County-Level Risk Analysis of Healthcare Access and Racial Disparities in Preventable Hospitalizations

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Introduction

Research Question: Does healthcare access affect the number of preventable hospital stays for different racial groups at the county level?
Relevance: Preventable hospitalizations are costly and avoidable. In 2017, 3.5 million preventable adult inpatient stays accounted for $33.7 billion in costs.
Objective: Identify key predictors of preventable hospitalizations, compare their effects across racial groups, and guide equity-focused health interventions.

Methods

Data: County Health Ranking 2025
Groups Studied: White vs. aggregated POC (Black, Hispanic, Asian and Pacific Islander, Native American, Other)

Key Variables

Category	Predictors
Clinical Access	Physician, Dentist, Mental Health Provider, Mammography
Affordability	Uninsured Rate, Income Inequality
Social/Geographic	Unemployment, Rurality, High School Completion
Outcome	Preventable Hospital Stays per 10,000

Analysis Workflow

Stage	Methods & Purpose
Exploratory	Random Forest: Ranked variable importance
Inference Model	Negative Binomial: Estimated predictor effect size

Negative Binomial Model

Purpose: Estimated the association between healthcare access predictors and the count of preventable hospital stays
Model Setup: Separate models for White and POC populations
Predictors: Physician supply per 10,000, Mental health provider and Dentist supply, Uninsured rate (%), Mammography screening (%), Income inequality, Unemployment rate, % Rural, and high school completion
Offset: Log of race-specific population
Outcome: Number of preventable hospital stays

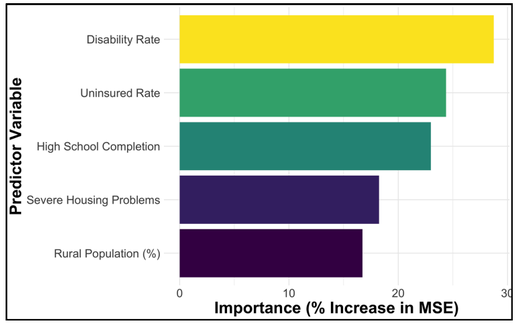
IRRS and Percent Change in Preventable Hospitalization by Race :

Group	Variable	IRR	% Change
POC	Unemployment	1.86	+86%
POC	HS Completion	1.45	+45%
POC	Rurality	1.38	+38%
POC	Uninsured Rate	0.92	-8%
POC	Dentist Supply	0.88	-12%
POC	Income Inequality	0.85	-15%
White	Unemployment	2.15	+115%
White	Rurality	1.25	+25%
White	Uninsured Rate	1.18	+18%
White	Physician Supply	1.12	+12%
White	HS Completion	0.87	-13%
White	Income Inequality	0.89	-11%

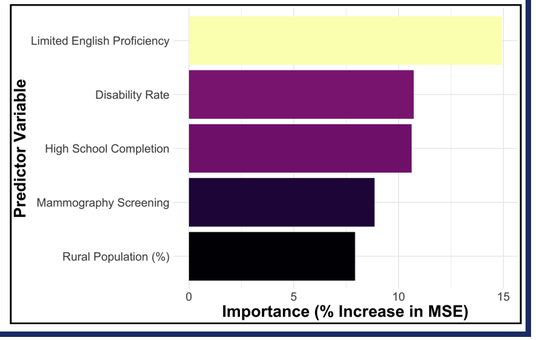
Random Forest

Purpose: Identify and rank most important predictors influencing preventable hospital stays
Predictors: Race variables, Preventable Hospital Stays, Primary Care Physicians, Uninsured Rate, Mental Health Providers, Other than Primary Care Providers, Dentists, Mammography Screening, Severe Housing Problems, High School Completion, Disability Rate, English Proficiency, Rural, Unemployment
Key Predictors Identified: Disability Race, High School Completion Rate, Mental Health Providers, Uninsured Rate, Percent Rural
Limitations: Ranks variable importance but does not quantify effect size (e.g., % change per unit increase)

Disability and High School Completion Rates among Top Predictors in White Majority Counties



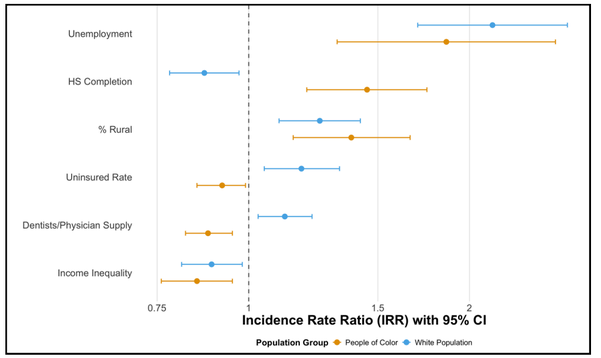
Limited English Proficieny Top Predictor Among POC Majority Counties



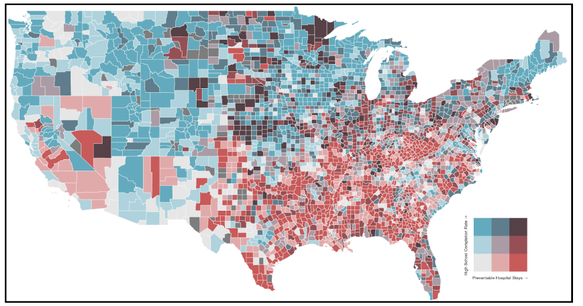
Results & Key Findings

Racial Disparity: Preventable hospitalizations are 43% higher in POC majority counties
Top Predictors by Race: POC: Unemployment & HS Completion
White: Unemployment & Rurality
Structural Disparities: Social determinants outweighed clinical access in POC counties, revealing structural roots of disparities.
Unexpected Trend: Positive correlation between clinician supply and preventable hospitalization for both groups, suggests issues such as over-hospitalization or inadequate outpatient care
Recommendations: Deploy mobile clinics in high-risk rural counties with large POC populations to address access gaps. Establish job training and education partnerships in areas with high unemployment and low high school completion rates

Negative Binomial Regression: IRRs for Hospital Stays



Increased Preventable Hospital Stays among counties with lower High School Completion Rates (US Counties)



Discussion

Limitations: Observational design limits causal inference. Aggregating POC groups may obscure subgroup differences. High Rates of missing data may reduce statistical power
Future Work: Extend to longitudinal analyses to strengthen causal insights. Examine hospital overuse in areas with high clinician supply. Advocate for more ethnic data collection.

References

Data: University of Wisconsin Population Health Institute. County Health Rankings & Roadmaps 2025

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