Race and Ethnicity are Significant Predictors of Broadband Internet Access in Tennessee

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January 2021

Home internet access has gained increasing importance for decades, and its influence throughout our lives has never been clearer than during the COVID-19 pandemic. Access to high-speed internet varies widely however, as seen for Tennessee in Figure 1. Household broadband access tends to be highest near major Tennessee cities, yet even within cities it varies significantly. Figure 2 shows broadband access for Nashville in Davidson County, along with selected demographic data. Here you can see that broadband access tends to be lowest where there is low household income and low proportion of White non-Hispanic people. National statistics mirror these trends and show that those with lower incomes as well as Black or Hispanic people tend to have less broadband internet at home in the United States[1,2].

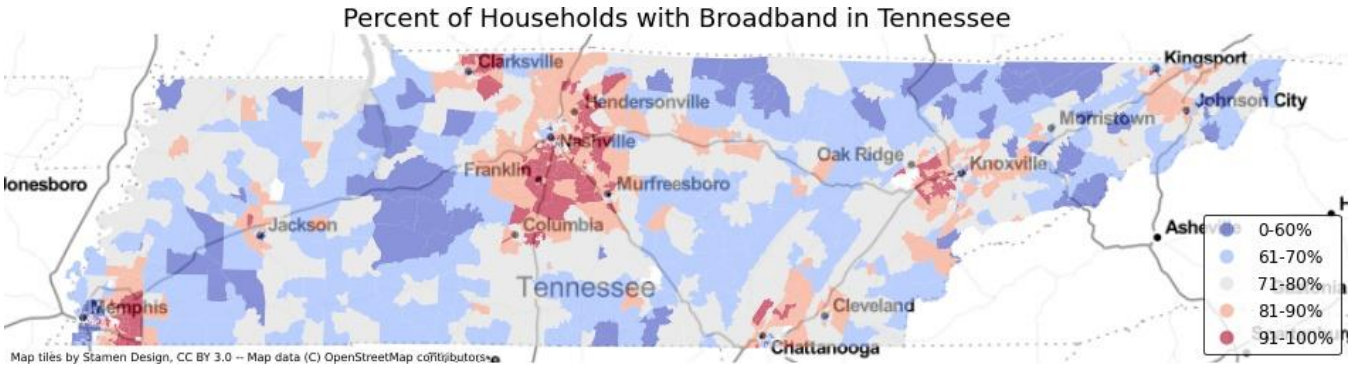

Figure 1: Percent of households with broadband subscriptions for each census tract in Tennessee. Data from the US Census Bureau 2019 American Community Survey. Broadband access appears to generally be higher near cities and suburbs, although significant variation exists at a finer scale.

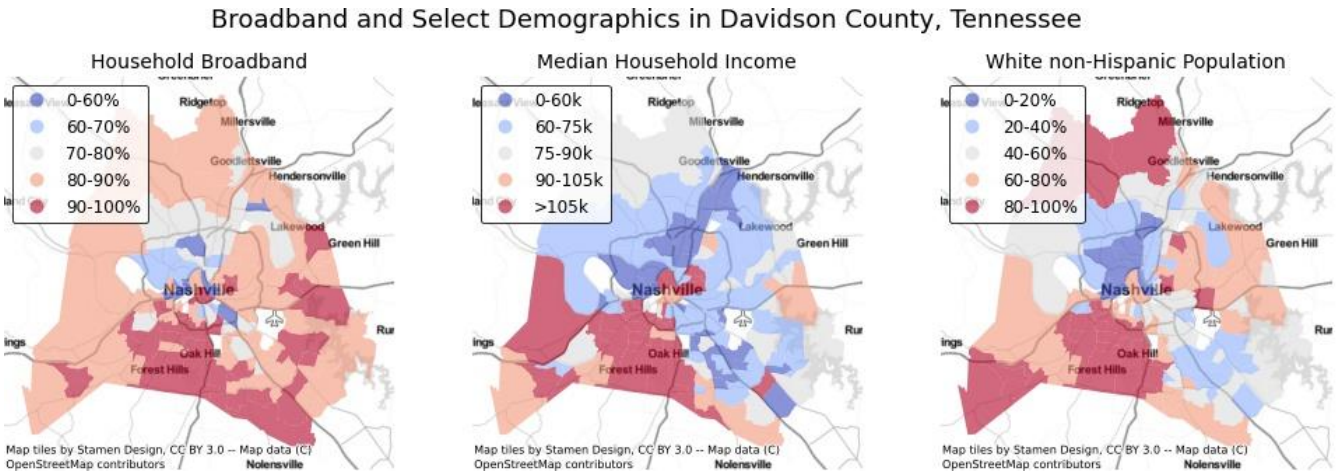

Figure 2: Household broadband subscriptions, median household incomes, and percent White non-Hispanic population in Davidson County, Tennessee. Areas of low broadband access roughly correlate with lower incomes and a lower percent of White non-Hispanic people.

[1] US Census Bureau report ACS-39, https://www.census.gov/library/publications/2018/acs/acs-39.html
[2] Pew Research Center, https://www.pewresearch.org/internet/fact-sheet/internet-broadband/

In many cases one might expect that a household lacks high-speed internet because they can't afford it or because a rural area lacks the necessary infrastructure. These two issues, while absolutely important for increasing internet access for all, do carry the hope that engineering advances might continue to make access cheaper or more widespread. If however lower broadband access for minority groups is not only driven by economics or rural location but is further driven by their race or ethnicity, this would indicate an even more serious societal problem necessitating fixes to deeply rooted biases. Because minority groups that tend to have less broadband at home also tend to have lower incomes[3], one must account for the combined effects of each of these factors to find out which are important predictors. My analysis of US Census Bureau data indicates that race and ethnicity are statistically significant predictors of household broadband internet access in Tennessee, even after accounting for economics and population density.

I have performed multivariable polynomial regression analysis of household broadband internet access in Tennessee using economic, racial, and ethnic factors, as well as population density as an indicator of urban/rural location. These data are derived from the US Census Bureau American Community Survey covering the period 2015-2019 for Tennessee's 1,497 census tracts. I test whether polynomial regression models including race and ethnicity perform better than those that don't include these factors, and I also test the statistical significance of racial and ethnic factors when they are included in the model. My prior hypothesis was that household broadband access would be well predicted by economics and population density, and that race and ethnicity would have no additional predictive power beyond their correlation with economics or population density. The full modeling documentation can be found here: https://github.com/Tate-G/portfolio/blob/main/Race_and_Internet_in_TN.ipynb.

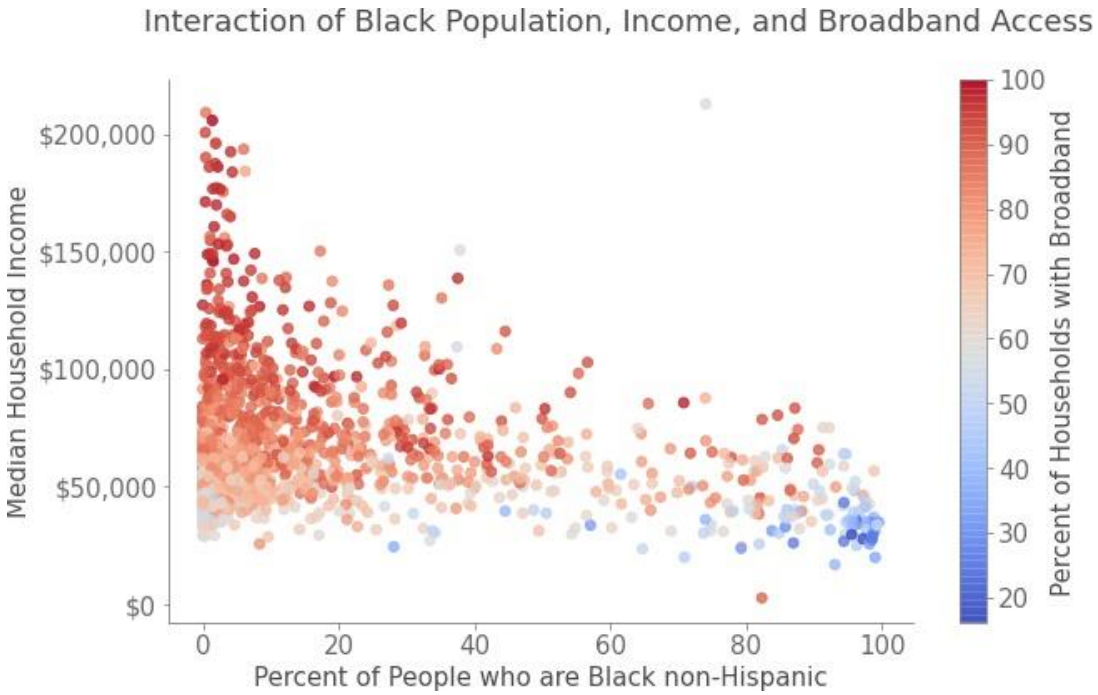

Figure 3: The interaction between percent Black non-Hispanic population, median household income, and the percent of households with broadband subscriptions in each census tract in Tennessee. Broadband access decreases with increasing percent Black non-Hispanic population, even when only considering lower-income tracts.

[3] US Census Bureau Report ACSBR/19-07, https://www.census.gov/library/publications/2020/acs/acsbr19-07.html

As expected, I did find that median household income, median home value, and population density were all statistically significant predictors of broadband access. Median home value was a particularly strong predictor, likely because it carries information about both income and access to services (internet included). However, I also found that adding information on race and ethnicity improved regression model performance. Additionally, numerous factors on race and ethnicity or interaction factors that included race and ethnicity were statistically significant terms in the model. Significant racial and ethnic factors were the percent of Hispanic, Black non-Hispanic, White non-Hispanic, and American Indian non-Hispanic people in each tract.

The importance that race and ethnicity play in predicting household broadband access is illustrated in an example from Figure 3. This figure shows the interaction between the percent of Black non-Hispanic people, the median household income, and the percent of households with broadband subscriptions in each tract. One significant trend visible here is that broadband access is higher for higher incomes. Additionally, one can see that almost all of the higher-income tracts have a low percentage of Black non-Hispanic people. Beyond this however, you can see that for those tracts with lower incomes the percentage of broadband access decreases with increasing percentage of Black non-Hispanic people. I further examined only the tracts with lower incomes, i.e. those with a median household income less than the state median. For lower-income tracts, 90% of minority Black non-Hispanic tracts had at least 60% of households with broadband, but only 49% of majority Black non-Hispanic tracts had this much broadband access.

The fact that race and ethnicity influence internet access must be incorporated into our efforts to address these inequities going forward. My results show that internet access is not simply an economic or logistical problem. Engineering advances that broaden access, public works that expand infrastructure, or even subsidies to assist low-income households would certainly help more people get connected. However, these would be insufficient to close existing gaps in access because there is a separate racial and ethnic influence also at play. We additionally need to take these racial and ethnic disparities into account as we consider the effects of lower internet access on education or job opportunity. For instance, as the COVID-19 pandemic has caused periods of remote-only education, unequal internet access likely exacerbated the existing[4] educational disadvantages for minority children. Less broadband access additionally restricts remote job opportunities, affecting not only minority options for employment but also forcing more minorities to work in-person during the pandemic and be at greater risk of contracting COVID-19. These racial and ethnic impacts are likely to have a persistent effect long after the pandemic, and should be included in policy decisions and social efforts to reduce inequality going forward.

[4] National Center for Education Statistics report, 2019-038 https://nces.ed.gov/pubs2019/2019038.pdf