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Issue

Public transportation has been blamed for facilitating the spread of COVID-19 in dense, urban areas. As a response to the COVID-19 pandemic, transit agencies have reduced service and implemented mask-wearing mandates and social distancing aboard transit. Some prior studies that address public transportation provide some evidence that negative COVID-19 outcomes are linked to high transit use.[1,2] One early study of COVID-19 transmission on trains in China found that transmission is also affected by the density of passengers, seat spacing, and length of time traveled with other passengers aboard the trains.[3]

Researchers at UC Irvine explored the implications of high bus use on COVID-19 transmission in Los Angeles County between June 2020 and January 2021 by first developing a statistical model relating COVID-19 cases to demographic information (such as race/ethnicity, household income, etc.) and then by developing a statistical model using COVID-19 community case data and bus ridership across the Los Angeles Metro system. This model was then compared to another statistical model of COVID-19 infections that excluded bus ridership.

Key Research Findings

There is no evidence that higher bus ridership is linked to increased COVID-19 transmission in the community. Using a dynamic model of COVID-19 infections and bus ridership at the community level shows that bus ridership is unlikely to be the cause behind spikes in COVID-19 infections in Los Angeles County. This relationship is apparent in Figure 1, where high spikes in COVID-19 infections occur during periods where ridership stayed relatively stagnant. A possibility for this finding is the early implementation of safety measures aboard transit in Los Angeles County.

Seasonality plays a strong role during periods of high COVID-19 transmission. In all the statistical models developed, seasonality had a strong predictive effect on COVID-19 infections in each community. These effects were more pronounced in November and December, when COVID-19 infections were very high.

Demographics, with a few notable exceptions, were not highly correlated with differences in COVID-19 transmission. Only 40 percent of variation in COVID-19 transmission across communities was due to changes in demographics across communities. However, because the areas defined as communities were relatively large, it is possible that this analysis failed to capture some important effects for some key subgroups.

Incorporating information about train ridership will produce more accurate modeling results. The dataset used for the analysis featured in this brief was limited to only bus ridership. A model incorporating rail ridership can help identify transfer points and measure their activity to find whether those stations are linked with higher community COVID-19 transmission.
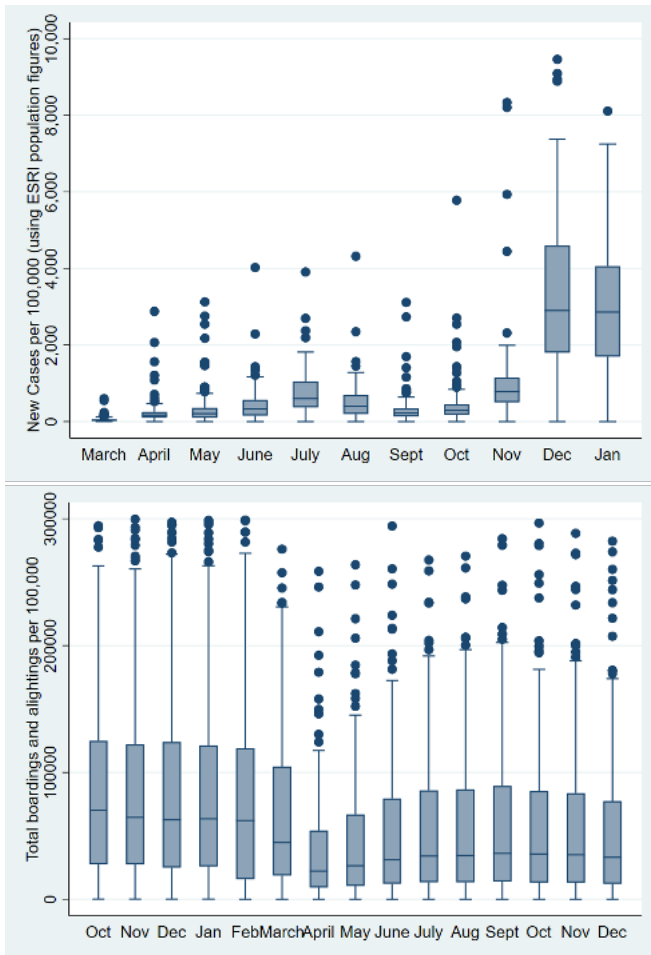
the area between the 75th and 25th percentile of the distribution, and the "whiskers" are drawn at the 97.5th and 2.5th percentile. The "dots" represent outliers observations outside the central 95% of the population. The COVID-19 plot excludes 0.29% of the total observations and the bus ridership plot excludes roughly 6% of observations.

Incorporating information about mobility to points of interest will also produce more accurate modeling results. Because COVID-19 related restrictions changed frequently, it is possible that some COVID-19 cases were caused by increased traffic to and from points of interest such as indoor malls, museums, and retail being reopened. Using more geographically detailed data on mobility can help distinguish between COVID-19 cases caused by bus or other mobility modes.

More Information

This policy brief is drawn from the chapter titled 'The Impacts of Bus Use on COVID-19 Dispersion' included in the book 'Pandemic in the Metropolis'. The book chapter and this brief are both authored by Henry Bernal and Professor David Brownstone, at the University of California, Irvine. For more information, please contact Professor David Brownstone at dbrownst@uci.edu.

Figure 1. Distribution of COVID-19 cases (top) and bus ridership in each community in Los Angeles County (bottom). The shaded rectangles show

[1]Fathi-Kazerooni, S., R. Rojas-Cessa, Z. Dong, and V. Umpaichitra. (2021). "Correlation of subway turnstile entries and COVID-19 incidence and deaths in New York City." *Infectious Disease Modelling*, 6: 183-194.

[2]McLaren, J. (2020). "Racial disparity in Covid-19 deaths: Seeking economic roots with Census data." *NBER Working Paper No. 27407*.

[3]Hu, M., H. Lin, J. Wang, C. Xu, A. J. Tatem, B. Meng, X. Zhang, Y. Liu, P. Wang, G. Wu, and H. Xie. (2021). "Risk of coronavirus disease 2019 transmission in train passengers: an epidemiological and modeling study." *Clinical Infectious Diseases*, 72(4): 604–610.