Does public transportation decrease social isolation?

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Abstract

[Abstract to be written last.]

Keywords pick, 3-5, good, keywords

1   Introduction

Social isolation is a critical public health issue that has been linked to higher rates of overall mortality and the development of chronic conditions such as depression, cardiovascular disease, hypertension, and cancer. [13] [12] [5] One possible contributing factor to social isolation is limited access to public transportation, which has been identified as a significant barrier to social participation, particularly for older adults living in rural areas or those with mobility challenges. [4] This research examines whether the availability of public transportation influences social isolation levels. Understanding this relationship can inform policies that improve transportation infrastructure to improve social connectivity and overall well-being.

2   Background

Previous research suggests that public transit can reduce barriers to social engagement. Lamanna et al. (2020) note the lack of direct evidence on how public transportation affects social isolation. Wang et al. analyzed mobility patterns in 50 U.S. cities, highlighting how marginalized communities face limited transit access, reducing opportunities for employment, services, and social interaction.[14]

Several studies link transportation infrastructure to social well-being. One study using ANOVA and OLS models found that the built environment, including transit access, influences social isolation and loneliness.[11] A scoping review of public transit investments found that improved accessibility increased social participation, while disinvestment contributed to isolation.[1]

A case study in Saskatchewan, Canada, revealed that losing bus service led to increased stress and loneliness, especially for rural, Indigenous, and disabled populations.[8] Similarly, a Japanese study found that public transportation use was significantly associated with lower loneliness.[7] Although this article used a very small sample size of 31, the results were found to be statistically significant. Finally, a study on the older English adults (62+) found that the use of the bus pass was positively associated with better outcomes such as a better quality of life, higher life satisfaction, fewer depressive symptoms, and more likely to engage in physical activity compared to the group who did not use the bus pass.[3]

Building on these findings, our research explores the association between public transportation access and social isolation, providing insights that can guide infrastructure improvements for better social and health outcomes.
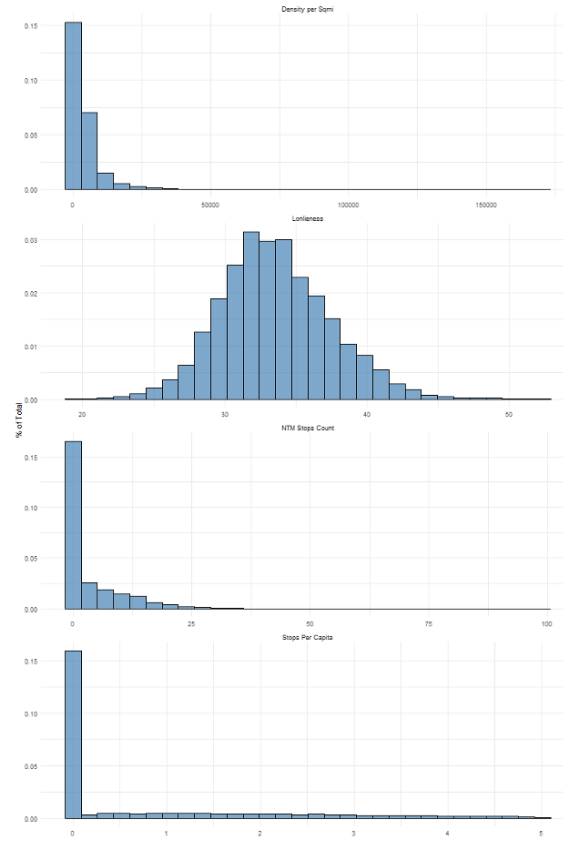
Figure 1: Figure 1. Distributions of the variables of interest as a percentage of the total data

3   Methods

We measure social isolation using census-tract-level data from the CDC PLACES database, which provides prevalence estimates of social isolation and lack of emotional support among adults.[2] Transportation data comes from the National Neighborhood Data Archive (NaNDA), which includes transit stop counts per census tract.[9] Urbanicity is determined using 2010 Rural-Urban Commuting Area (RUCA) Codes. [10]

These datasets are merged using census tract FIPS codes. Population density per square mile is calculated as:

$$Density = Population / LandArea \tag{1}$$

We conducted preliminary EDA by summarizing key variables, including transit stops per 1,000 people and social isolation levels, using descriptive statistics and visualizations. We examined distributions and correlations between social isolation and transit availability while considering confounders such as urbanicity and population density.

Our analysis found that social isolation scores are normally distributed around 33.5%. However, explanatory variables, such as transit stop counts, are heavily right-skewed, indicating a dataset dominated by low-density areas with few transit stops. Figure 1 shows histograms of our key variables, highlighting their distributions.

Missing national, census-level study data is significant. Transit data was unavailable for 1,006 census tracts, and Connecticut is entirely missing. The CDC PLACES data is missing for 11 states: Arkansas, Colorado, Hawaii, Iowa, Louisianna, New York, North Dakota, Oregon, Pennsylvania, South Dakota, Virginia. We excluded these states from our analysis.

Figure 2 presents correlations, revealing that social isolation is most strongly associated with population density. Surprisingly, higher density correlates with increased social isolation, which may reflect urban stressors. Social isolation is also positively associated with transit stop counts, while RUCA codes show a slight negative correlation—suggesting that more metropolitan areas experience higher isolation.
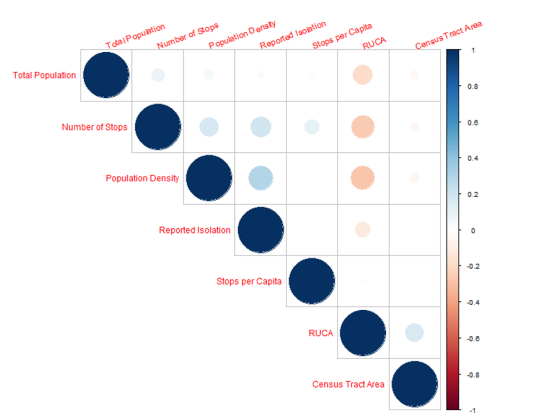
Figure 2: Figure 2. Correlation between analysis variables

3.1 Hypothesis Testing

To address our research question, we plan the following hypothesis test:

1. **Null Hypothesis (H_0):** Social isolation is not associated with the number of public transit stops in a census tract.

2. **Alternative Hypothesis (H_1):** Higher transit availability corresponds to lower social isolation levels.

We will also stratify results by rural and urban areas to assess whether transit access influences social isolation differently across regions.

4 Results

The results section is probably next easiest to write after the Methods section, since it essentially boils down to presenting your data. If anything, the production of good, high quality figures is the most important and potentially time-consuming part of this. However, make sure to not analyze any of your results here! All of that belongs in the discussion.

5 Discussion and Limitations

[And here is the 'meat' of the paper, so to speak. This is where you interpret your results, pointing out interesting trends within your data and how they relate to your initial hypothesis. This is also the place to justify your methodology, if you're so inclined (i.e. Why did you specifically use a certain statistical test over another? Why this tool over that tool?).]

Several data limitations may affect our findings. CDC PLACES data as of 2022 and NaNDA transit data as of January 2023 creates a potential temporal mismatch. We also observed a significant amount of missingness in our data sources. We use loneliness as a proxy for social isolation, though loneliness is a subjective feeling, whereas social isolation is an objective measure of physical proximity to and social interaction with others.[6] The transit stop count represents a lower bound, as missing values do not distinguish between zero stops and unavailable data.

Conclusions

What are the long-term implications of your findings? Wrap up your discussion succinctly while pointing out the significance of your work as well as it what it means for the fields you examined as much as possible. Lastly, suggest ideas for future studies that could build on your work, and justify why they might be useful. Otherwise, you're all done!

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