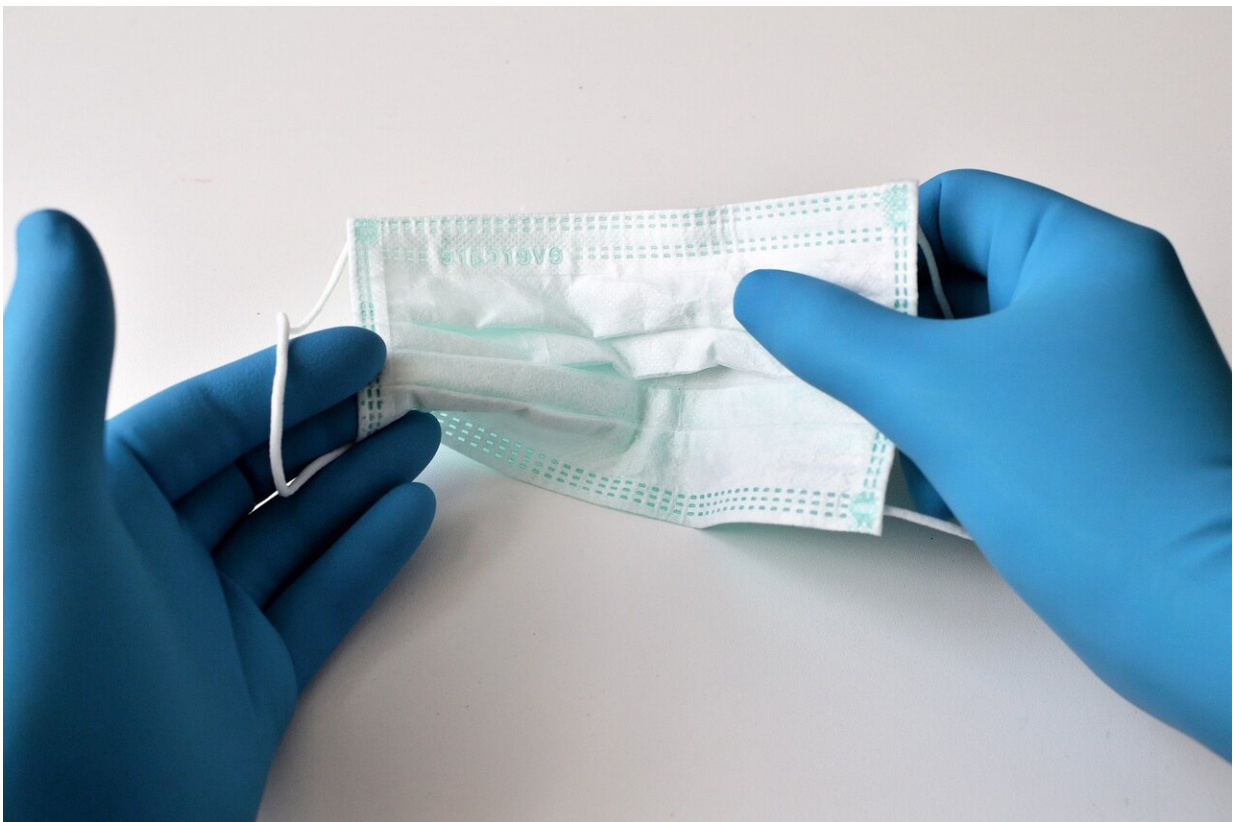


Online searches can help foreshadow future COVID-19 surges and declines, new study shows

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Online searches for mobile and isolated activities can help to predict later surges and declines in COVID-19 cases, a team of researchers has

found. Its findings, based on a four-month analysis of online searches, offer a potential means to anticipate the pathways of the pandemic—before new infections are reported.

"This is a first step towards building a tool that can help predict COVID case surges by capturing higher-risk activities and intended mobility, which searches for gyms and in-person dining can illuminate," says Anasse Bari, a clinical assistant professor in computer science at New York University's Courant Institute of Mathematical Sciences and one of the authors of the paper, which appears in the journal *Social Network Analysis and Mining*. "Using such 'alternative data' is nothing new and has been applied for other purposes—for instance, alternative data has been used in finance to generate data-driven investments, such as studying satellite images of cars in parking lots to predict businesses earnings."

"Our research shows the same techniques could be applied to combatting a pandemic by spotting, ahead of time, where outbreaks are likely to occur," adds Megan Coffee, a clinical assistant professor in the Division of Infectious Disease & Immunology at NYU Grossman School of Medicine. "Developing a barometer of behavior would, with further work and validation, allow policymakers and epidemiologists to track the impact of social interventions and brace for rising surges."

The research also showed an association between intended activities outside the home after lockdown restrictions were lifted, pointing to how the effects of policy decisions can be measured using alternative data.

Since the onset of the pandemic, governments have restricted activities, often based on surges of COVID-19 cases, then loosened these restrictions after declines. However, these actions are in response to infection rates and are designed to limit the spread of future cases.

In the *Social Network Analysis and Mining* study, the researchers sought to determine if there were ways to spot behaviors known to be risky during the pandemic (e.g., visits to barbershops and nail salons) ahead of local and regional outbreaks—and conversely, identify behaviors known to be less risky (e.g., exercising at home) prior to declines in coronavirus cases.

"Our goal was to capture the underlying social dynamics of an unprecedented pandemic using alternative data sources that are new to infectious disease epidemiology," explains Bari. "When someone searches the closing time of a local bar or looks up directions to a local gym, they give some insight into what future risks they may have."

To examine this, they studied online searches from March through June in 2020 in all 50 states. Here, they divided searches into two categories—or "tracks": a mobility index track, which categorized searches linked to interactions with others outside the home (e.g., "theaters near me," "flight tickets"), and an isolation index track, which categorized searches linked to activities done at home ("food delivery," "at-home yoga").

The team's choice of search keywords was informed by a recent Democracy Fund + UCLA Nationscape survey that tracked activities individuals reported they would prioritize attending if "restrictions were lifted on the advice of public health officials regarding activities." The most popular results included "going to a stadium/concert," "going to the movies," and "attending a sports event."

Using Google Trends data, the researchers tracked search trends related to mobility and isolation to develop mobility and isolation indexes. They complemented these with a "net movement index," which was the difference between the mobility index and the isolation index.

The researchers then looked at COVID-19 case growth 10 to 14 days later—the expected lag between exposure and symptoms—at the state level by examining data from state and local health agencies.

Overall, they found that the net movement index correlated with new COVID-19 cases—reported weekly—in 42 of 50 states over the studied period (March-June 2020).

The researchers also looked more closely at five states (Arizona, California, Florida, New York, and Texas) to determine the impact of the ending of stay-at-home orders on searches. In all of these states, the mobility index, which decreased during the initial lockdown phase, increased as re-openings began. Subsequently, COVID-19 cases rose again nationwide in June 2020 and surged in Arizona, California, Florida, and Texas.

By contrast, an earlier sharp decline in mobility indices was followed by a sharp decline in the case growth data in these same five states.

"From this work, we hope to build a [knowledge base](#) on human behavior change from alternative data during the life cycle of the pandemic in order to allow machine learning to predict behavior in future epidemics," says Aashish Khubchandani, an NYU undergraduate and one of the paper's authors.

The researchers recognize that search-based methods to predict infection outbreaks raise privacy concerns. However, they emphasize that their tool uses large volumes of search queries, not individual ones, and relies on anonymized data in order to offer health-related projections.

More information: Anasse Bari et al, COVID-19 early-alert signals using human behavior alternative data, *Social Network Analysis and Mining* (2021). [DOI: 10.1007/s13278-021-00723-5](https://doi.org/10.1007/s13278-021-00723-5)

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