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Statistical Analysis of Broadband Access in South Carolina and the Advent of COVID-19

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The Digital Divide

Over 126,000 households in South Carolina lack broadband access, with many rural hospitals, businesses, libraries, and schools falling short of the minimum broadband requirements. COVID-19 has exacerbated the digital divide due to a sudden reliance on digital methods for accomplishing everyday tasks. Where broadband is unavailable, students cannot complete their schoolwork, businesses may be forced to close, and telehealth is inaccessible.

Figure 1. Impacts of COVID-19 on the digital divide

Semester Goals

Throughout the Summer of 2020, the team researched the digital divide and how to combat it. This semester, the team was split up to work on two different yet related scopes. One was to analyze data sets for correlations between broadband access and various characteristics of SC counties. The other scope has been focused on communicating the urgency of increasing broadband access to legislators and other stakeholders. It has shifted from a goal of posting a national petition for broadband's classification as a public utility to an informational campaign on the impacts of broadband across campus and the state.

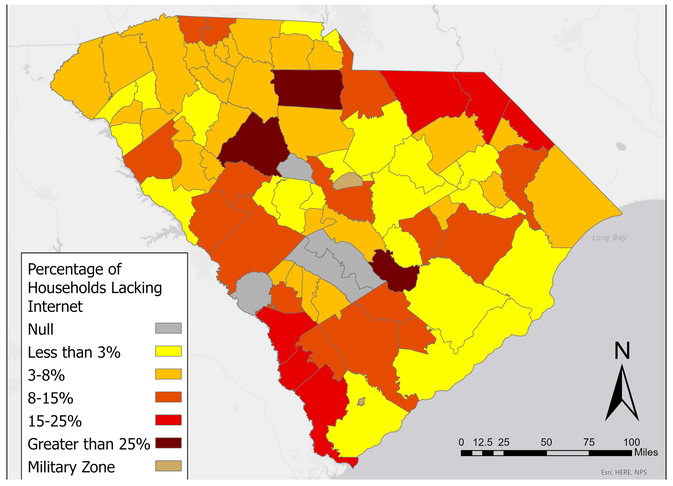

Figure 2. Percentage of households with students that lack broadband in each school district

Statistical Research

Based on SC county data, statistical models were formulated to serve as a solid foundation for the information campaign (See presentation by Pamela Bretscher, Cora Bisbee, and Victoriana Malvoso for more information). These models were directly based on a study performed by Emory University on Georgia counties, which evaluated correlations between broadband access, social determinant factors, health outcomes, and deaths due to COVID-19. While correlation does not imply causation, the hypothesis is that these factors interact in both directions; i.e. broadband companies invest more infrastructure in affluent communities, while poorer communities with less broadband access lack economic mobility due to being disconnected from the digital economy. Therefore, a correlation analysis can quantify these interconnections.

	Life Exp	COVID Death Rate	Adult Obesity	Inf Mortality	Heart Dis Death Rate	Cancer Mortality	Diabetes	Asthma Prev.
Broadband	**0.43518**	-0.17747	**-0.50122**	**-0.38511**	**-0.38142**	-0.24126	**-0.58009**	0.10383
Minority %	**-0.55671**	**0.53169**	**0.50389**	**0.49254**	**0.32392**	0.29006	**0.48124**	0.15877
Poverty Rate	**-0.78699**	**0.55233**	**0.56947**	**0.54708**	**0.66113**	**0.51909**	**0.72294**	**0.31751**
Uninsured Rate	-0.18858	0.22724	0.12261	**0.33383**	0.12663	-0.05828	0.18666	-0.12414
County Type	**0.37341**	-0.25578	-0.21223	**-0.29405**	**-0.33101**	**-0.29841**	**-0.45367**	-0.26341
Med. Household Inc	**0.84578**	**-0.54206**	**-0.65772**	**-0.50468**	**-0.70105**	**-0.62547**	**-0.76592**	-0.16270
Hospital Presence	0.05492	-0.16867	-0.26139	**-0.29701**	-0.10495	-0.14226	-0.21073	-0.03945

*Correlations in **bold** are statistically significant (p-value < 0.05)

Figure 3. Correlation matrix of broadband access and social determinant factors (leftmost column) and health outcomes (top row)

Correlation matrices such as that in Figure 3 intersect factors and quantify each of their relationships from –1 to 1. For example, broadband access is positively correlated with life expectancy across each county, whereas county type (which is 0 for rural or 1 for urban) has negative correlations with many health outcomes, indicating that urban counties with greater broadband connectivity may be healthier than their rural counterparts.

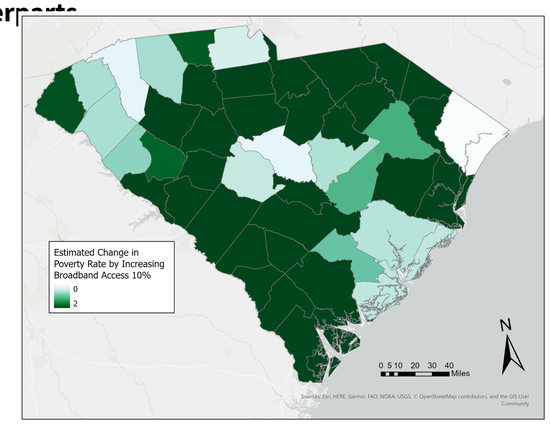

Figure 4. SC map of estimated changes in poverty rate by increasing broadband access by 10% (without exceeding 100%)

Regression Models

Figures 4 and 5 demonstrate maps made from linear regression models, which quantify equations with a designated factor as the response variable (Y) and other factors as the predictor variables (X), akin to the equation: $Y = m*X + b$
These maps demonstrate the potential impacts of increasing broadband access in counties in need, particularly in the context of COVID-19. Note that the direct correlation between broadband and COVID-19 deaths in Figure 3 did not meet the criteria for statistical significance, requiring an evaluation of their indirect relationship through poverty rate, which was found to have statistically significant correlations with both factors.

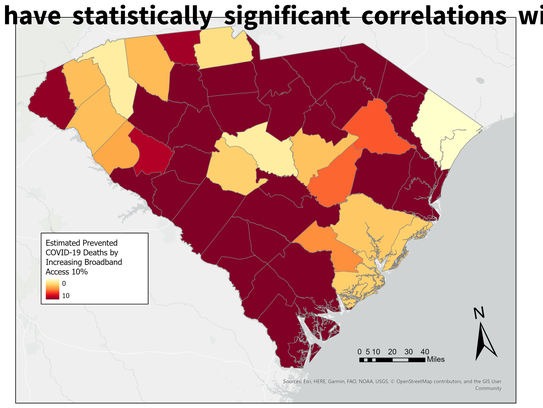

Figure 5. SC map of estimated prevented COVID-19 deaths per 100k population by lowering poverty rate through increasing broadband access by 10%

Conclusion

This semester, we have uncovered correlations between broadband access and many factors, including COVID-19 susceptibility. These correlations hint at deeply entangled interconnections within these communities. Increased access to broadband is one avenue to ameliorating the resulting negative social and health outcomes. We hope to use this research and campus resources to raise awareness about broadband and present our findings to state legislators.

Acknowledgements

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References (Source Sans Pro, size 32)

All data sources are available online, and due to their extensive amount for this analysis, links are available upon request.