Overestimating population immunity contributed to US delta variant surge

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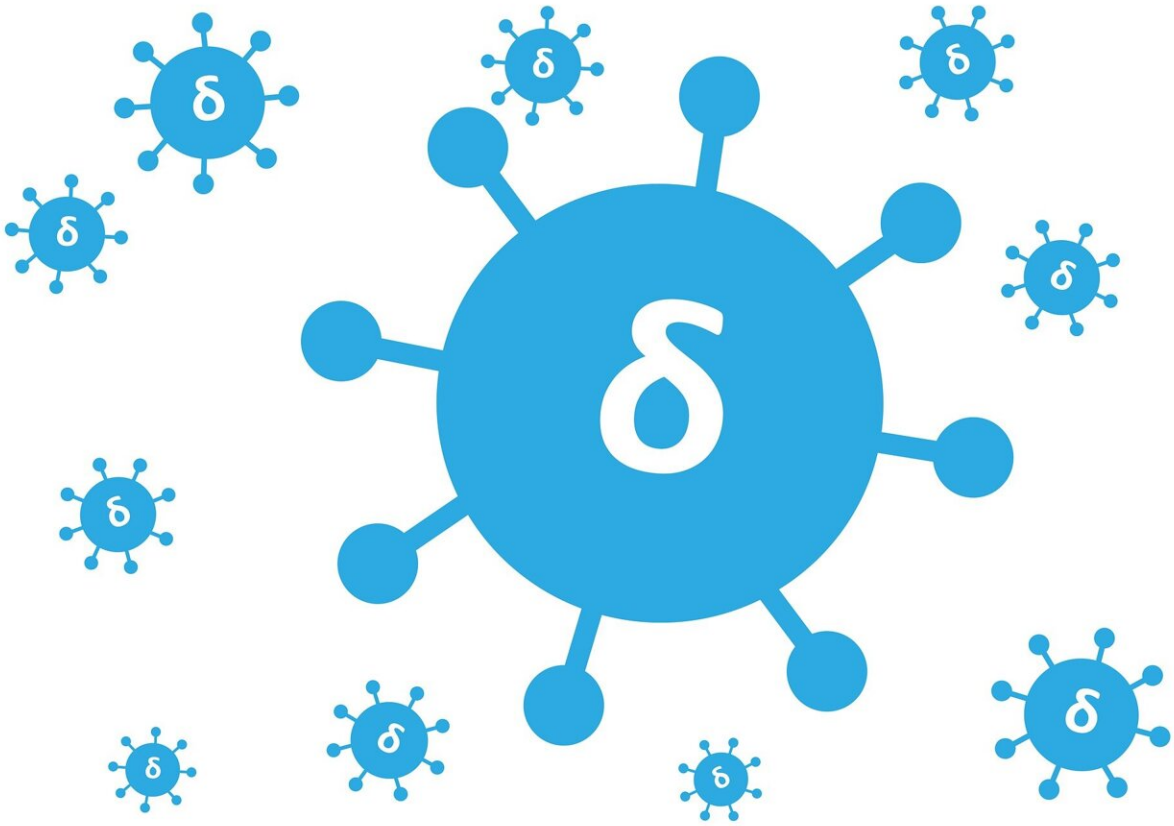

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When the delta variant of SARS-CoV-2 hit the United States in summer 2021, it led to a larger-than-expected surge in cases, hospitalizations and

deaths. New research suggests this lack of preparedness may have been partially due to overestimating the number of US citizens who were immune or partially immune to the virus.

According to the researchers, who focused their analysis on southern New England, it had been previously estimated that a combination of prior infections and high vaccination rates had led to between 80 and 85 percent of southern New Englanders having immunity against SARS-CoV-2 infection by the time the delta variant began to circulate in July 2021.

But in their new study, the researchers found that the percentage of those immune was actually closer to 67 percent, leaving almost one-third of Rhode Island, Connecticut and Massachusetts residents still fully susceptible to infection.

Maciej Boni, associate professor of biology at Penn State, said this was likely due to underestimating the number of people who had both been previously infected and vaccinated.

"We found that prior to June 2021, about 27 percent of vaccines given in southern New England were given to people who had already been previously infected with SARS-CoV-2," Boni said. "This overlap of infection and vaccination led to an inaccurate picture of the percentage of the population that was still susceptible to infection, therefore throwing off projections of what the delta variant surge would look like here in the US."

The researchers said the findings—published today (May 26) in *JAMA Network Open*—can help shape future vaccination strategies.

"If we're running a crisis-situation vaccination campaign in the future, we should avoid allocating just enough vaccines to push the population

to herd immunity," Boni said. "Instead, we should purchase more vaccines than we think we need, roll out the campaign as quickly as possible, and push the total number of vaccinees well past the herd immunity threshold."

According to the researchers, the most trusted and classic approach to predict future surges is to consider the number of people who already have some degree of immunity, either through vaccination or previous infection. This helps determine how many people are still susceptible to infection and serious disease.

But, Boni said calculating the percentage of the population that has been previously infected with COVID-19 has been difficult throughout the pandemic. It can be challenging to estimate not only the number of unreported symptomatic cases, but the number of asymptomatic cases, as well.

"When estimating population immunity, it's also vital to take vaccination rates into account, including how many people have been both infected and vaccinated," Boni said. "You can't simply add the number of people who have been infected with the number of people who have been vaccinated or an overestimation of immunity will occur."

For this study, the researchers gathered thousands of data points, structured into 11 separate data streams, from Massachusetts, Connecticut, and Rhode Island, including information on confirmed cases, hospitalizations, deaths, and weekly vaccination numbers.

Then, the researchers created a model to estimate the overlap of previous infection and vaccination. The model assumed that people who knew they had already been infected did not get a vaccine between January and May 2021, when vaccines were in limited supply. But it also estimated the number of people who got vaccinated because they were

unaware they had already had COVID-19.

"Combining these factors meant that 27 percent of people that lined up for vaccinations in spring 2021 were already antibody-positive and just didn't know it," Boni said. "Of course, many people who knew they were infected also got vaccinations, per CDC and DOH recommendations, meaning this is a minimum estimate of vaccines that went to people who already had COVID antibodies in southern New England. It is likely that population immunity was overestimated in many other states as well."

More information: Maciej Boni et al, SARS-CoV-2 attack rate and population immunity in southern New England, March 2020 to May 2021, *JAMA Network Open* (2022). DOI: 10.1001/jamanetworkopen.2022.14171

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