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Opinion: Why COVID-19 positivity rate may be a misleading metric

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Cornell, Duke and the University of Illinois at Urbana-Champaign all conduct COVID-19 surveillance testing. As of early December 2020, Cornell had 308 positive cases amongst students, faculty and staff, while Duke had 267 cases and the University of Illinois 4,407.

All of these universities routinely reported positivity rates under 0.50%, yet their population infection rates (percentage of people who have been infected) were dramatically different; 2% for Cornell, around the same for Duke, and over 13% for the University of Illinois.

Unfortunately, these universities were demonstrating how misleading positivity rates can be. Given the widespread use of positivity rates, when do they convey useful information?

States and counties use positivity rates to communicate their COVID-19 status. Becker Hospital Review reports every states' seven-day positivity rate. Iowa and Idaho have some of the nation’s highest positivity rates, but also some of the lowest number of tests per capita. This makes it difficult to assess their true COVID-19 infection risk.

In contrast, Michigan has both a high positivity rate and a high number of tests per capita. This means that a wider swath of the Michigan population is being tested, and this tested population has a large number of infections.

Positivity rates are computed by dividing the number of positive test results over some time period (like a seven-day window) by the number of tests administered. So if 1,000 tests are administered to 1,000 unique people over a seven-day period and 60 positive tests are reported, then the seven-day positivity rate is 6%.

Positivity rates become problematic when the same people get tested more than once, in the same time period or over multiple time periods, as is the case with surveillance testing. In the above example, if more tests become available during a given week, with 500 people getting tested one time and 500 people getting tested twice, all from the same group of 1,000 people

with 60 unique positive tests, then the seven-day positivity rate is 60 divided by 1,500 tests, or 4%.

How can the same number of people and the same number of positive tests result in two different positivity rates?

Positivity rates are a function of the number of tests administered and the distribution of people tested. For surveillance testing, with the same people tested multiple times, positivity rates give the illusion of lower COVID-19 community risk. Reporting the percentage of unique people that tested positive over some time period provides a better way to measure community risk.

Michigan has had more than 900,000 confirmed cases, which means that 9% of Michigan residents have had confirmed infections, Michigan's population infection rate. Its recent seven-day average positivity rate of around 12% is a function of the number of tests and the pool of people tested.

If all the recent tests were to unique people, then the positivity rate provides an estimate of statewide COVID-19 infection risk. If some people were tested more than once over the past seven days, the actual statewide COVID-19 infection risk is underestimated by the positivity rate, which means that the COVID-19 risk situation could be even worse.

Comparing positivity rates between two populations, one conducting surveillance testing and one that is not, is not only flawed, it is deceptive. A recent Forbes article comparing Illinois' state positivity rates with the University of Illinois' positivity rate says nothing about whether the state infection rate is problematic, or the university's infection rate is good.

As new variants of the coronavirus circulate and become the dominant infections, positivity rates need to be replaced by population infection rates and the percentage of active cases, particularly in those communities that employ surveillance testing or widespread testing.

Moreover, the rates of change in these measures are most informative to assess community COVID-19 risk status. With more people vaccinated, adding the percentage of a population immunized will provide an added dimension to this data.

Positivity rates may be easy to compute, but they are prone to certainly misrepresent, and often underestimate, actual community COVID-19 risk.

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