COVID-19 DISEASE TRANSMISSION AND ECONOMIC CORRELATION
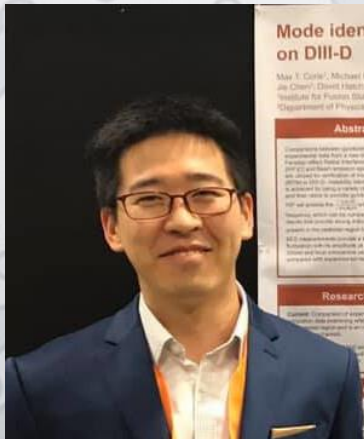
TEAM: SILENT TITANIC SPACE PYTHON

ACKNOWLEDGEMENTS

This project would not have been possible without the collaborative efforts of our team members, mentors, and sponsors.

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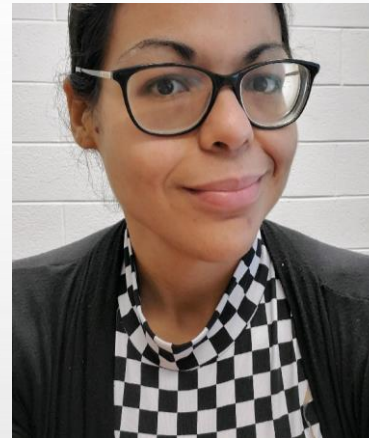# INTRODUCTION [1]

- Severe acute respiratory corona virus 2 (SARS-COV2) is the causative agent of COVID19, which has caused more than 1 million deaths and 49 million infections worldwide.

- SARS-COV2 is a highly infectious virus that can also infect susceptible domesticated animals through water droplets

- SARS-COV2 infectivity is based on several factors including transmission and human intervention

[1] Spinelli, A., & Pellino, G. (2020). COVID-19 pandemic: perspectives on an unfolding crisis. The British journal of surgery.

→ Fever
→ Dry Cough
→ Shortness of Breath
→ Pneumonia
→ Myalgia
→ Septic Shock
→ Renal Failure

→ Hydroxychloroquine
→ Ribavirin
→ Remdesivir
→ Lopinavir/Ritonavir
→ Favipiravir
→ RAS inhibitors

→ Immunity Boosters
→ Essential Vitamins
→ Nutritious Diets
→ Social Distancing
→ Hand-Sanitizers
→ Face-Masks

CoVID-19 → Human-to-Human Transmission → Viral Pathogenesis → Clinical Characteristics → Pharmacological & Non-Pharmacological Intervention

PROJECT OVERVIEW

- Investigation of disease transmission in Atlanta

- Projection of infection rates and spread of disease in Atlanta

- Impact of projections on hospital capabilities and resources in Atlanta

- Impact of disease in Georgia viewed as death rates among income brackets

PROJECT METHODS

- Susceptibility, infection, recovery (SIR) modeling

- Heat mapping

- Scatter plots of COVID-19 impact per economic status

- HPC computing technology using google cloud

PROJECT UTILITY

SCENARIO:

"Bob" is a resident of Hall county in the Metro-Atlanta area and works in a popular restaurant. Bob relies on public transportation and therefore may be at higher risk for exposure to COVID-19. If infected and asymptomatic, he could continue to work and spread the virus to others which will have wide-reaching repercussions in his community. How can we examine what the potential impact will be?
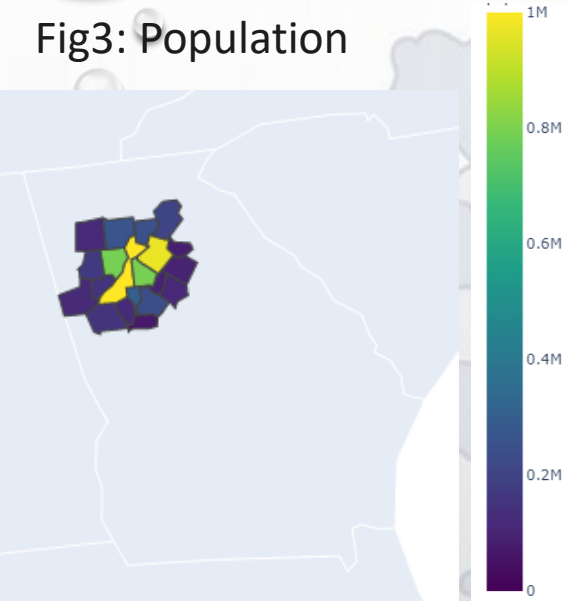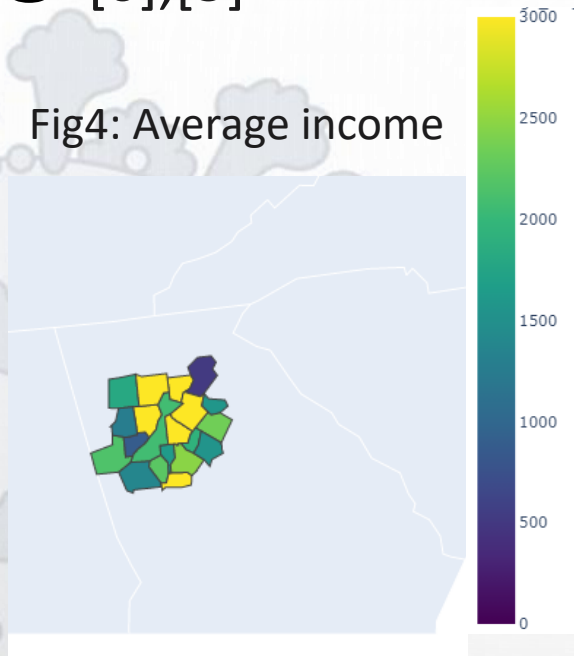
Fig3: Population
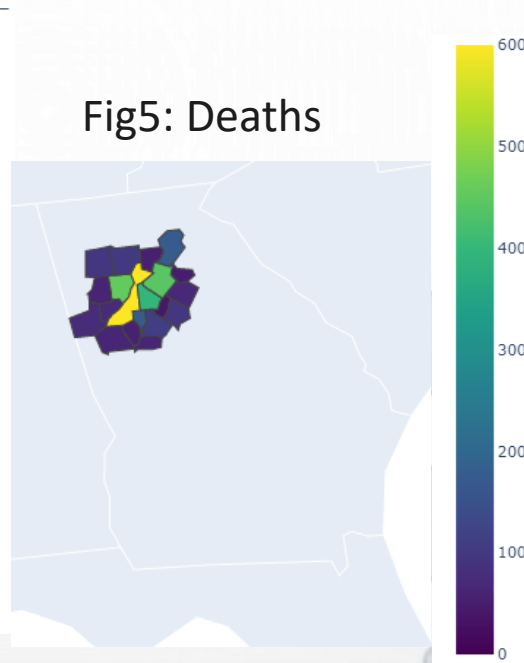
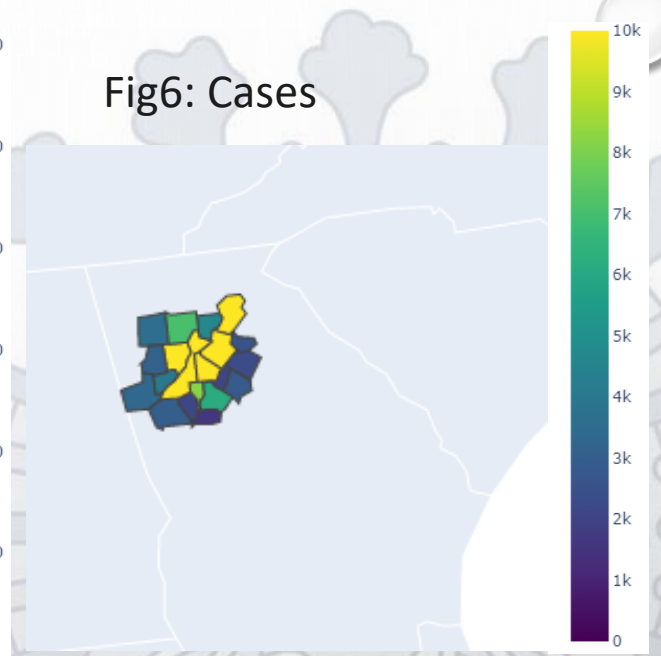Fig4: Average income

Fig5: Deaths

Fig6: Cases

After we were able to generate choropleth maps using plotly in Jupyter notebook. we noticed a significant correlation between the average income and a populations ability to combat the coronavirus. This is especially true in Hall County(North Atlanta) where average income and population is low yet COVID deaths and cases remain relatively high.

[0]Please see the reference for the data sources
[3]The heat map framework uses Georgia county FIPS (**Federal Information Processing Standards)** codes to generate choropleth maps using plotly in jupyter notebook
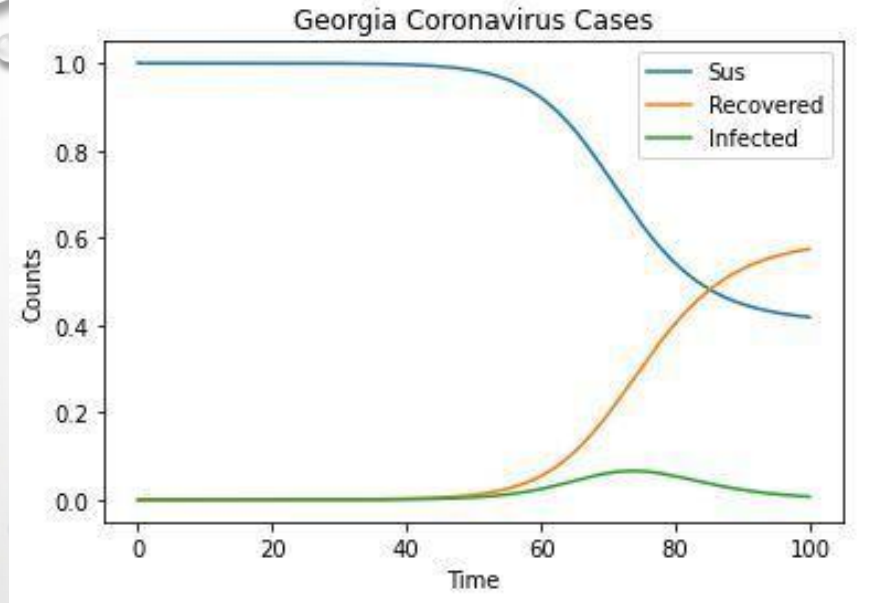
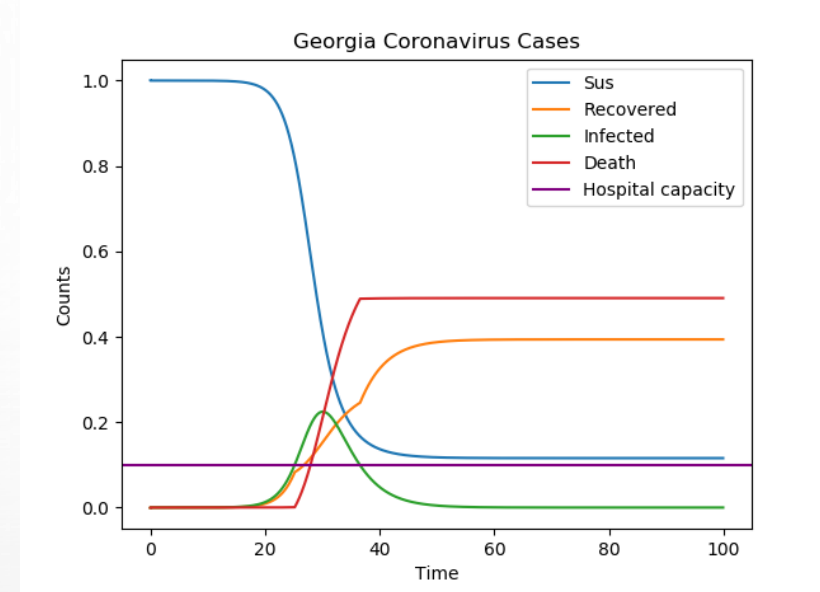Figure 1: SIR model showing susceptible, infected, and recovered

Figure 2: SIR model showing susceptible, infected, recovered, death and health capacity

- Data from the SIR model demonstrates the effect of COVID-19 if the number of infections were to exceed the hospital capacity.

- This data could be used to develop strategic containment and resources regulations, which may reduce the rate of death for that county.

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[2] SIR model: https://www.maa.org/press/periodicals/loci/joma/the-sir-model-for-spread-of-disease-the-differential-equation-model
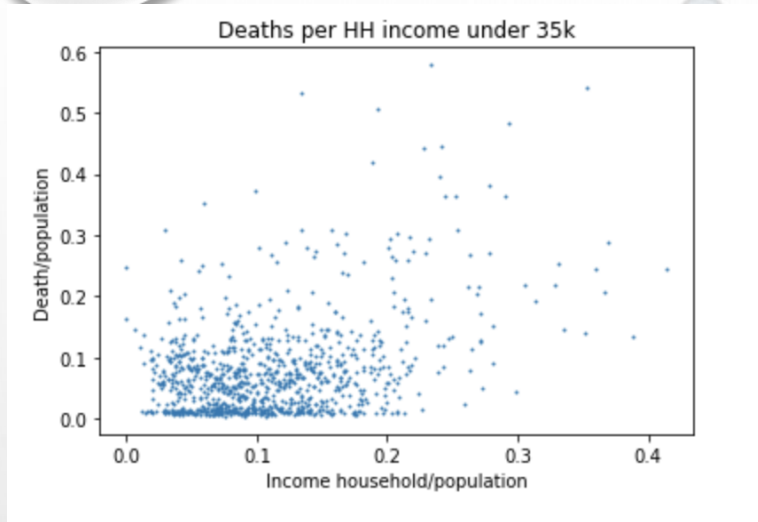
COVID-19 IMPACT PER ECONOMIC STATUS[0]

Fig7: income <35k
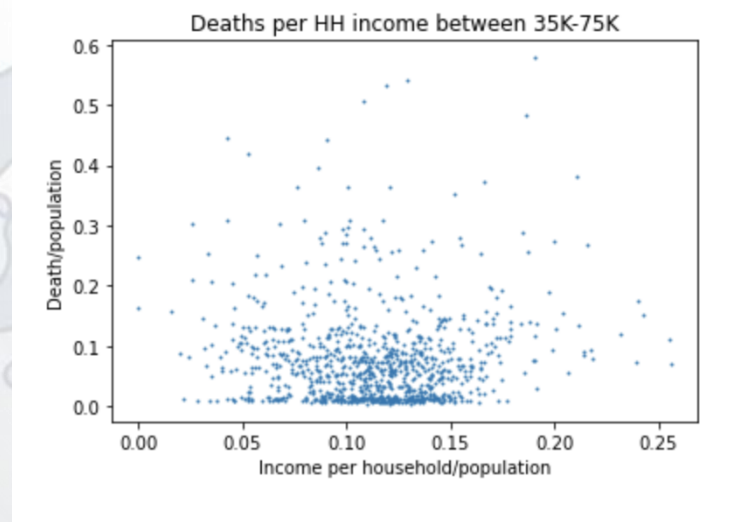

Fig8: income 35k~75k
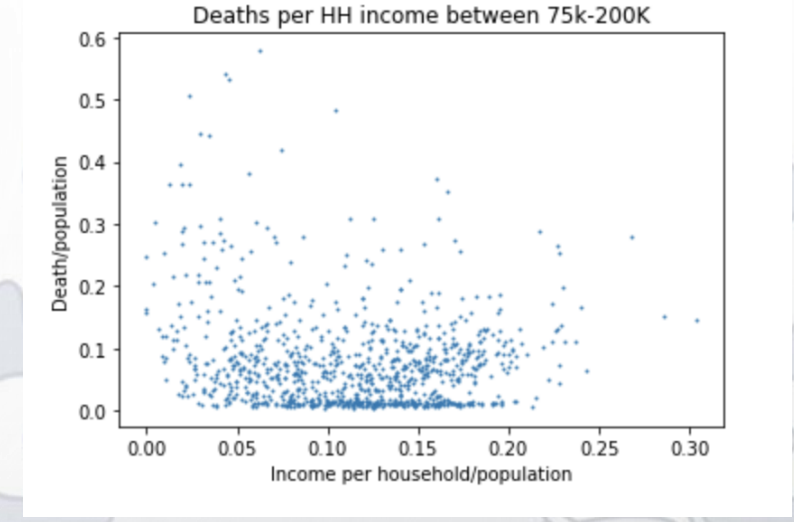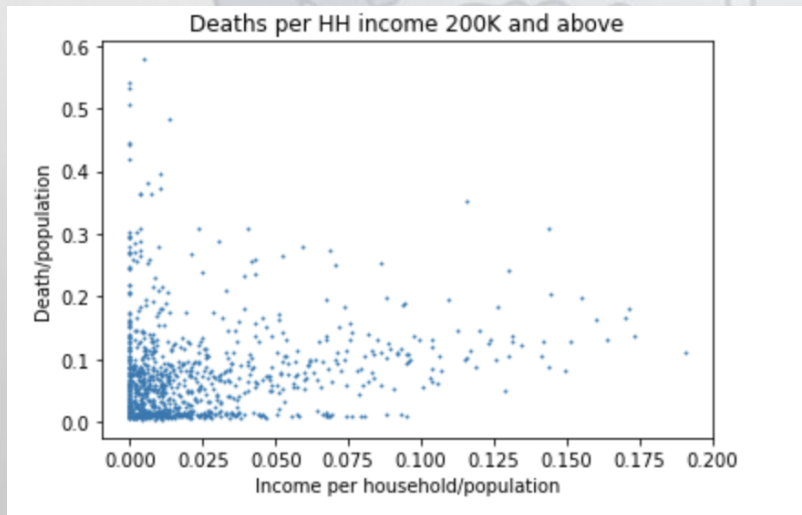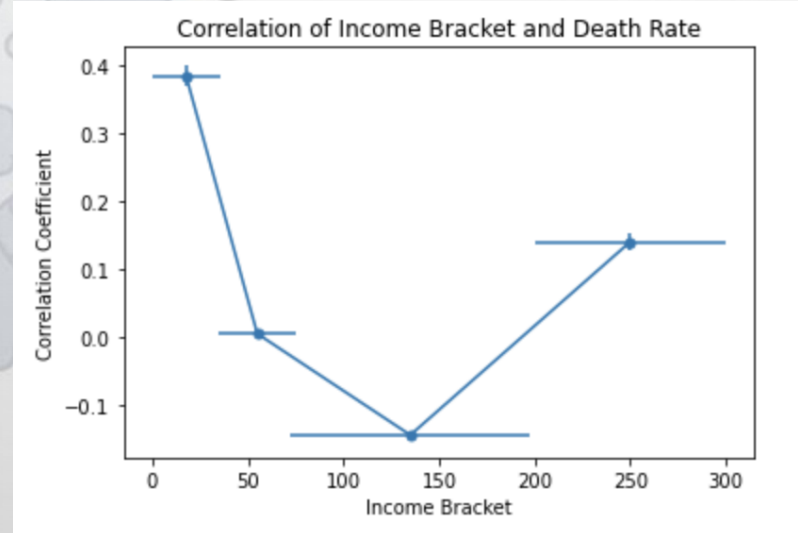

Fig9: income 75k~200k

Fig10: income >200k
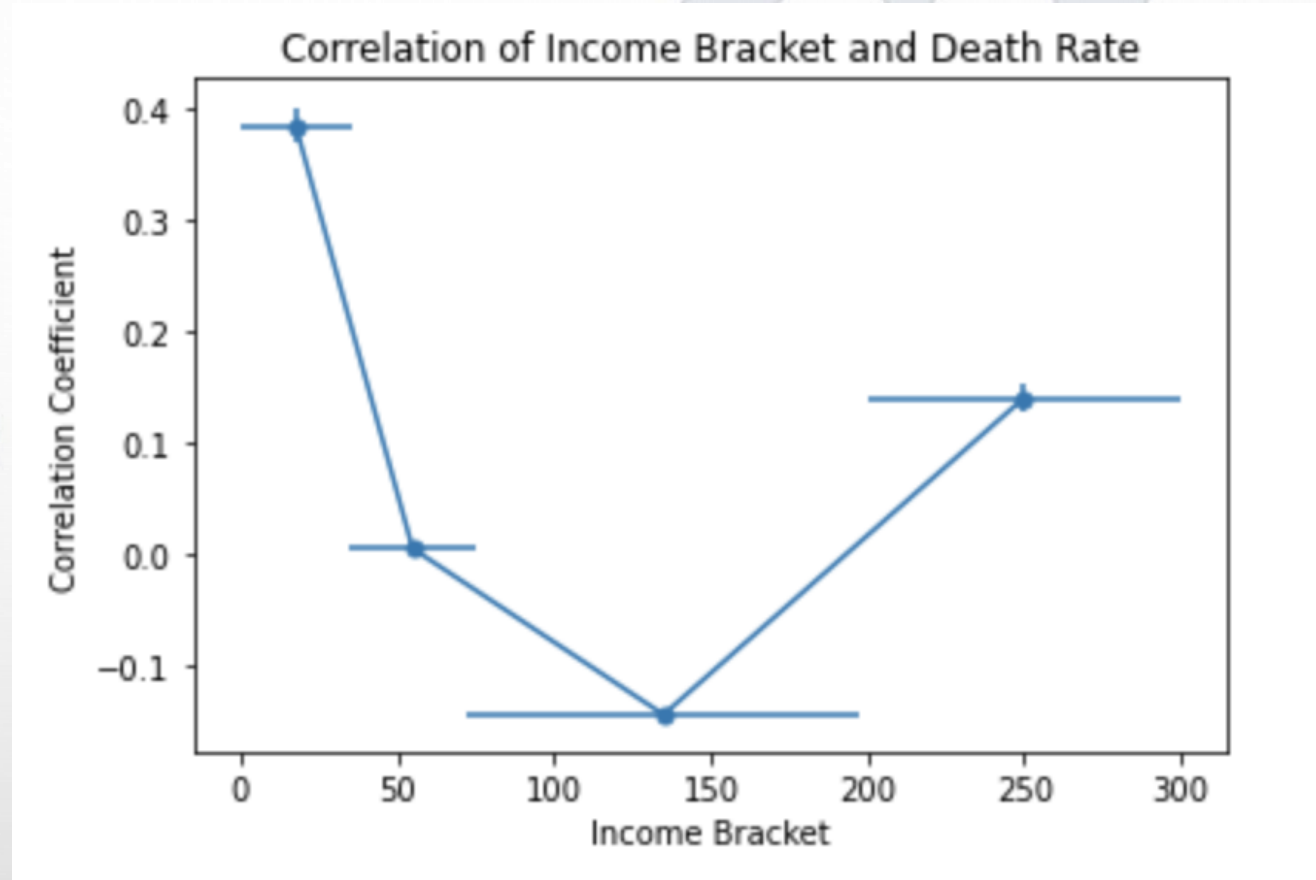

Fig11: Correlation of income bracket and death rate
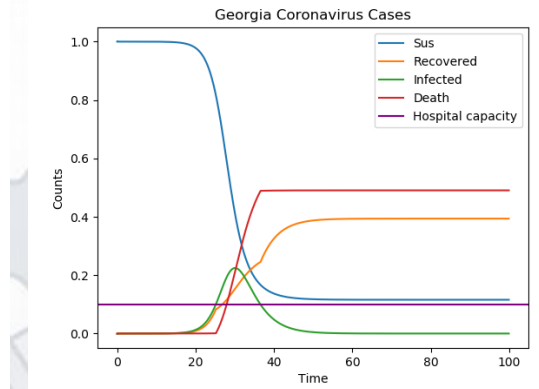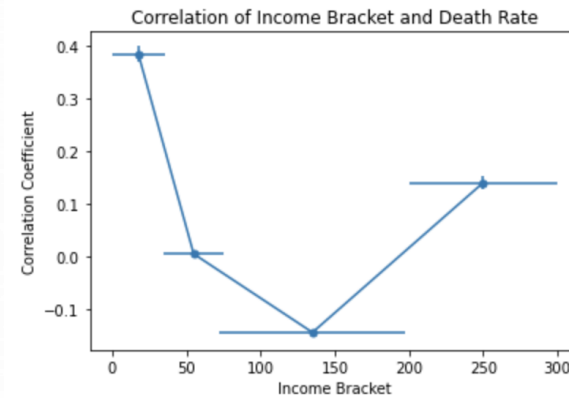
[0]Please see the reference for the data sources

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SIGNIFICANCE

After normalizing data by population, we were able visualize the correlation income had on the death rate in each county with scatter plots. The percent error for uncertainty for the data correlation was relatively small, suggesting high accuracy in our measurements.
Conclusion: income has a direct impact on covid-19 health outcomes and economic disparity is a driving factor in the higher death rates in lower income communities.

Correlation of Income Bracket and Death Rate

SUMMARY

COVID-19 is a highly infectious disease, however, **it's a mode of transmission is often influenced by human activity and medical access.** Areas with lower income are often more reluctant to seek medical attention because of non-paid leave and medical costs. Fulton county, having the highest population, has been amongst the top counties with more cases since the beginning of the outbreak. Our data suggest that there is a **positive correlation between counties with lower income brackets and the number of COVID-19 related deaths**, with the death rate being highest in Fulton county. Our data could be used to set parameters around COVID-19 containment and medical access to counties with lower income brackets, which may **reduce the number of infections and shed light amongst health disparities within those afflicted areas like Bob**.

REFERENCES

[0] Data sources

GEORGIA DEPARTMENT OF HEALTH
https://dph.georgia.gov/covid-19-daily-status-report

EMORY UNIVERSITY HEALTH EQUITY DASHBOARD

GEORGIA COVID-19 DATA HUB
https://covid-hub.gio.georgia.gov/

GEORGIA CORONAVIRUS CASES AND DEATHS
https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/georgia

[1] SPINELLI, A., & PELLINO, G. (2020). COVID-19 PANDEMIC: PERSPECTIVES ON AN UNFOLDING CRISIS. THE BRITISH JOURNAL OF SURGERY.

[2] SIR MODEL: HTTPS://WWW.MAA.ORG/PRESS/PERIODICALS/LOCI/JOMA/THE-SIR-MODEL-FOR-SPREAD-OF-DISEASE-THE-DIFFERENTIAL-EQUATION-MODEL

[3]INFO: THE HEAT MAP FRAMEWORK USES GEORGIA COUNTY FIPS **(FEDERAL INFORMATION PROCESSING STANDARDS)** CODES TO GENERATE CHOROPLETH MAPS USING PLOTLY IN JUPYTER NOTEBOO

LIVE DEMONSTRATION: HTTPS://YOUTU.BE/ MDELH4MFBA

THANK YOU