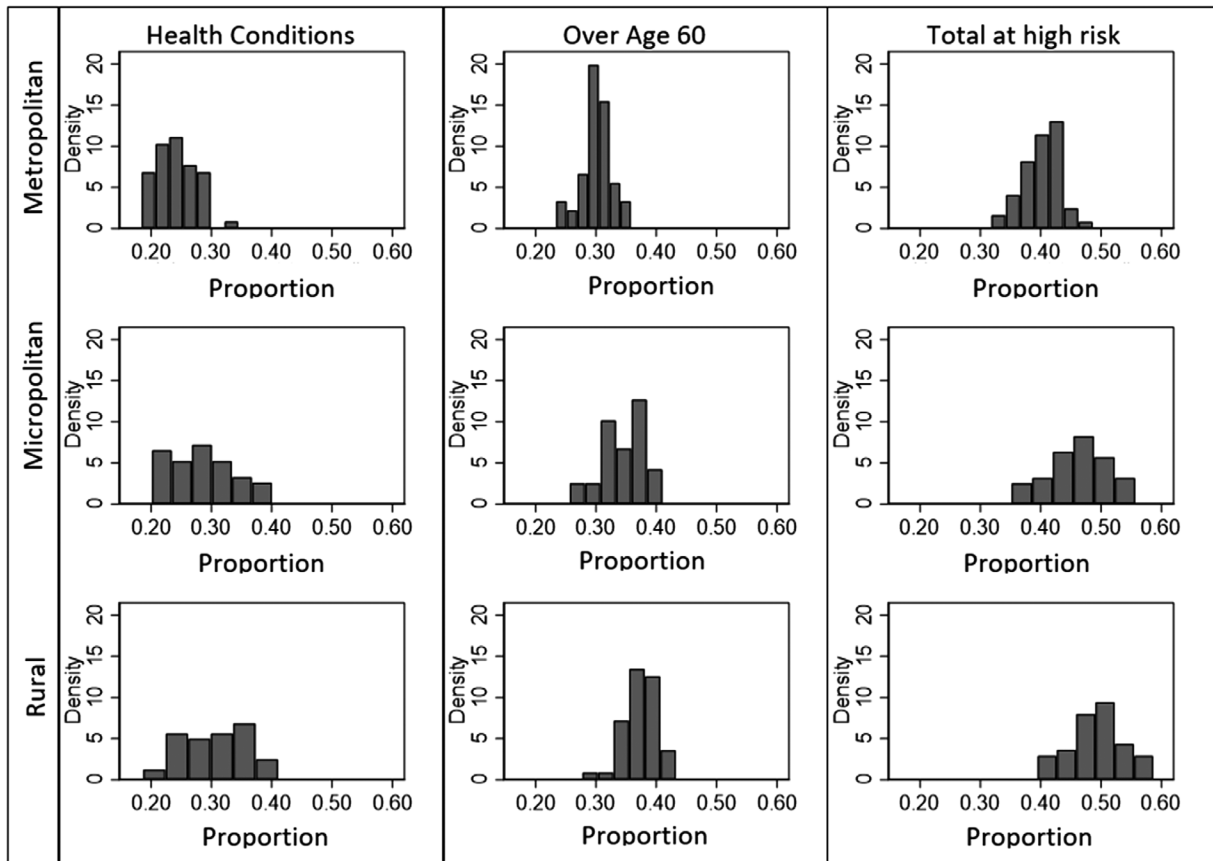
More than half of rural residents are at increased risk of hospitalization and death if infected with COVID-19. Due to the higher percentage at high risk of hospitalization, rural residents will generate an estimated 10% more hospitalizations per capita than urban residents given equal

spread. The need for care may be particularly devastating in the South Census region, where the percent of rural population that is high-risk exceeds 50% for 10 states. In addition, rural hospital closures further exacerbate the capacity to treat seriously ill patients with COVID-19 in rural areas. Since 2017, 40 rural hospitals have closed and others have reduced their number of beds, further reducing capacity for COVID-19 care even below the estimates presented in this study.<sup>17</sup> Additionally, rural access to intensive care and ventilators, key aspects of care needed for the 5% of critically ill COVID-19 patients, is limited.<sup>18</sup> As a result, many rural residents may travel or be transferred to urban hospitals for care. Transfers require precious time that can affect outcomes in critical situations, even under normal conditions. Transfers during the wave of COVID-19 infections in cities may present additional challenges if the receiving hospital is also overwhelmed. As a result, the preparedness of urban hospitals will impact care for some rural residents as well.

**Supply Chain Modifications**

Resources for combating this epidemic are limited, and rural areas need financing and supplies to strengthen their response to COVID-19. Some hospital vendors have rationed orders for personal protective equipment and other supplies according to ordering history. As a result, rural

**Figure 2** Proportion of States' Residents at Risk of Serious Illness Due to COVID-19 in Metropolitan, Micropolitan, and Rural Areas.  
 Source: Authors' analysis of 2018 Behavioral Risk Factor Surveillance System data.



hospitals that have been tightly controlling expenses may be limited to those small supply stocks, leaving them unprepared to handle the surge during the epidemic. The national stockpile is intended to be a safety net but is insufficient for a crisis of this magnitude. Policy makers should consider how national resources are distributed according to projected need in both low- and high-density areas. Structural urbanism may lead to disproportionate distribution of supplies as they become available, with rural areas getting fewer supplies and equipment per capita.<sup>19</sup> Senate lawmakers are urging the Federal Emergency Management Agency to coordinate with the Department of Agriculture and Department of the Interior efforts to support the rural COVID-19 response.<sup>20</sup>

**Regulatory Changes**

In response to COVID-19, the Centers for Medicare & Medicaid Services (CMS) is waiving certain regulations to give providers more flexibility and reduce report-

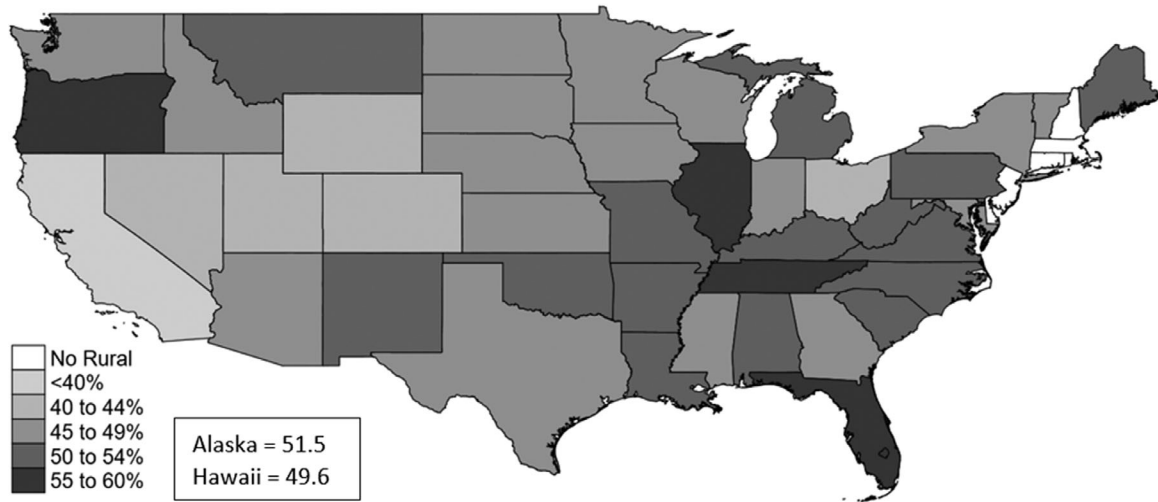
ing burden.<sup>21</sup> For example, CMS waived bed restrictions and length of stay limitations for Critical Access Hospitals. However, reimbursement for the cost of caring for COVID-19 patients is a concern for rural providers who care for uninsured or underinsured patients. Although providers are not charged for the COVID-19 test, they are charged for the flu and respiratory syncytial virus infection (RSV) tests, which are required prior to receiving the COVID-19 test. As the need for testing grows, unreimbursed expenses may become prohibitive for some rural providers to continue providing care, particularly for uninsured or underinsured patients.

**Financial Assistance**

Many rural hospitals remain at high risk of financial distress, and the additional costs associated with epidemic preparation may force more hospitals to close or fail to meet the needs of their community.<sup>22</sup> Cash supply and short-term financing for rural hospitals may not be

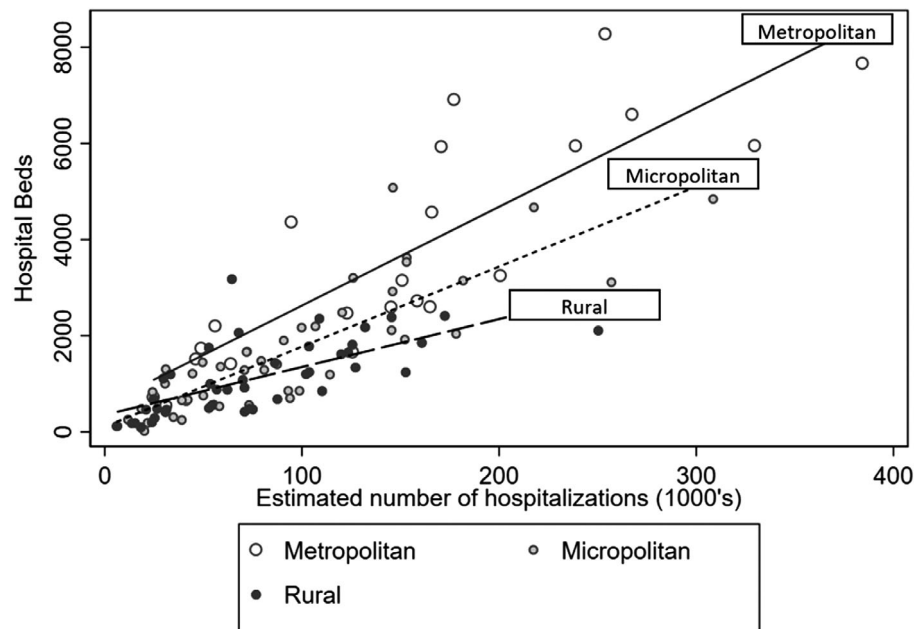
**Figure 3** Percent of Rural Residents at High Risk of Serious Illness Due to COVID-19.

Source: Authors' analysis of 2018 Behavioral Risk Factor Surveillance System data.



**Figure 4** Number of Hospital Beds Compared to Estimated COVID-19 Hospitalizations for State Metropolitan, Micropolitan, and Rural Populations.

Source: Authors' analysis of 2018 Behavioral Risk Factor Surveillance System and 2017 Area Health Resource File data. Truncated to show observations with state high-risk population less than a half million people. Assumes 30% of high- and low-risk populations are infected with COVID-19 and assumes a 10% hospitalization rate in low-risk populations and 30% hospitalization rate in high-risk populations.



sufficient to support the up-front costs of care and preparation during a high-volume period, like an epidemic.<sup>23</sup> Advance payments prior to and during the surge would support rural hospitals' efforts to prepare for the epidemic and provide necessary care. CMS implemented a 20% reimbursement increase for COVID-19 patients through the Inpatient Prospective Payment System, but these changes

do not benefit the majority of rural hospitals because they receive cost-based reimbursement.<sup>24</sup>

On May 1, 2020, the Department of Health and Human Services (HHS) announced that it is distributing \$10 billion from the Provider Relief Fund to rural providers in support of the national response to COVID-19.<sup>25</sup> Rural Health Clinics and Community Health Centers will



receive a minimum level of support no less than \$100,000, with additional payment based on operating expenses. Rural acute care general hospitals and Critical Access Hospitals will receive a minimum level of support of no less than \$1,000,000, with additional payment based on operating expenses.

## Limitations

This limited, descriptive analysis presents a best-case scenario where spread of COVID-19 is 30%. We assumed only 10% of people at low risk would require hospital care, but there is little evidence about the actual rate of hospitalization in this population because many mild cases go undetected. Though recent data suggest the infection rate is not lower in rural areas, there is substantial uncertainty in these preliminary estimates.<sup>26</sup> This estimate of bed capacity does not consider current occupancy rates. Rural hospitals typically have lower average daily census than urban hospitals, but they will still be responsible for injuries and other acute illnesses that occur during the pandemic, reducing capacity for COVID-19 care. Institutionalized adults are a group that may be at high risk of serious illness if infected with COVID-19, but this group is not captured in the BRFSS responses. As a result, our data may underestimate the total number at high risk during the pandemic.

## Conclusion

Experts expect COVID-19 burden to stress hospital capacity across the country, and rural areas are no exception. This analysis represents a conservative estimate of the number of people at risk of serious illness from COVID-19 and the ability of rural hospitals to meet demand for COVID treatment. The \$10 billion distribution will augment the cash of rural hospitals and providers for several weeks. However, policy makers need to consider supply chain modifications, regulatory changes, and ongoing financial assistance to support rural communities in caring for people affected by COVID-19.

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