Does public transportation decrease social isolation?

Naomi Buell & Richie Rivera
April 30th, 2025

Introduction

Research question: **Does access to public transportation decrease social isolation?**

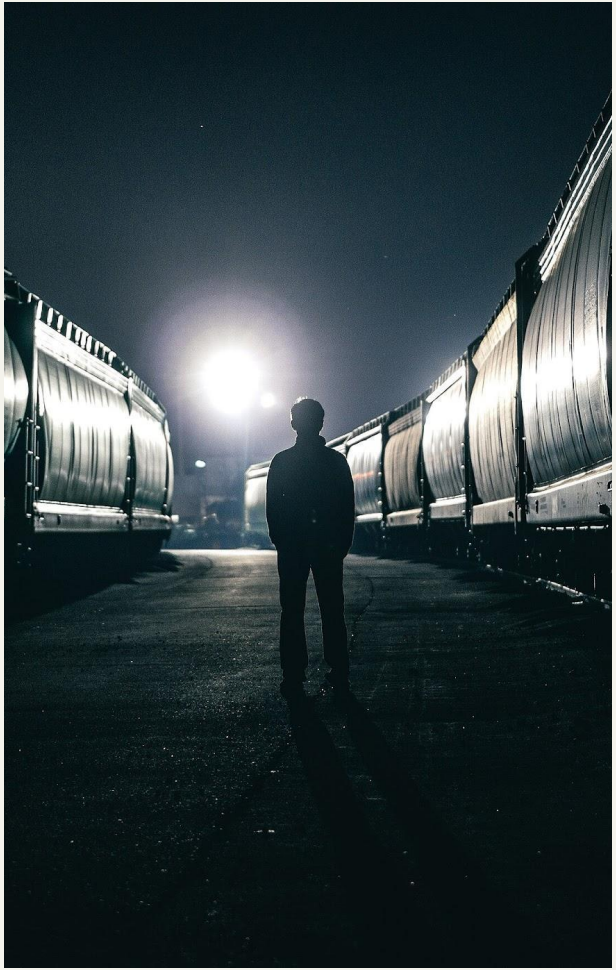
Why Social Isolation Matters

Social isolation is not having relationships, contact with, or support from others. It is a critical public health issue that **has been linked to higher rates of overall mortality** and the development of chronic disease such as **depression**, **cardiovascular disease**, **hypertension**, and **cancer**.

Potential Barrier: Transportation Access

Public transportation has been identified as a significant barrier to social engagement — particularly for **older adults**, people living in **rural areas**, or those with **mobility challenges**.

This research examines whether the availability of public transportation influences social isolation levels. Understanding this relationship can inform policies that enhance transportation infrastructure to improve social connectivity and overall well-being.



Methodology

We performed the following:

Data Collection

- CDC PLACES
- National Neighborhood Data Archive (NaNDA)
- Rural-Urban Commuting Area (RUCA) codes
- 2020 U.S. Census

EDA and Cleaning

- Explored distributions and correlations of key variables
- Removed incomplete observations
- Centered and scaled predictors to normalize distributions

Modeling

- Stratified data by rurality level
- Built separate linear models for each rurality group

Analysis

- Observed R^2 values for captured variance
- Used coefficients of scaled models to see comparative strength
- Unscaled and centered coefficients for nominal strength

Data Sources (Census Tract-Level)

CDC PLACES

What is the rate of social isolation?

- Model-based estimates of health outcomes, behaviors, and social needs from the CDC to support public health initiatives (2022 data)

National Neighborhood Data Archive (NaNDA)

How many public transit stops are there?

- Public transit stop counts per capita and square mile from 270 transit agencies (2016–2018, 2024 data)

USDA RUCA Classification Codes

How rural is the area?

- Rural, suburban, and urban classifications based on commuting patterns (2010 data)

Census Data

What is the age distribution?

- Percentage of 65+, 85+, and 100+ year olds out of the total population (2020 data)

Correlation (R)

Exploratory data analysis revealed **counterintuitive** relationships:

- More 65+ year olds = less isolation
- More population density = more isolation
- More stops = more isolation

Results

Key Findings: Urban Areas

R^2 of the model	44%	n = 10,000
Stops Per 1K Capita	+20%	↑ Transit stops per 1,000 people ↑ Social Isolation
Proportion of the population 65+	-29%	↑ Percent of the population 65+ ↓ Social Isolation
Density per Square Mile	+.02%	↑Population Density ↑ Social Isolation

Key Findings: Suburban Areas

R^2 of the model	31%	n = 3,007
Stops Per 1K Capita	+57%	↑Transit stops per 1,000 people ↑ Social Isolation
Proportion of the population 65+	-28%	↑ Percent of the population 65+ ↓ Social Isolation
Density per Square Mile	+.03%	↑Population Density ↑ Social Isolation

Key Findings: Rural Areas

R^2 of the model	28%	n = 4,438
Stops Per 1K Capita	+52%	↑Transit stops per 1,000 people ↑ Social Isolation
Proportion of the population 65+	-27%	↑ Percent of the population 65+ ↓ Social Isolation
Density per Square Mile	+.02%	↑Population Density ↑ Social Isolation

Limitations

Limitations		Response
01	Feelings of social isolation (i.e., loneliness) as proxy for social isolation	We use loneliness as a proxy, but this is subjective; may explain unexpected trends in dense areas
02	Missingness	Modeled complete cases to minimize bias
03	Temporal mismatch between transit and isolation data	Used most recent data available
04	Transit data may understate true availability	Data is voluntarily submitted, could underestimate the true impact of transit availability on isolation

Conclusions

Unexpected Relationship
More transit access linked to *higher* social isolation.

Urban Transit Impact

This effect is biggest in the suburbs (+57% isolation).

Urban Areas are much less affected by availability of public transportation (20% vs 52/57%)

Data Gaps

Analysis limited by missing data (esp. rurality, older adults)

Of the 6,800 supported Federal Transportation Administration agencies, only 270 provided data to the NTM

Next Steps

Need better data (imputation, etc.) for clearer understanding

Adding more transit agencies and expanding the lists of predictors

Q&A

References

1. Wang F, Gao Y, Han Z, et al. A systematic review and meta-analysis of 90 cohort studies of social isolation, loneliness and mortality. Nat Hum Behav. 2023;7(8):1307-1319. doi: https://doi.org/10.1038/s41562-023-01617-6
2. Healthy People 2030. Social Cohesion. U.S. Department of Health and Human Services. Accessed October 25, 2024. https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/social-cohesion
3. Leigh-Hunt N, Bagguley D, Bash K, Turner V, Turnbull S, Valtorta N. An overview of systematic reviews on the public health consequences of social isolation and loneliness. Public Health. 2017;152:157-171. doi: https://doi.org/10.1016/j.puhe.2017.07.035
4. Lamanna, M., Klinger, C. A., Liu, A., & Mirza, R. M. (2020). The Association between Public Transportation and Social Isolation in Older Adults: A Scoping Review of the Literature. Canadian journal on aging = La revue canadienne du vieillissement, 39(3), 393–405.
5. Brenden Smith. 2025. “CDCPLACES: Access the ’CDC PLACES’ API.” https://CRAN.R-project.org/package=CDCPLACES.
6. Greenlund, Kurt J., Hua Lu, Yan Wang, Kevin A. Matthews, Jennifer M. LeClercq, Benjamin Lee, and Susan A. Carlson. 2022. “PLACES: Local Data for Better Health.” Preventing Chronic Disease 19 (June). https://doi.org/10.5888/pcd19.210459.
7. Pan, Longrong, Robert Melendez, Philippa Clarke, Grace Noppert, Iris Gomez-Lopez, Megan Chenoweth, Anam Khan, Mao Li, and Lindsay Gypin. 2023. “National Neighborhood Data Archive (NaNDA): Public Transit Stops by Census Tract and ZIP Code Tabulation Area, United States, 2016-2018 and 2024.” ICPSR - Interuniversity Consortium for Political; Social Research. https://doi.org/10.3886/ICPSR38605.V2.
8. Paykin, Susan, Moksha Menghaney, Qinyun Lin, and Marynia Kolak. 2022. Spaykin/Rural-Urban-Classification: Rural, Suburban, Urban Classification for Small Area Analysis. Zenodo. https://doi.org/10.5281/ZENODO.6359701.
9. U.S. Census Bureau. 2023. “2020 Census Demographic and Housing Characteristics File (DHC).” Washington, DC: U.S. Census Bureau.

For access to the data and code used in this analysis, visit our GitHub repository: Data 646 Final Project.