Mapping Obesity: A County-Level Analysis of Lifestyle and Food Environment Factors

Jordan Faustin
Howard University

Helen Peng
Carnegie Mellon University

Anvith Thumma
Arizona State University

Carnegie Mellon University
Statistics & Data Science

Background

Motivation:
Obesity has been a major public health challenge in the U.S., affecting individuals both physically and financially. Our research aims to identify key factors contributing to adult obesity and explore effective strategies to improve health outcomes.

Main Question:
Does physical inactivity level and access to healthy food affect obesity rate at the county level?

Importance:
Obesity is a leading risk factor for chronic diseases like diabetes, heart disease, and certain cancers. The rates vary by region, income, and race, reflecting systemic inequities in food access and physical activity opportunities so, understanding its drivers is critical for finding impactful solutions.
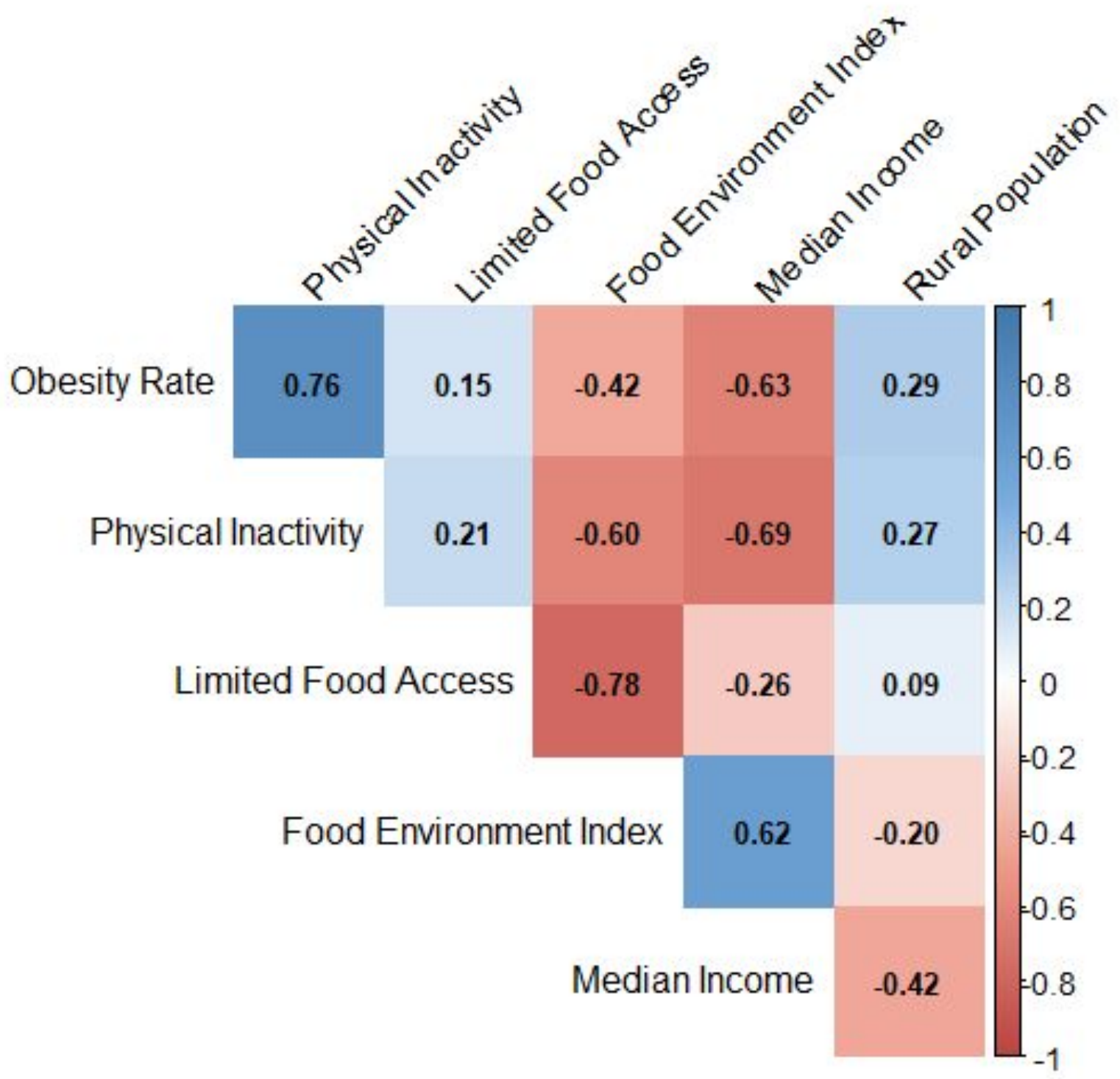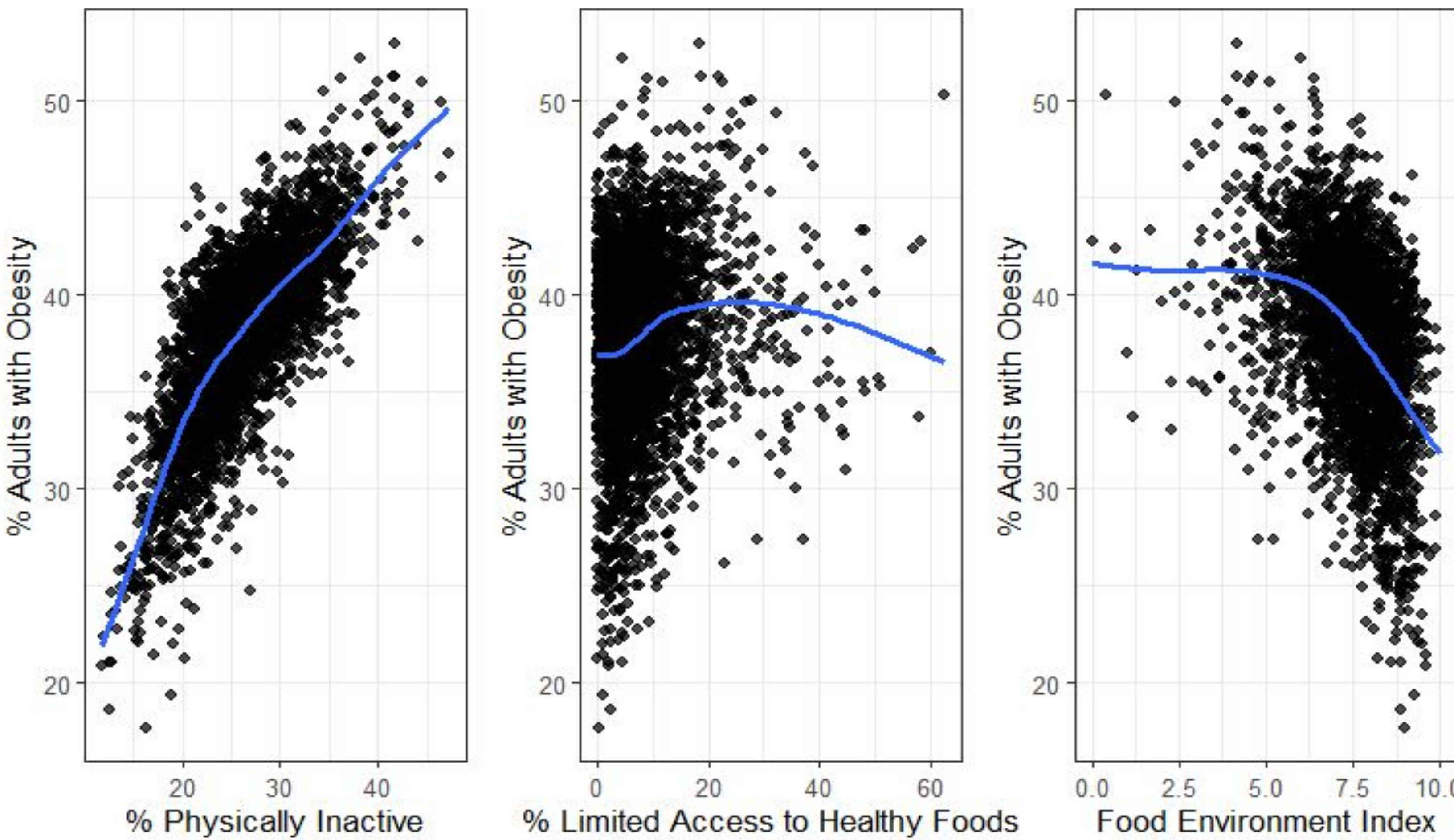
Data Sources:
We used the **2025 County Health Rankings & Roadmaps** dataset.

Variables of Interest:
- **Adults with Obesity (%):** Percentage of adults (18+) with a body mass index (BMI) ≥ 30 kg/m² (age-adjusted).
- **Physical Inactivity (%):** Percentage of adults (18+) reporting no leisure-time physical activity (age-adjusted).
- **(FEI) Food Environment Index (1-10):** Composite score indicating community access to healthy food and income levels.
- **Limited Access to Healthy Food (%):** the percentage of the population that is low income and does not live close to a grocery store
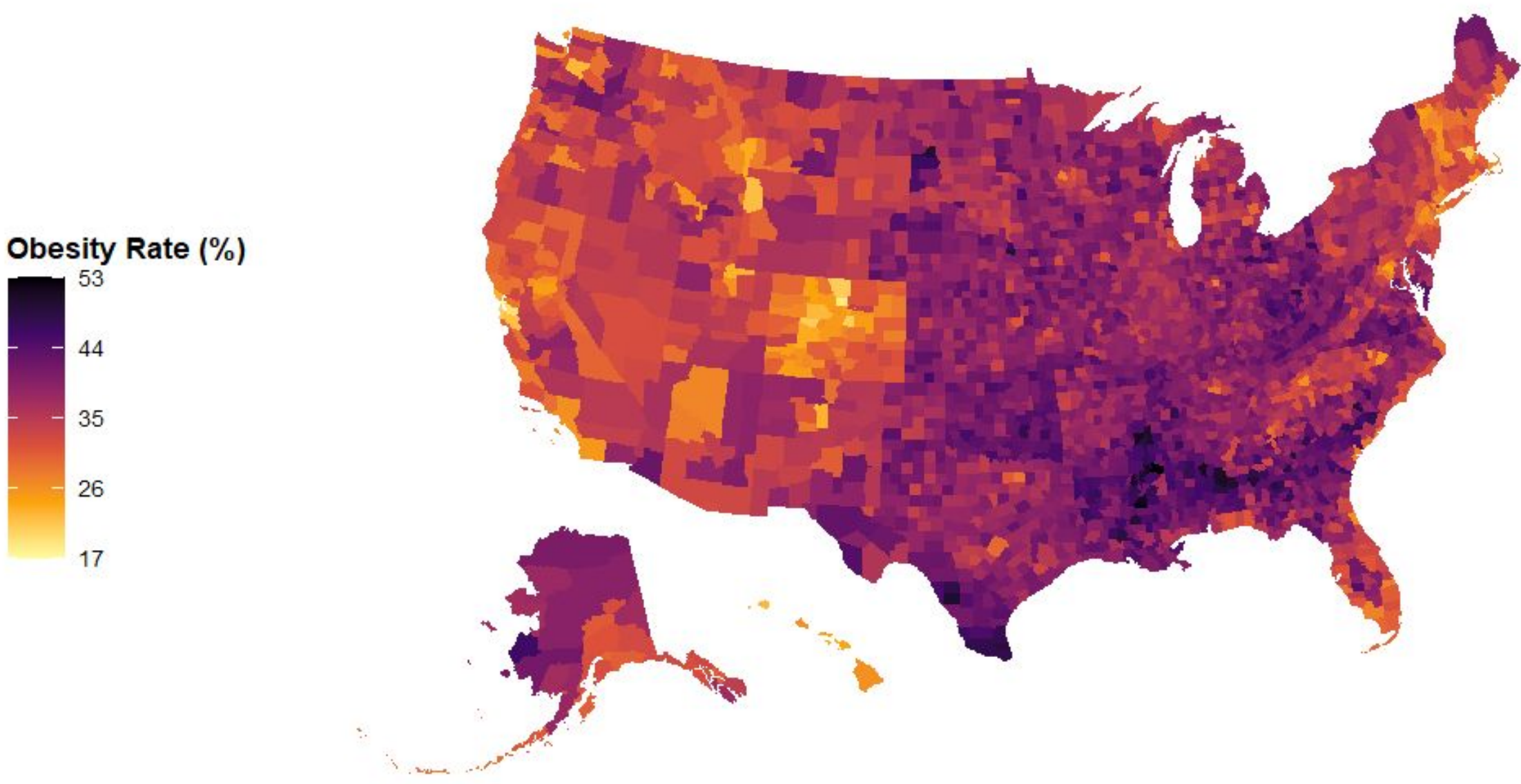
Exploratory Data Analysis

The correlation between **Food Environment Index** and **Limited Access to Healthy Food** is r = 0.78, it captures much of what limited access measures, but in a more holistic and predictive way

- **Physical Inactivity (%)** vs. **Adults with Obesity (%)**: Shows a clear positive relationship — higher inactivity is associated with higher obesity rates.
- **Limited Access to Healthy Food (%)** vs. **Adults with Obesity (%)**: Shows little to no clear relationship, suggesting it's not a strong standalone predictor.
- **Food Environment Index** vs. **Adults with Obesity (%)**: Shows a strong negative relationship, particularly when the index is ≥ 6 — highlighting it as a more comprehensive and effective metric, especially since it already incorporates limited food access and income factors.

Methods

We used **Huber regression** with a logit-transformed outcome to model adult obesity rates as a function of physical inactivity and the food environment index.

This approach improves robustness to outliers compared to standard linear regression, with outliers identified using Cook's Distance (threshold: 4/n).
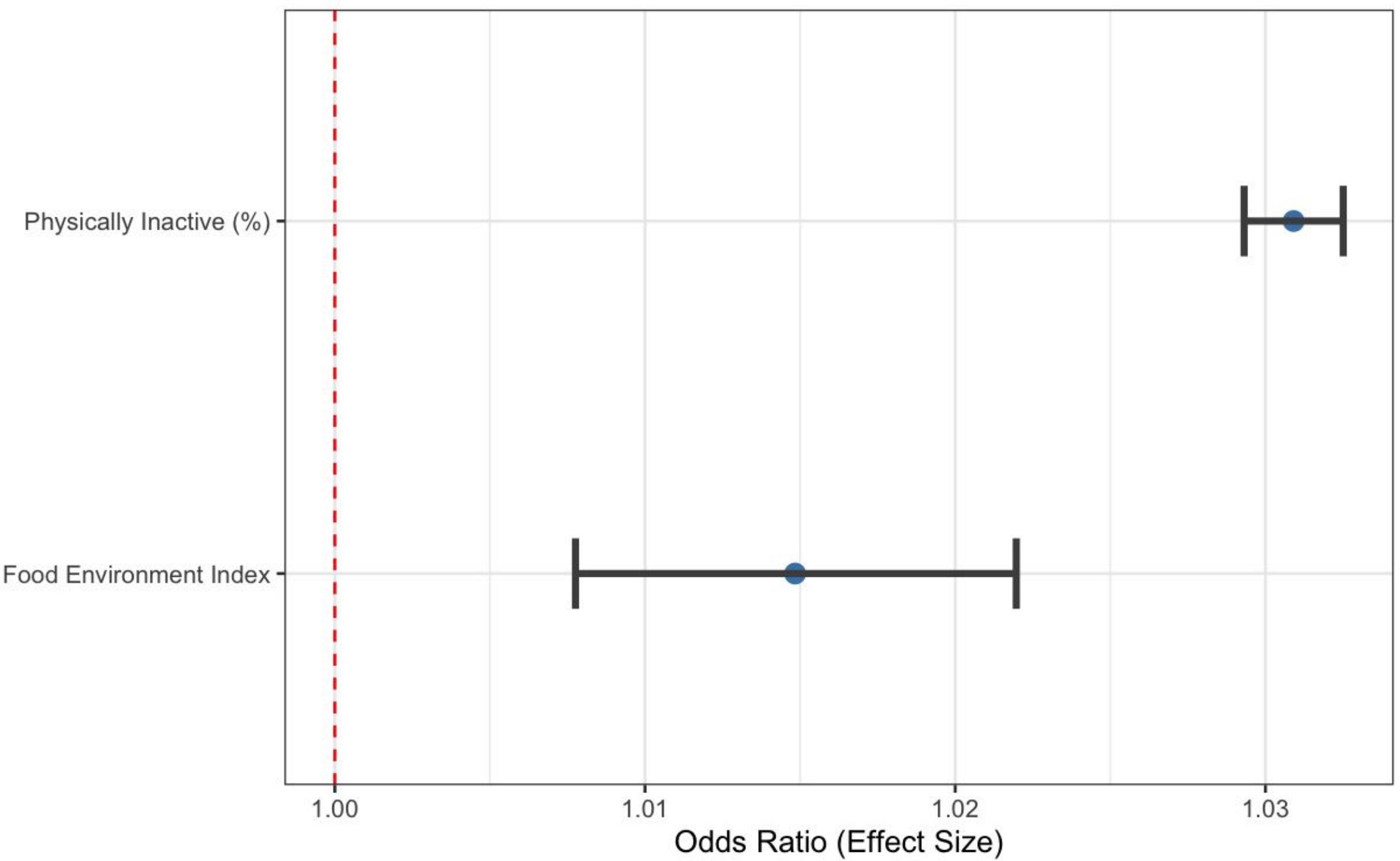
County Analysis

Regional Patterns:

- Higher obesity rates in the **Midwest** and **Southeast**

- Lower obesity rates in the **Northeast** and **West**

Results

Both predictors are **statistically significant**. A 1% increase in physical inactivity is associated with a 3.1% increase in obesity odds, while a 1-point increase in the food environment index corresponds to a 1.5% increase, controlling for the other variable.

Discussions

Conclusions:
- **Physical inactivity** is a significant predictor of adult obesity at the county level.
- **Limited access to healthy food** is not a reliable standalone predictor of obesity. **FEI** is a more robust metric, as it incorporates access to healthy food along with other socioeconomic factors.

Limitations:
- Analysis is based on county-level data, which does not reflect individual behaviors.
- We cannot infer causal relationships between predictors and obesity rates from the techniques we used.

Future Work:
- Investigate additional factors that may influence obesity.
- Incorporate methods for causal inference to strengthen the validity of findings.