Houston Bus Ridership Highlights Socioeconomic Disparities in COVID-19 Outcomes

Daniel Q. Phu

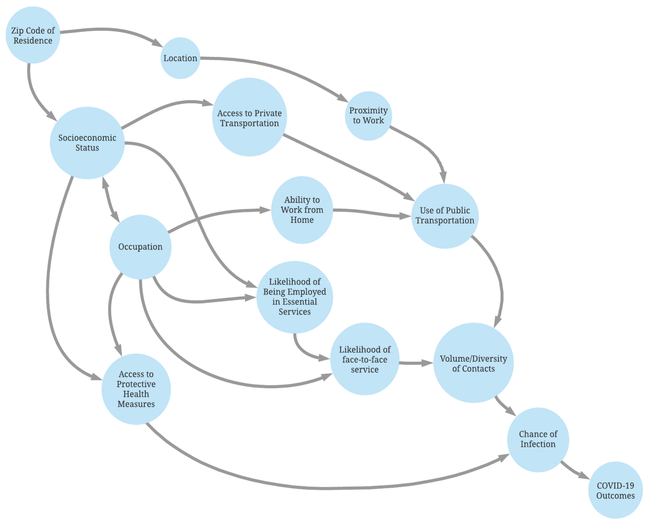
Data Analytics in Student Hands

UNIVERSITY of HOUSTON

Introduction

In the early stages of the COVID-19 pandemic, when no effective treatments exist, identifying and overcoming barriers to healthy behaviors can help reduce disease transmission. Increasing evidence suggests that socioeconomic disadvantages have contributed to disproportionate COVID-19 outcomes, but the behavioral connections supporting this relationship remain unclear.[1]

- Median household income is negatively correlated with COVID-19 prevalence in April 2020, but the relationship offers little actionable insights.[2]
- Reports suggest that essential workers must maintain face-to-face interactions and therefore face increased risk of COVID-19 infection.[3] However, in Houston, the percent of essential workers in a zip code has little correlation with its COVID-19 prevalence in April 2020.[2]
- Use of public transportation in Houston is negatively correlated with median household income, so understanding bus ridership may help the explain socioeconomic disparities in COVID-19 outcomes.[2,4]



Directed acyclic graph demonstrating the relationships between socioeconomic status, public transportation, and COVID-19 outcomes

Objective

This research uses bus ridership to investigate the relationship between human mobility, socioeconomic status, and COVID-19 outcomes in Houston, TX.

Methods

Dataset

- October 2019 ridership per bus stop, which was assumed as pre-pandemic ridership[4]
- Median household income, percent of essential workers, and percent of workers using public transportation for each Houston zip code[2]
- COVID-19 confirmed cases as of April 20, 2020 per zip code[5]

Regression Model

- Ridership was compared with COVID-19 prevalence using a linear regression model
- R-Squared value was used to determine degree of association

Stratification Analysis

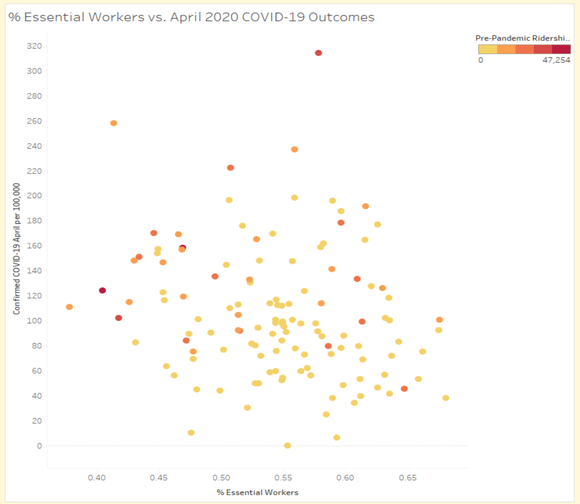
- Controlled for median household income and percent of essential workers by stratifying the data and analyzing the subgroups to see if the original correlations remained

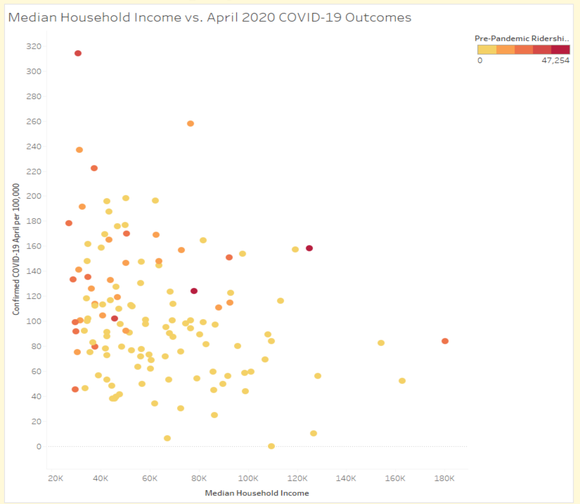
Higher bus ridership is associated with higher COVID-19 prevalence among zip codes of similar socioeconomic status.

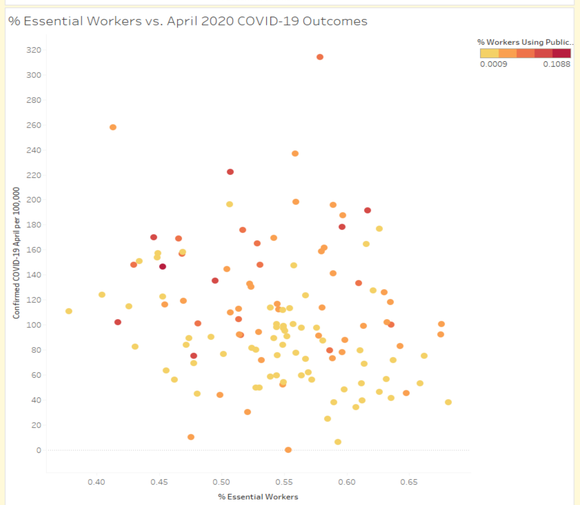
Take a picture to **download the abstract**
Contact: dphu2@uh.edu

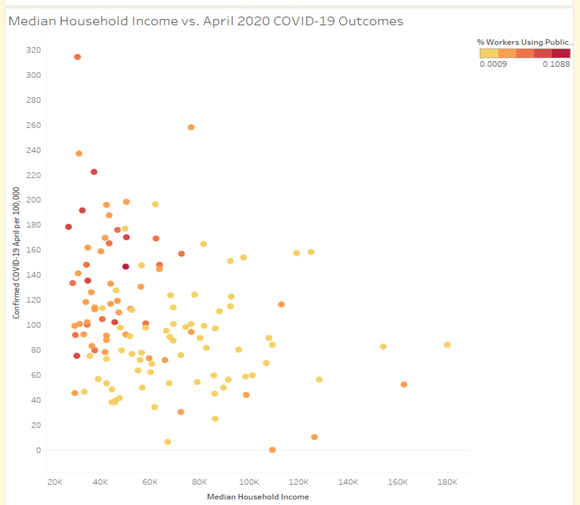
The percent of essential workers had little correlation with COVID-19 outcomes. However, zip codes that had a high bus ridership value tended to have worse COVID-19 outcomes than other zip codes with a similar percent of essential workers.

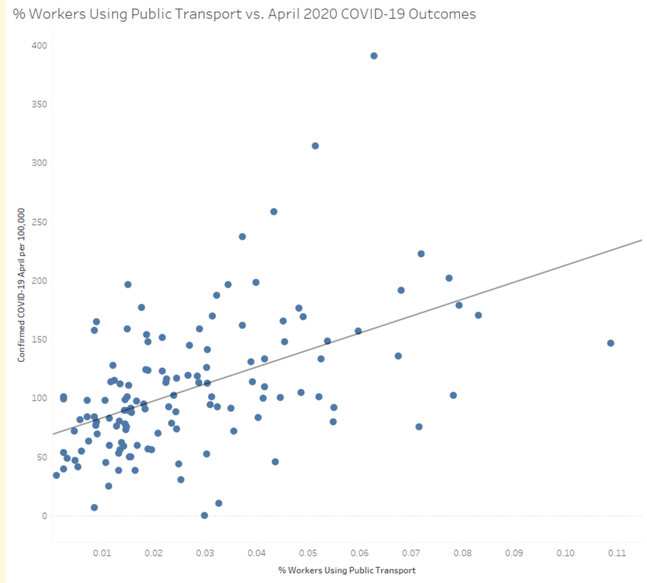
Zip codes with a low median household income tended to have worse COVID-19 outcomes. However, zip codes that also had a high bus ridership value tended to have even worse COVID-19 outcomes than other zip codes with a similar median household income. The relationship weakens in zip codes of the lowest and highest median household income subgroups.

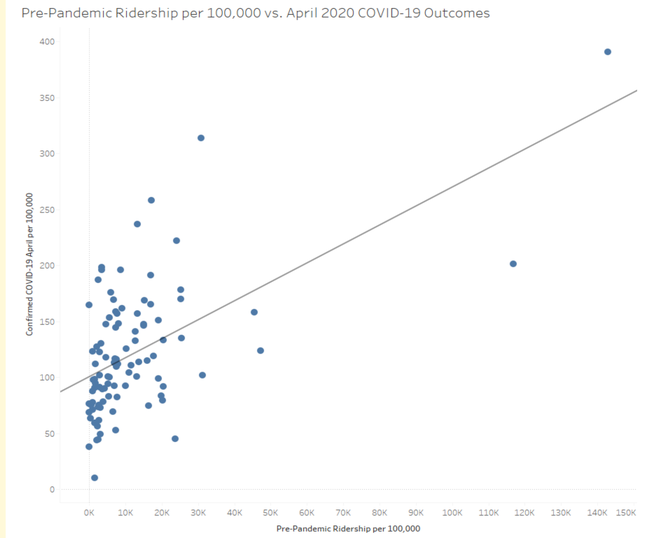












Overall ridership had a stronger correlation to COVID-19 outcomes than did the percent of workers using public transport, which may be due to people who use public transportation for reasons other than work.

Conclusion

These findings suggest that the increased likelihood of disadvantaged populations to use public transportation may be associated with disproportionate COVID-19 outcomes. Bus ridership, when considered with other factors, may improve accuracy when identifying vulnerable populations to more effectively allocate general public health resources. These findings also suggest the importance of further research in the efficacy of public health interventions specific to public transportation.

Acknowledgements

I would like to thank the Pharis Fellowship mentors for their invaluable guidance throughout this project: Peggy Lindner, Dan Price, Andrew Kapral, and Ioannis Konstantinidis. I would also like to thank all Pharis Fellowship fellows for their contributions to this project.

References

1. Health Equity Considerations and Racial and Ethnic Minority Groups. (n.d.). Retrieved August 22, 2020, from https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html
2. Houston. (n.d.). 2019 Demographics. Retrieved August 22, 2020, from http://www.houstonstateofhealth.com/demographicdata?id=38555
3. Implementing Safety Practices for Critical Infrastructure Workers Who May Have Had Exposure to a Person with Suspected or Confirmed COVID-19. (n.d.). Retrieved August 22, 2020, from https://www.cdc.gov/coronavirus/2019-ncov/community/critical-workers/implementing-safety-practices.html
4. METRO, W. (n.d.). METRO Home. Retrieved August 22, 2020, from https://www.ridemetro.org/pages/newsdownloads.aspx
5. Home. (n.d.). Retrieved August 22, 2020, from https://publichealth.harriscountytx.gov/Resources/2019-Novel-Coronavirus/COVID-19-Data-Dashboards

DASH Data Analytics in Student Hands
Humana Integrated Health System Sciences Institute University of Houston
Hewlett Packard Enterprise Data Science Institute University of Houston
COMMUNITY HEALTH WORKERS INITIATIVE
CREATE CENTER FOR RESEARCH, EVALUATION, & ADVANCEMENT OF TEACHER EDUCATION

This project was conducted through the Data Analytics in Student Hands (DASH) summer undergraduate research fellowship program at the University of Houston with support from the Humana Integrated Health System Sciences Institute, Hewlett Packard Enterprise Data Science Institute, Center for Research, Evaluation, and Advancement of Teacher Education, and University of Houston Community Health Worker Initiative. Responsibility for the results and conclusions of this research reside solely with the authors.