Researchers use mobile device data to predict COVID-19 outbreaks

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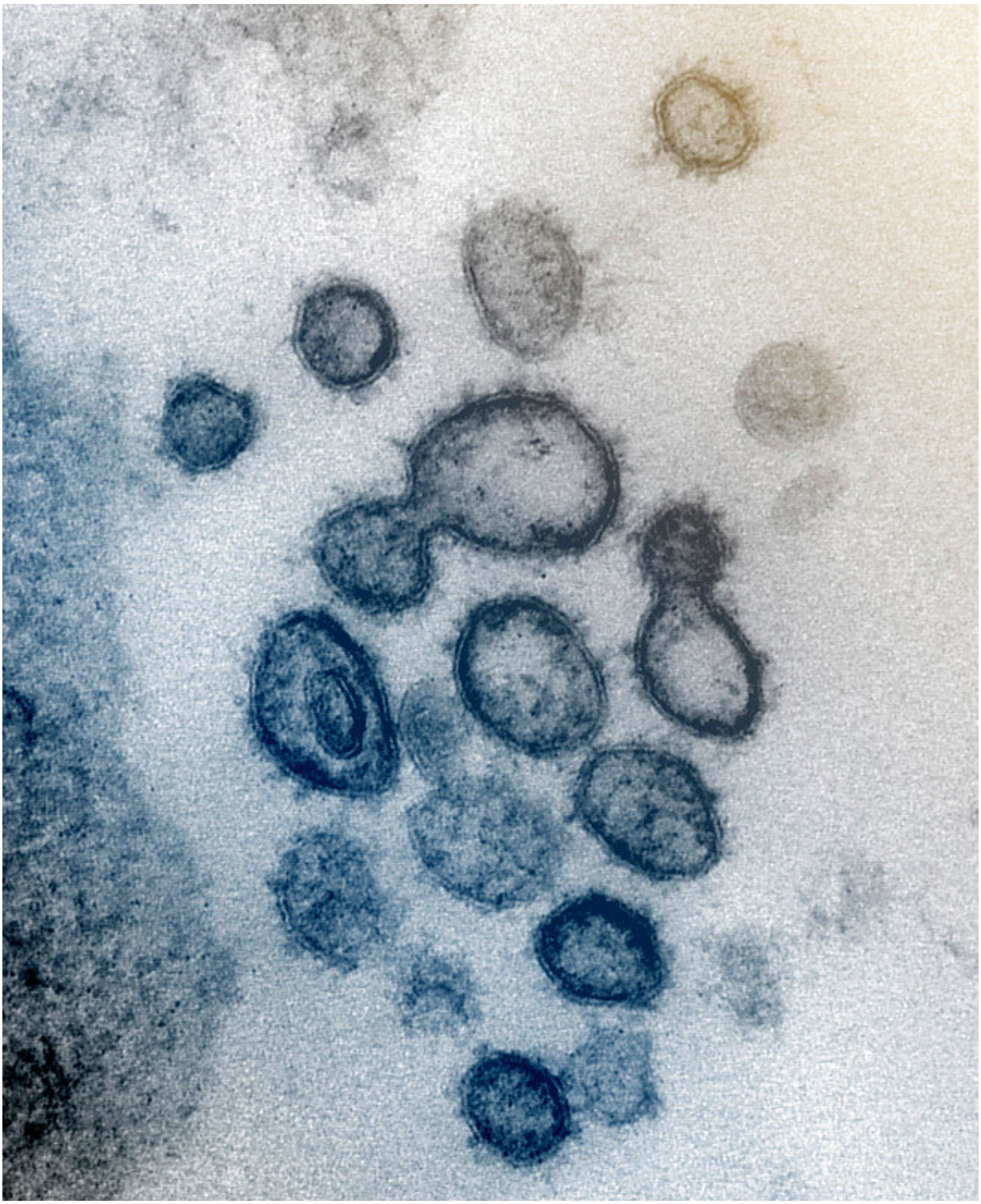

This transmission electron microscope image shows SARS-CoV-2 -- also known as 2019-nCoV, the virus that causes COVID-19 -- isolated from a patient in the US. Virus particles are shown emerging from the surface of cells cultured in the

lab. The spikes on the outer edge of the virus particles give coronaviruses their name, crown-like. Credit: NIAID-RML

Researchers at the Yale School of Public Health were able to accurately predict outbreaks of COVID-19 in Connecticut municipalities using anonymous location information from mobile devices, according to a new study published in *Science Advances*.

The novel analysis applied in the study could help health officials stem community outbreaks of COVID-19 and allocate testing resources more efficiently, the researchers said.

The study was conducted by data scientists and epidemiologists from the Yale School of Public Health, the Connecticut Department of Public Health, the U.S. Centers for Disease Control and Prevention and Whitespace Ltd., a spatial data analytics firm.

The key to the findings was the precision with which researchers were able to identify incidents of high frequency close personal contact (defined as a radius of 6 feet) in Connecticut down to the municipal level. The CDC advises people to keep at least six feet of distance with others to avoid possible transmission of COVID-19.

"Close contact between people is the primary route for transmission of SARS-CoV-2, the virus that causes COVID-19," said the study's lead author Forrest Crawford, an associate professor of biostatistics at the Yale School of Public Health and an associate professor of ecology and evolutionary biology, management, statistics and data science at Yale.

"We measured close interpersonal contact within a 6-foot radius everywhere in Connecticut using mobile device geolocation data over the

course of an entire year," Crawford said. "This effort gave Connecticut epidemiologists and policymakers insight to people's social distancing behavior statewide."

Other studies have used so-called "mobility metrics" as proxy measures for social distancing behavior and potential COVID-19 transmission. But that analysis can be flawed.

"Mobility metrics often measure distance traveled or time spent away from a location, such as your home," Crawford said. "But we all know it's possible to move around a lot and still not get very close to other people. So mobility metrics are not a great proxy for transmission risk. We feel close contact predicts infections and local outbreaks better."

The findings are based on a review of Connecticut mobile device geolocation data from February 2020 to January 2021. All of the data was anonymized and aggregated, and no personally identifiable information was collected.

A novel algorithm computed the probability of close contact events across the state (times when mobile devices were within six feet of each other) based on geolocation data. That information was then incorporated into a standard COVID-19 transmission model to predict COVID-19 case levels not only across Connecticut, but in individual Connecticut towns, census tracts, and census block groups.

The researchers said they successfully predicted an initial wave of Connecticut COVID-19 cases from March to April 2020, a drop in statewide cases during June to August and localized outbreaks in certain Connecticut towns in August and September.

Many health officials currently rely on general surveillance data such as the number of confirmed cases, hospitalizations and deaths to track the

spread of COVID-19. But that process can lag actual disease transmission by days and weeks. Analyzing close personal contact rates is much faster, the researchers said.

"The contact rate we developed in this study can reveal high-contact conditions likely to spawn local outbreaks and areas where residents are at high transmission risk days or weeks before the resulting cases are detected through testing, traditional case investigations and contact tracing," Crawford said.

More information: Forrest W. Crawford et al, Impact of close interpersonal contact on COVID-19 incidence: Evidence from 1 year of mobile device data, *Science Advances* (2022). DOI: 10.1126/sciadv.abi5499

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