The Socioeconomic Roots of Racial Disparities in Hospitalizations

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Background

Main question:

Do income inequality, unemployment, and high school completion rates affect the number of preventable hospital stays of certain racial groups at the county level?

Motivation:

To enhance public health outcomes while simultaneously reducing healthcare expenditures.

Why is this important:

- Facilitates the identification and mitigation of health disparities
- Informs and shapes public health policies
- Enables the development of targeted and effective interventions

Data sources:

County Health Rankings & Roadmaps. (n.d.).

Data / Key Variables

Explanatory variables:

- Income inequality
- Unemployment
- High school completion
- Race percentages

Response variable:

Preventable hospital stays - admissions that result from conditions that, if properly managed in a timely manner in a primary care setting, would not escalate to the point where hospitalization is necessary.

Methods

As part of our modeling strategy, we employed **generalized additive models (GAMs)** and **random forests** to investigate the relationships between our predictors and our response variable, preventable hospital stays.

Generalized Additive Models (GAMs):

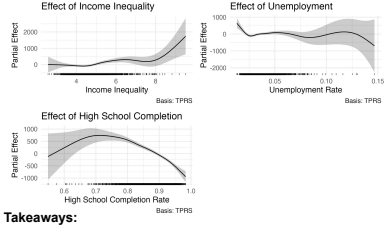
Flexible statistical models that use smooth curves to capture relationships between variables, allowing for better predictions than straight lines.

Random Forests:

Random forest combine multiple decision trees to improve prediction accuracy and reduce the risk of overfitting.

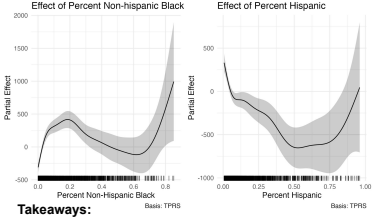
Results

Partial effects of predictors on preventable hospital stays in GAM model



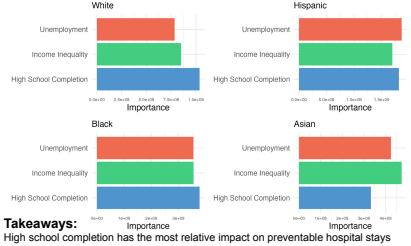
Takeaways:
Income inequality increases preventable hospital stays. Very low unemployment sees an increase in such stays, while high school completion rates above 80% reduce them.

Partial effects of race predictors on preventable hospital stays



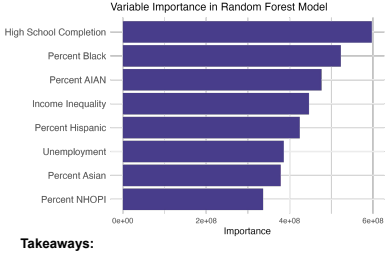
Takeaways:
This suggests that higher percentage black populations generally increase preventable hospital stays, while higher percentage hispanic initially decrease, then increase preventable hospital stays. The nonlinear trends suggests the influence of other underlying factors.

Relative variable importance from random forest for each race



Takeaways:
High school completion has the most relative impact on preventable hospital stays for white and black people. For hispanic people, unemployment and high school completion are the most impactful. In contrast, for asians, income inequality is most important.

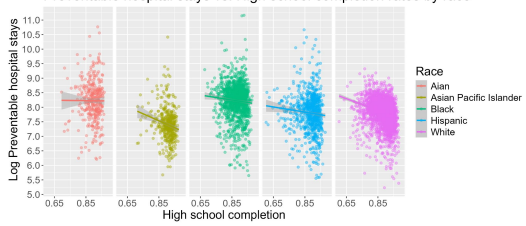
Variable Importance in Random Forest Model



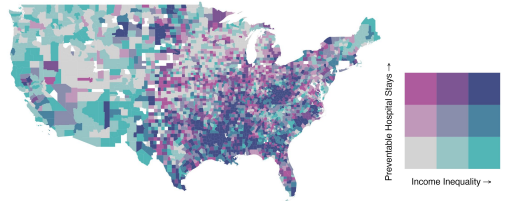
Takeaways:
These results highlight the need to focus on increasing high school completion rates and addressing barriers to care in predominantly African American communities.

EDA / more results

Preventable hospital stays vs. High school completion rates by race



Association between income inequality and preventable hospital stays in the U.S.



Discussions

Conclusions/summary:

- Counties with higher income inequality have higher rates of preventable hospital stays.
- Fewer people in a county visit the hospital for preventable illnesses as more residents complete a form of high school education.
- A slight rise in unemployment can increase preventable hospital admissions when nearly everyone is employed, but it has little impact when unemployment is already high.

Limitations:

- Preventable hospital stays are only reported for medicare enrollees, so findings can not be generalized to younger populations.
- Income inequality, high school completion, unemployment not available for each race
- Predictors other than our own might better predict preventable hospital stays (Ex: access to care, poverty, health behaviors)

Future work:

- Work with other predictor variables such as income and poverty rates to gain a broader perspective of preventable hospital stays.