

CDC's Pandemic Severity Assessment Framework and COVID-19 Hospitalizations

By Alex Brill and Christy Robinson | April 2020

The focus during a public health crisis like the current pandemic naturally revolves around the consequences for the public: how many people have been tested, how many have been infected, and how many have died. There has also been intense focus on the sufficiency of specific medical supplies — namely, ventilators and personal protective equipment — but as hospital admission rates rise rapidly, COVID-19 is certain to put a strain on the broader healthcare system.

To assess ongoing demand for medical supplies, decision-makers will need forecasts of COVID-19 hospitalizations in the coming months. Situating our analysis in the [Pandemic Severity Assessment Framework](#) (PSAF), we estimate that the number of COVID-19 hospitalizations in the United States will be between 12.3 million and 26.3 million. The PSAF, which was developed seven years ago by researchers at the Centers for Disease Control and Prevention (CDC), puts emerging pandemics in historical context in order to better predict their outcomes. Available data indicate that COVID-19 is comparable to the 1918 pandemic under this framework.

COVID-19 IN CONTEXT

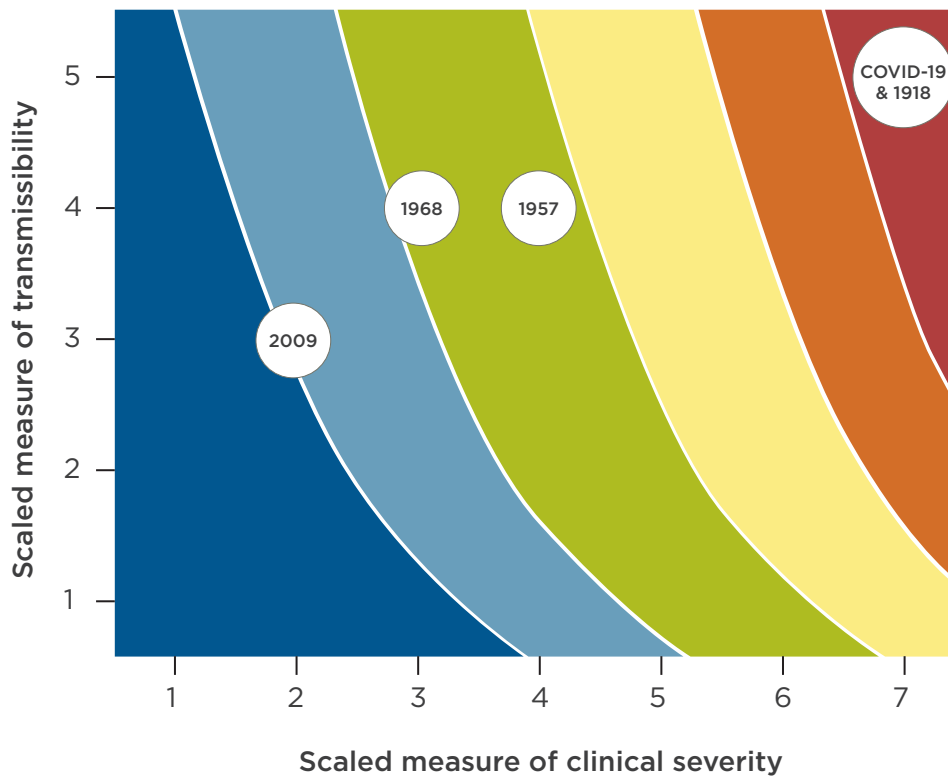
The 20th century saw [three global pandemics](#), in 1918, 1957, and 1968. In 1918, 50 million people died worldwide, with more than 500,000 deaths in the United States. The pandemics in 1957 and 1968 each killed roughly 1 million people

around the world, with approximately 100,000 US deaths. The first pandemic of this century, [H1N1](#), hit in 2009 but was relatively mild compared to the 20th-century outbreaks, resulting in roughly 150,000–575,000 deaths worldwide, with approximately 12,500 deaths in the United States.

As the Department of Homeland Security has [noted](#), disparity among pandemic death rates “largely relates to the severity of infections and the virulence of the influenza viruses that caused the pandemics.” In public health, these two factors are called clinical severity and transmissibility, and they underpin the PSAF.

The PSAF was developed specifically to facilitate a meaningful comparison of a new pandemic to past ones and allow for an assessment of a new outbreak's public health consequences. The framework is quite simple. As **Figure 1** shows, with clinical severity on the x-axis and transmissibility on the y-axis, pandemics can be plotted using an assigned ordinal scale value (1–7 for clinical severity, and 1–5 for transmissibility) based on precise criteria.

FIGURE 1. PANDEMIC SEVERITY ASSESSMENT FRAMEWORK SHOWING COVID-19 AND FOUR PREVIOUS PANDEMICS



Source: Based on Carrie Reed, Matthew Biggerstaff, Lyn Finelli, et al., “Novel Framework for Assessing Epidemiologic Effects of Influenza Epidemics and Pandemics,” *Emerging Infectious Diseases* 19, no. 1 (January 2013): 85–91.

In early March, public health researchers led by Andre Freitas used evidence from patients in China to [estimate](#) that COVID-19 has a transmissibility score of 5 and a clinical severity score of 4–7. Based on more recent US data on case-fatality and case-hospitalization ratios, a clinical severity score of 7 is most likely. By these estimates, as **Figure 1** shows, COVID-19 is likely as severe as the 1918 pandemic.

ESTIMATED HOSPITALIZATIONS FOR COVID-19

While the PSAF is valuable for understanding COVID-19 relative to past pandemics and the overall severity of the outbreak, specific outcomes are not conveyed in the framework. Underlying elements of the PSAF, however, can be examined

more closely to gain additional insights such as the expected number of COVID-19 hospitalizations.

For a pandemic with a transmissibility rating of 5 and a clinical severity rating of 7, the PSAF tells us we can expect a community attack rate of 25 percent or greater and a case-hospitalization ratio in excess of 7 percent. Unfortunately, COVID-19’s attack rate, while still uncertain, could be significantly higher. The midpoint of a recent Harvard Global Health Institute [analysis](#) assumes an attack rate of 40 percent. The case-hospitalization ratio varies by locality and over time. According to the [COVID Tracking Project](#), the median case-hospitalization ratio among reporting states is 15 percent, while the ratio in [New York](#) is more than 20 percent.

For our analysis, we model attack rates of 25 and 40 percent and case-hospitalization ratios of 15 and 20 percent. By our estimate, the number of COVID-19 hospitalizations could range from 12.3 million to 26.3 million (see **Table 1**).

TABLE 1. PROJECTED COVID-19 HOSPITALIZATIONS

ATTACK RATE (CASES)	CASE-HOSPITALIZATION RATIO	
	15%	20%
25% (82 million)	12.3 million hospitalizations	16.4 million hospitalizations
40% (131 million)	19.7 million hospitalizations	26.3 million hospitalizations

Source: Authors' calculations.

ANTICIPATING DEMAND FOR HOSPITAL RESOURCES

Nationally, the number of COVID-19 hospitalizations is not well reported, but in New York alone there were nearly **43,000** hospitalizations as of April 13, 2020, more than double the total reported at the beginning of the month. Ultimately, the exact number of hospitalizations will depend on the effectiveness of social distancing as well as the precise transmissibility and clinical severity of COVID-19.

In the coming weeks and months, sufficient hospital resources will be vital for keeping the death toll as low as possible, especially if the estimated hospitalizations occur over a short period of time. Some items, like personal protective equipment today, will face shortages and require concerted response efforts. In other cases, proper planning can ensure an adequate supply is available to providers. An estimate of COVID-19 hospitalizations, like ours, can help with this type of planning. As more data from across the United States become available, these estimates can be further refined.

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About MGA and the Authors

Matrix Global Advisors (MGA) is an economic policy consulting firm in Washington, DC, specializing in fiscal, health care, and tax policy matters. Alex Brill is the founder and CEO of MGA. He previously served on the staff of the House Ways and Means Committee and the White House Council of Economic Advisers. Christy Robinson is a principal at MGA.

