Population Mobility & COVID-19 Burden Across Hospital & Nursing Home Settings, 2020–2025

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Introduction

Travel and population mobility have been widely discussed as contributors to COVID-19 spread. Commercial air travel and public transit have been cited as potential drivers of transmission and downstream healthcare burden. However, evidence describing how different forms of mobility relate to COVID-19 outcomes across healthcare settings over extended periods remains limited.

Objectives

To evaluate the association between population mobility and COVID-19 burden across two distinct care settings:

1. Air travel & hospitals: weekly commercial flight volume vs. national COVID-19 hospitalizations

2. Public transit and nursing homes: county-level transit reliance vs. COVID-19 cases among nursing home residents and staff

Methods

Retrospective ecological study with two complementary analyses:

Air travel & Hospitalizations

- Weekly TSA passenger volume linked to national COVID-19 hospitalizations
- Analyses: Lagged correlations (0-8 weeks), ordinary least squares regression, and first-difference models

Public Transit & Nursing Homes

- County-level public transit reliance (annual commuters per 1,000 workers; ACS 5-year estimates) in the most populous county of each U.S. state (n = 50)
- Cumulative COVID-19 cases among residents and staff
- Analyses: negative binomial regression with population offsets; sensitivity rate-based models

Results

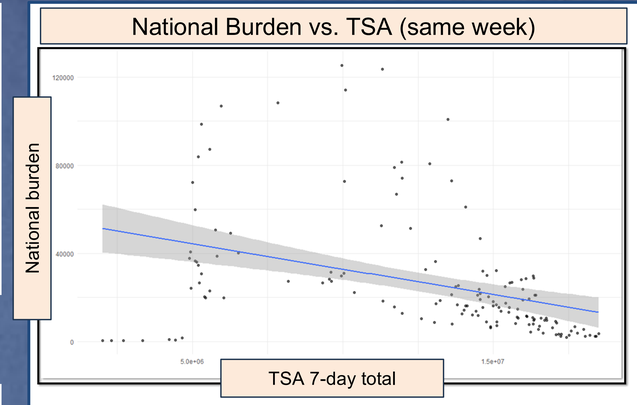

Figure 1. TSA Volume vs. National COVID-19 Hospitalizations (2020-2024)
Weekly TSA 7-day passenger totals vs national COVID-19 hospitalizations (n=252). Significant inverse same-week association (r=-0.38; R^2=0.14; p<0.001). Shaded area = 95% CI.

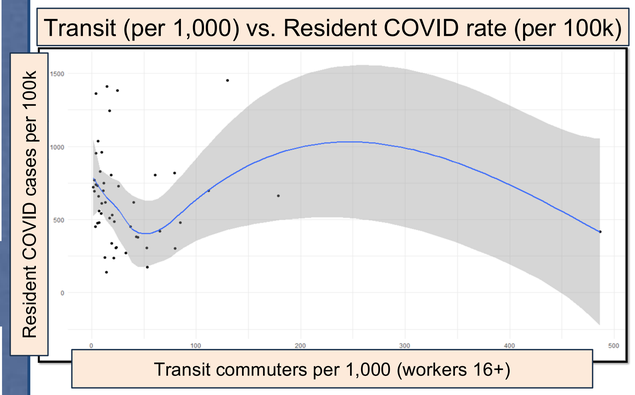

Figure 2. Transit Reliance vs Nursing Home Resident COVID-19 Rate (2020-2025)
Transit commuters per 1,000 workers vs resident COVID-19 cases per 100,000 (n=50 counties). No significant association (IRR = 0.99; p = 0.49). Wide CIs at higher transit reflect sparse data.

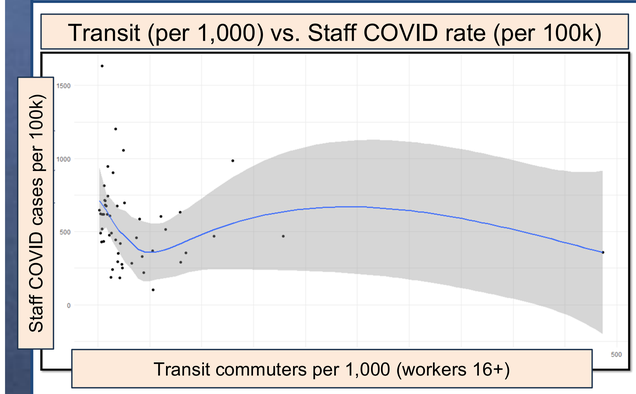

Figure 3. Transit Reliance vs Nursing Home Staff COVID-19 Rate (2020-2025)
Transit commuters per 1,000 workers vs staff COVID-19 cases per 100,000 (n=50 counties). No significant association (IRR = 0.99; p = 0.21). Uncertainty increases at higher transit levels.

Discussion

The inverse association between air travel and hospitalizations aligns with evidence that the mobility-transmission relationship weakened significantly overtime. Research shows that while mobility explained 74% of transmission variation during the early lockdown, this dropped to 30% after measures relaxed, likely due to vaccination, masking, and behavioral adaptations.

In nursing home settings, our null findings reflect systematic reviews indicating that facility size and community prevalence are stronger outbreak predictors than external mobility patterns. Factors such as staff movement, PPE availability, and ventilation are more critical determinants than transit use.

Time-varying confounders, such as vaccination rates and the evolving disease severity of different COVID-19 strains, likely overshadowed any direct mobility effects.

Conclusion

Higher population mobility (commercial air travel, public transit) is not associated with increased COVID-19 burden in hospital or nursing home settings. Patterns likely reflect broader epidemic-phase dynamics: vaccination coverage, public health policies, healthcare utilization changes. Commonly used mobility indicators may be poor proxies for transmission risk or healthcare burden.

Acknowledgements

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References