

Traffic and mobile phone data predict COVID case counts in rural Pennsylvania

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According to a new study by Penn State researchers, movement around town predicted COVID-19 cases in Centre County, Pennsylvania, during initial stay-at-home orders and subsequent restricted phases in 2020. The researchers used data from mobile phones and traffic cameras, such as the one pointed at Park Ave near the Penn State arboretum pictured here, to approximate movement. Credit: Penn State

How much people moved around town predicted COVID-19 cases in a rural Pennsylvania county in 2020, according to a new study by researchers at Penn State. The researchers approximated movement

during the initial stay-at-home orders and subsequent restricted phases by using data from traffic cameras and mobile devices. They confirmed that increases in movement preceded increases in COVID-19 cases in Centre County, Pennsylvania. The results also revealed general compliance with local regulations and suggest that these types of passive surveillance data could be used to monitor and improve behavioral intervention guidelines for outbreak management.

"With the emergence of the COVID-19 outbreak in 2019, [local governments](#) initially relied heavily on behavioral interventions like stay-at-home orders in order to limit transmission," said Christina Faust, postdoctoral researcher at Penn State and first author of the study. "Knowing if people are willing to follow these kinds of interventions, and if these interventions do what they are intended to do, is important to future outbreak planning."

The researchers approximated movement from March to August 2020 in Centre County, Pa, which is home to Penn State's University Park campus, during a period when university students were primarily not residing in the area. This period encompassed the strictest restrictions in the county, including a 40-day red phase that involved a stay-at-home order except for life-sustaining businesses and activities; a 20-day yellow phase that stressed remote work and teaching and a preference for curbside retail; and the initial 78 days of a green phase that mandated reduced capacity at local businesses, mask wearing in public, and guidelines for additional businesses to reopen.

"Assessing the impact of intervention strategies is especially important in [rural areas](#), where access to healthcare is often limited and under-resourced," said Nita Bharti, Lloyd Huck Early Career Professor in Biology at Penn State and senior author of the paper. "Rural areas have limited health care capacity and struggle to manage the large numbers of patients we expect to see during outbreaks like this. Preventive strategies

to limit transmission are critical."

The research team used two data sources as proxies for movement. They collected real time images from 19 traffic cameras from across the county, including "connector" roads that provide links between towns and "internal" roads that measure movement within towns. They also studied anonymized location data from [mobile devices](#) from the company SafeGraph, which captured visits to over two thousand points of interest around the county, including grocery stores, coffee shops, gas stations, and locations on the Penn State campus. The team compared numbers of mobile visits recorded in the summer of 2020 to the pre-pandemic summer of 2019 to identify differences due to behavioral interventions. Their results appear in a paper published in the journal *Epidemiology & Infection*.

The research team found that, when moving from red phase to yellow and especially from yellow phase to green, traffic volume increased on both internal and connector roads. Although the numbers of visits to local points of interest were significantly lower than visit numbers from 2019, they increased as restrictions were lifted.

"During the strictest phases, movement was mostly internal, which is what we would hope to see in order to reduce opportunities for transmission between towns," said Faust. "As restrictions eased, we saw a lot more traffic, particularly on connector roads, and more mobile visits to points of interest, which collectively suggests overall compliance with these intervention strategies. What is particularly reassuring is that, even though changes in phase regulations were announced 10 days before they were implemented, we did not see a change in movement until the new phase came into effect."

Reported cases of COVID-19 in the county were related to movement collected from both data sources, with a 9 to 18-day lag depending on

data type. The researchers believe this lag includes the incubation time of the virus—when an individual is infected but may not yet show symptoms—as well as in some cases considerable delays in accessing a test and receiving test results.

"Increases in movement reliably preceded increases in COVID-19 cases during the study period," said Faust. "These results suggest that vehicle traffic and mobile visit data could be used in real time to monitor the outbreak. For example, if there is an uptick in movement, local governments could reinforce messaging and prepare to allocate resources for health care to high-[movement](#) areas."

The researchers note the importance of using multiple types of data; individual data sources may measure different types of behaviors and reflect certain subsets of a population. For example, they believe the vehicle data may represent permanent residents while mobile visits may better reflect students. While urban areas may have more data sources available, this study demonstrates that the combination of existing data sources in rural areas— vehicle traffic and mobile data—provide important information.

"Rural areas typically experienced delayed introductions to the virus and delayed outbreaks, but statewide regulations were largely based on outbreaks in [urban areas](#), where the bulk of cases occurred," said Bharti. "Local oversight, when paired with federal and statewide response and relief, can more effectively serve outbreak response, management, and planning efforts. Here we show that measuring local population movements through passive approaches can help assess the effectiveness of intervention strategies and inform policies that target transmission prevention."

More information: Christina L. Faust et al, Passive surveillance assesses compliance with COVID-19 behavioural restrictions in a rural

US county, *Epidemiology and Infection* (2021). DOI: [10.1017/S0950268821002107](https://doi.org/10.1017/S0950268821002107)

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