

# COVID-19 Vaccine Hesitancy

US County Level Data

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# Introduction

- More than **82 million** people infected by COVID-19 worldwide and more than **1.8 million** deaths globally (WHO)
- In 2020 world GDP fell by 3.6% (World Bank)
- 88 million people pushed into extreme poverty
- While the scientists have successfully come up with vaccines against COVID-19 and it is made available to general public, there still remains hesitancy towards the vaccine, especially in the United States. Why?

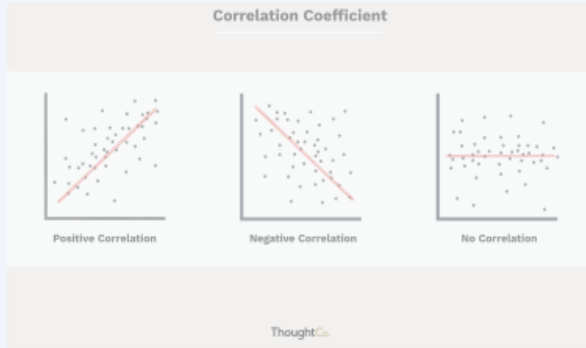
# Description of Data

- Centers for Disease Control & Prevention (CDC), Household Pulse Survey (HPS), Harvard Dataverse
- 3112 counties of United States of America in the final dataset, uniquely identified using the FIPS code
- Estimated Vaccine Hesitancy is the dependent variable
- 27 Independent variables testing demographics, health, politics and economic factors behind COVID vaccine hesitancy

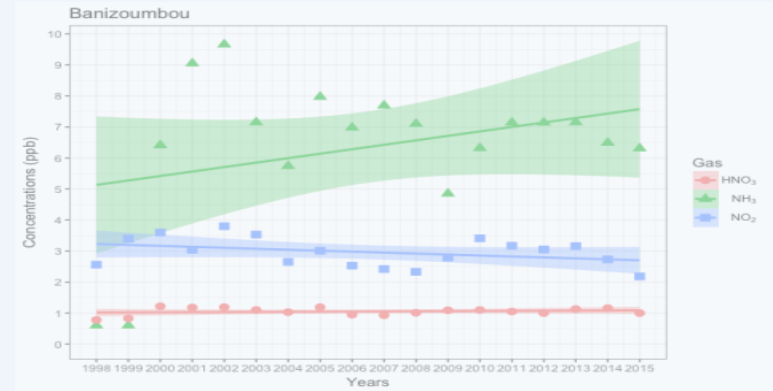
Variable	Description
COVID Vaccine Hesitancy	Estimated proportion of people who are hesitant in taking vaccines Continuous Variable
Social Vulnerability Index (SVI)	Index to measure how much a community is vulnerable to disaster. Includes Socioeconomic Status, Household Composition & Disability, Minority Status
Level of concern for Vaccination Rollout (CVAC)	Index that measures the rollout of the vaccine in a county Includes factors such as Historic Undervaccination, Sociodemographic barriers, Irregular Care Seeking Behaviour.
Race	White, African Americans, Hispanics, Asians, Alaskan American Indians.
Region	West, South, Northeast and Midwest Binary Variable
Median Household Income	Continuous Variable, Values from 2019
Unemployment Rate	Continuous Variable, Unemployment rate from 2020
Obesity and Diabetes	Percentage of obese and diabetic people in a county
Political Affiliation	Democrat or Republican, Binary Variable

# Analytical Methods Used

## Correlation Analysis



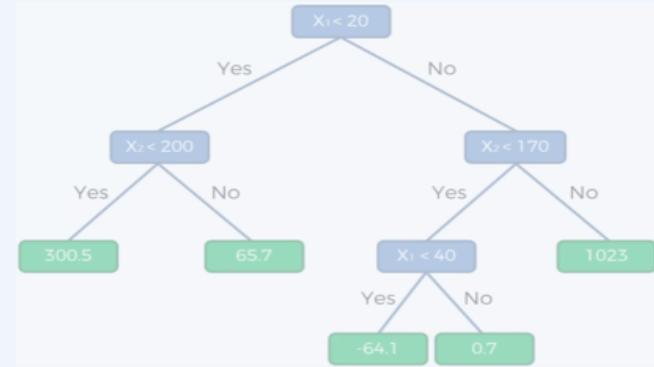
## Multiple Regression



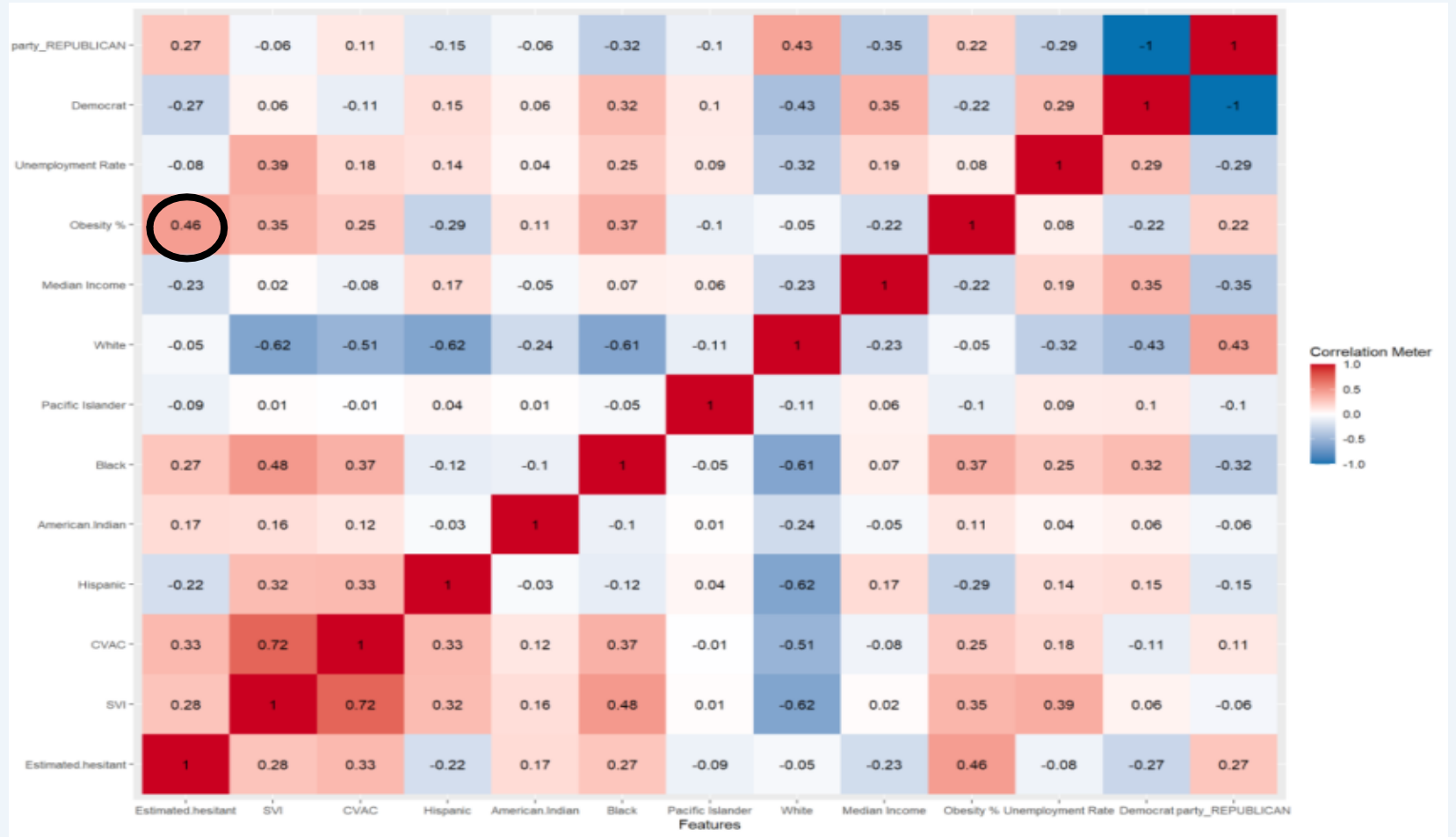
## K-Means Clustering



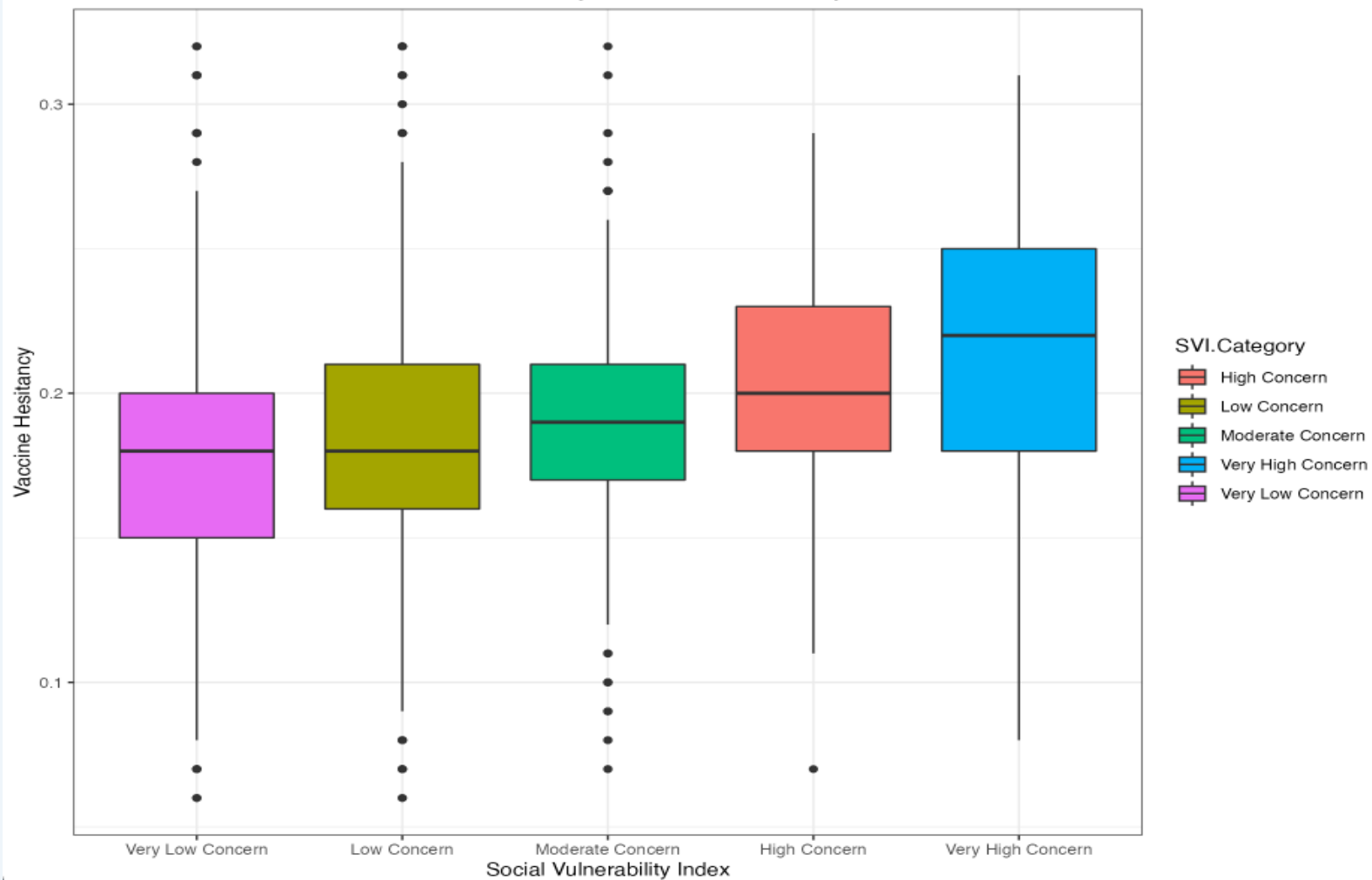
## Regression Trees



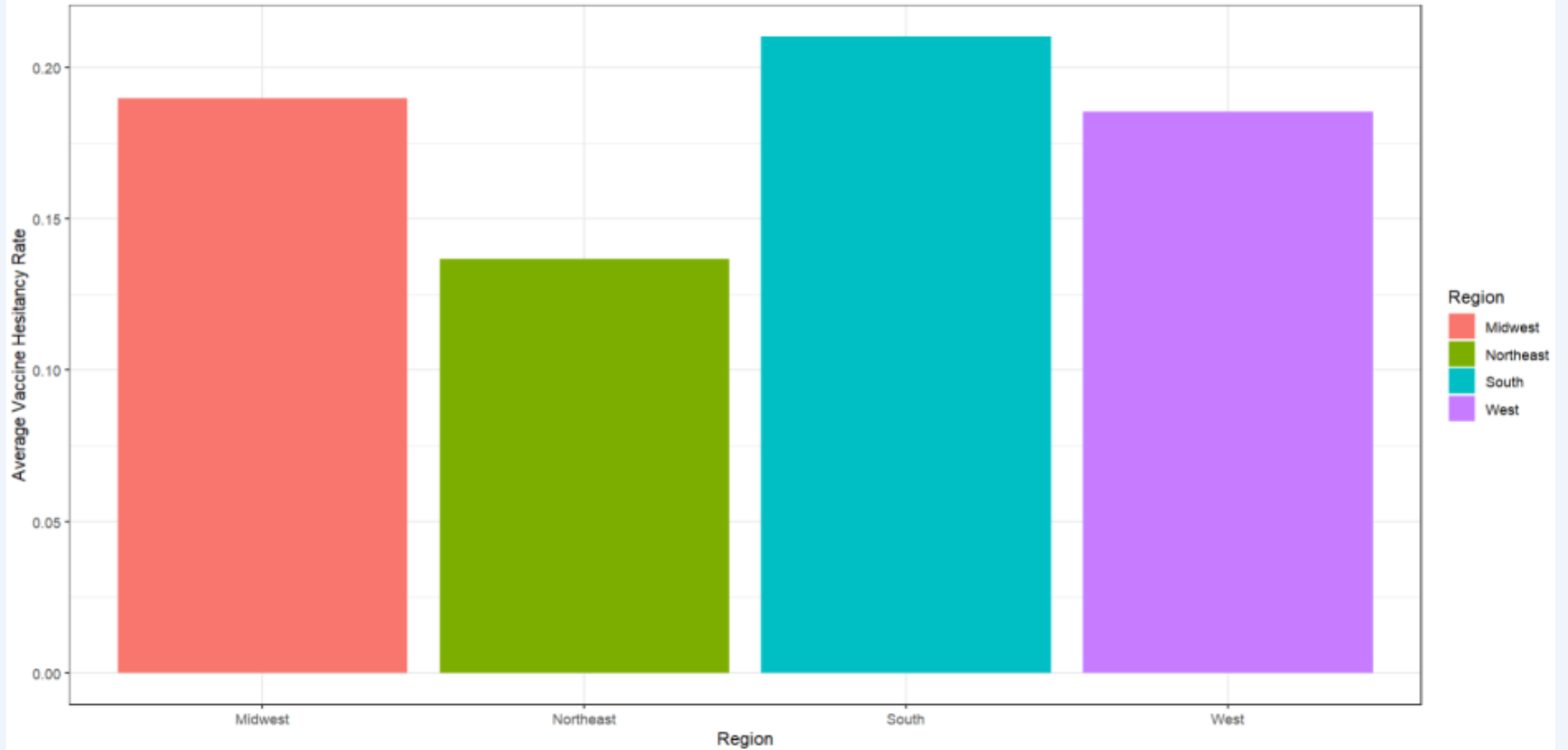
# Correlation Analysis



Social Vulnerability vs Vaccine Hesitancy

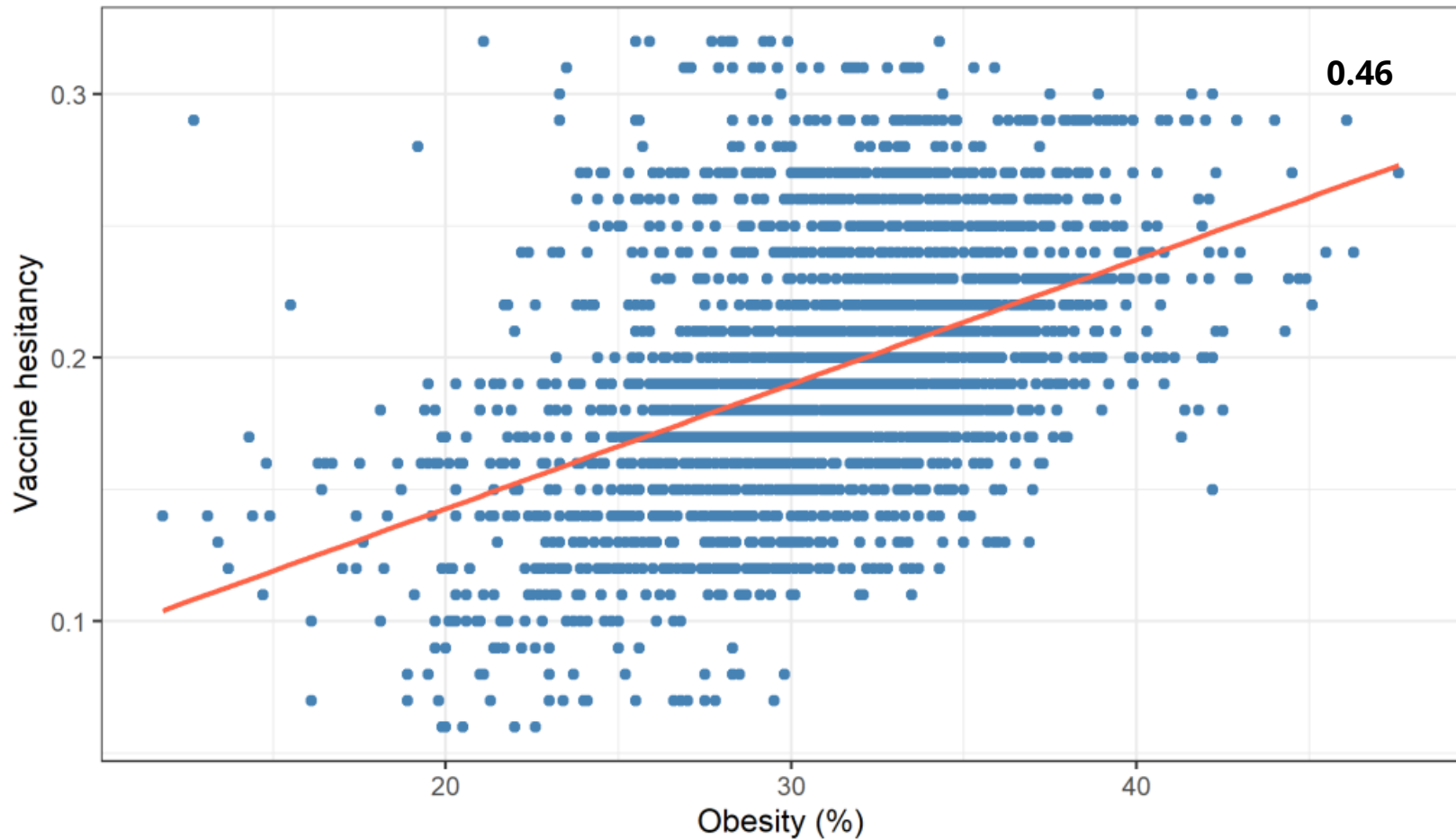


Region vs Average Vaccine Hesitancy Rate

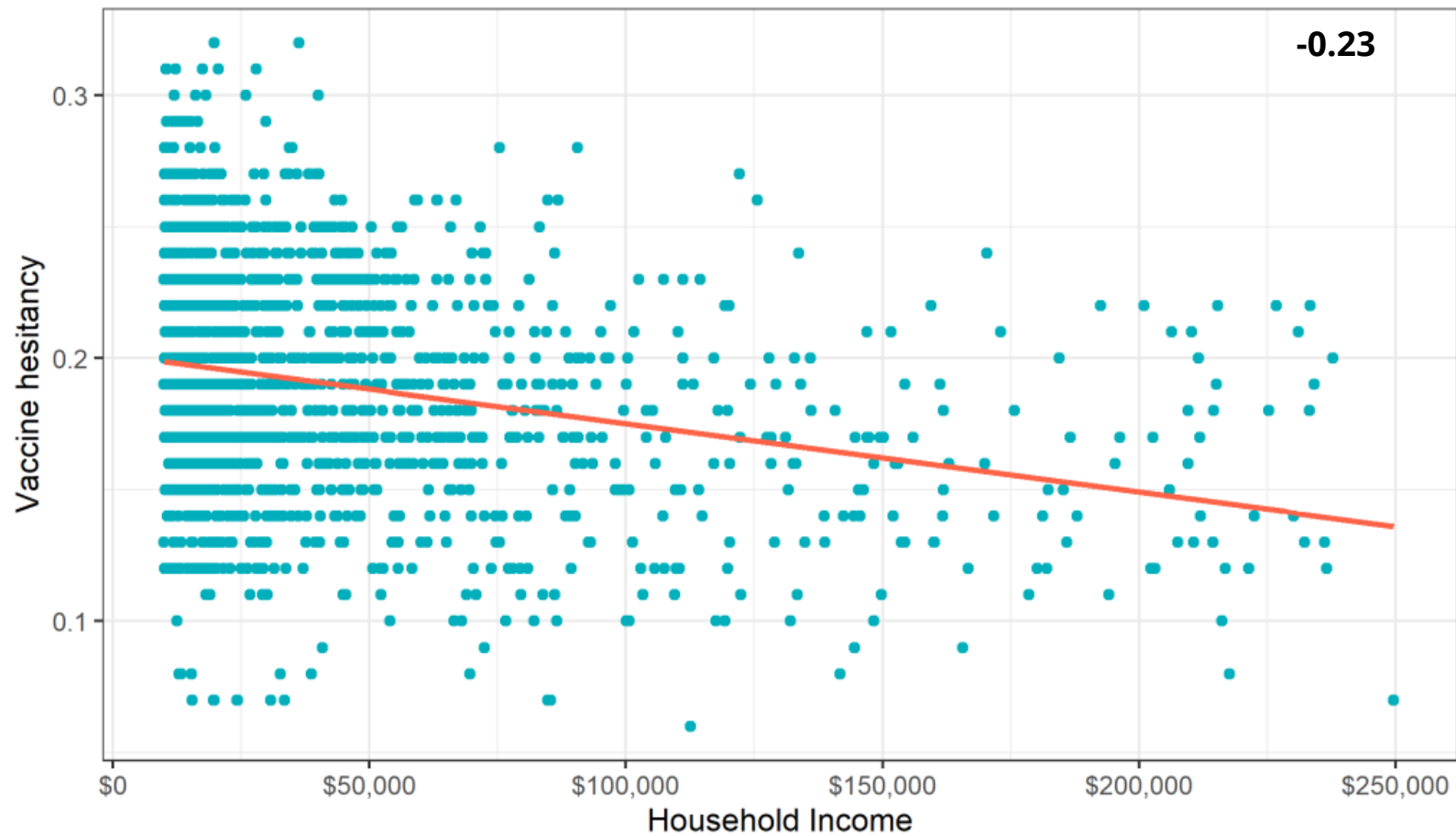




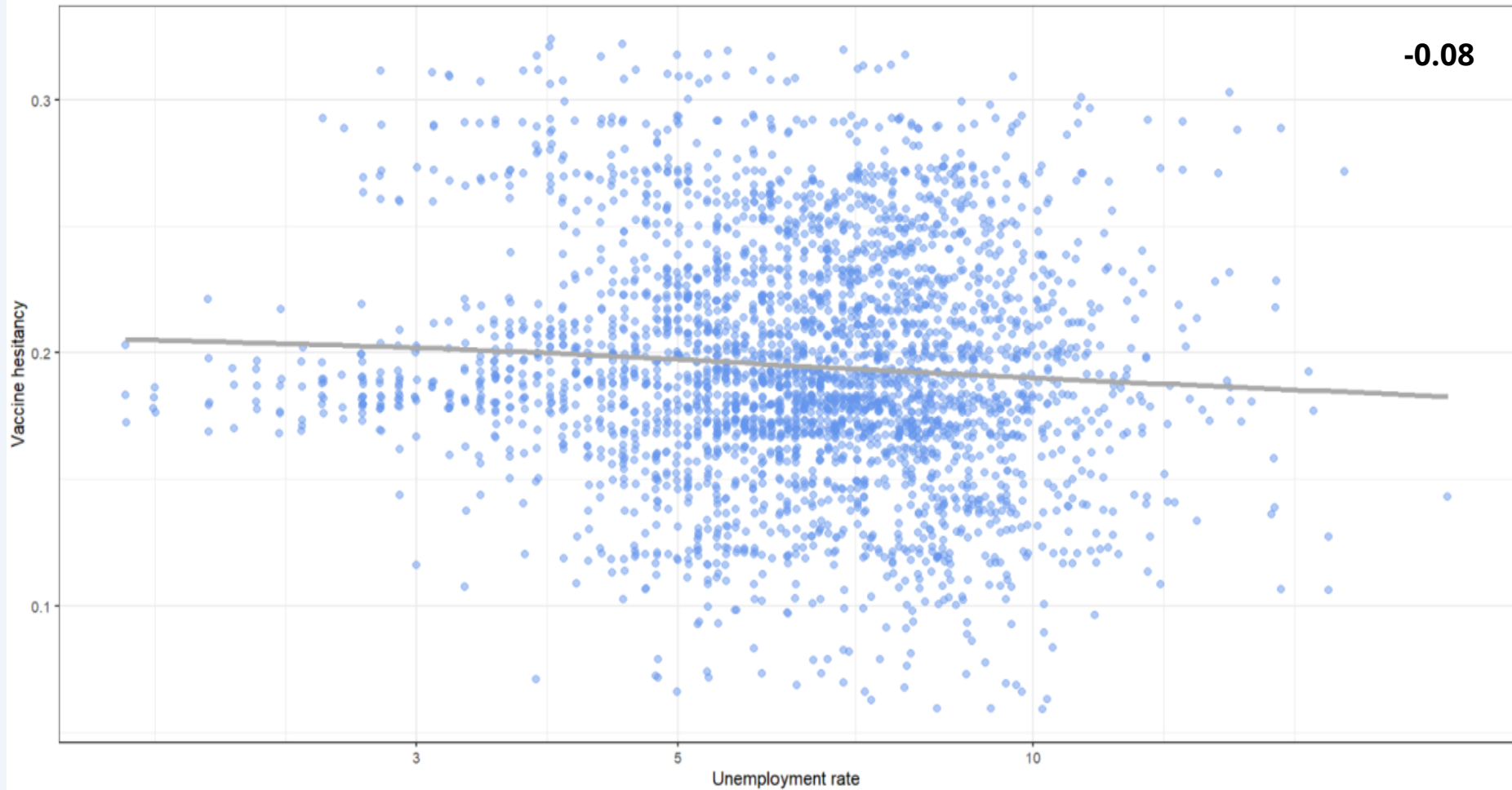
Obesity (%) vs Vaccine Hesitancy



# Household Income vs Vaccine Hesitancy



Unemployment Rate vs Vaccine Hesitancy



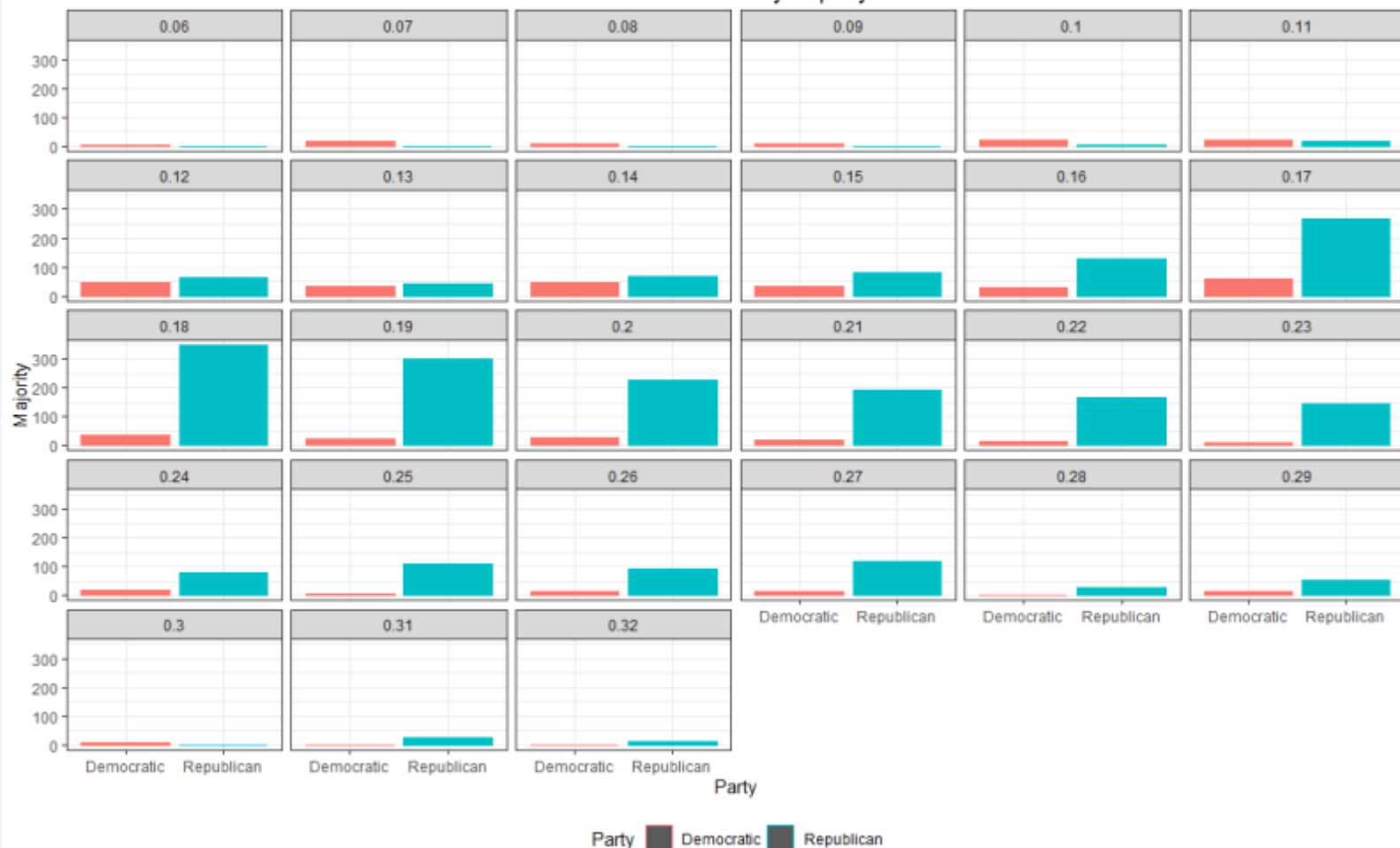
# Race vs Vaccine Hesitancy



Race

- American\_Indian\_Alaska\_Native
- Asian
- Black
- Hawaiian\_Pacific\_Islander
- Hispanic
- White

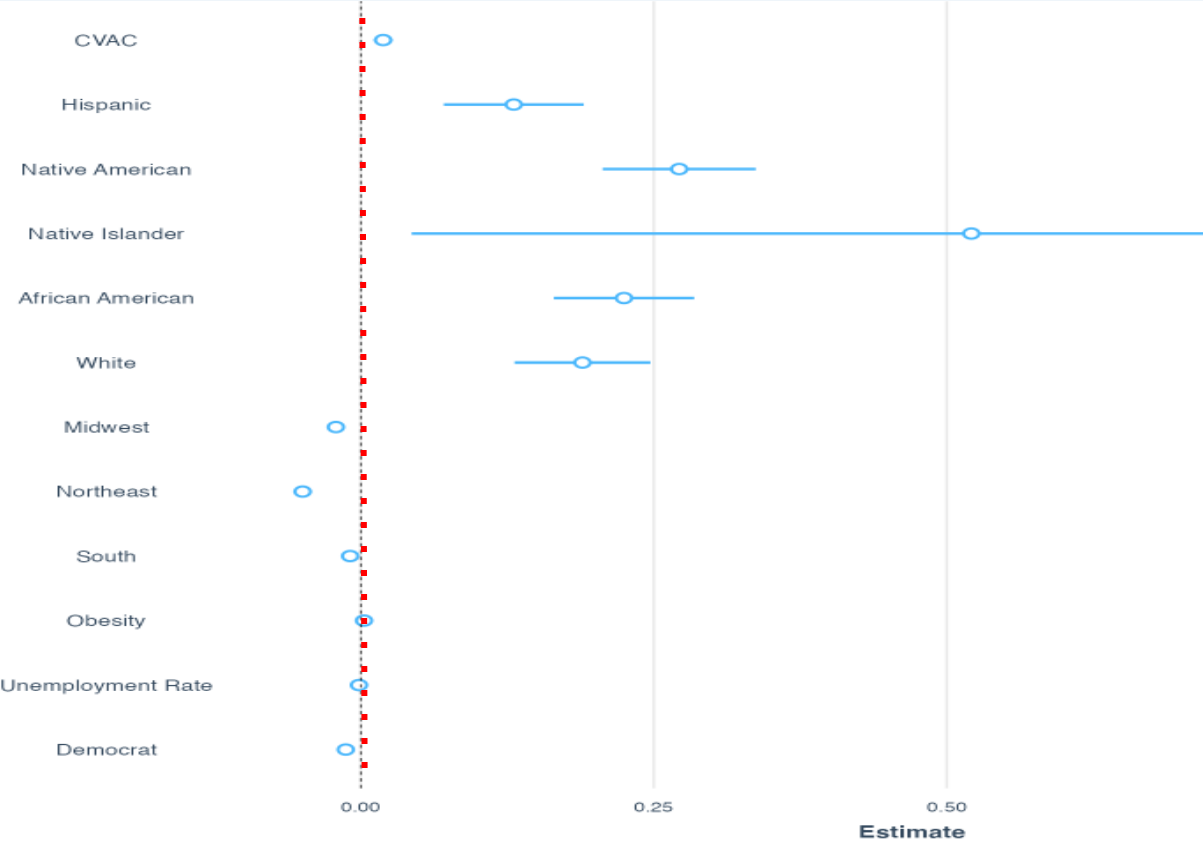
Vaccine Hesitancy vs party



## K- Means Clustering

	Vaccine Hesitancy	SVI	CVAC	American Indian	African Americans	White	Diabetes	Democrat	Median Income
1	0.26	0.88	0.77	0.57	0.01	0.31	13.28	0.42	11187.71
2	0.19	0.48	0.49	0.02	0.01	0.75	8.86	0.23	28205.75
3	0.14	0.39	0.25	0.00	0.11	0.68	9.24	0.99	248843.78
4	0.19	0.37	0.39	0.01	0.03	0.89	11.30	0.00	22241.78
5	0.22	0.81	0.82	0.01	0.25	0.58	13.11	0.17	22745.41

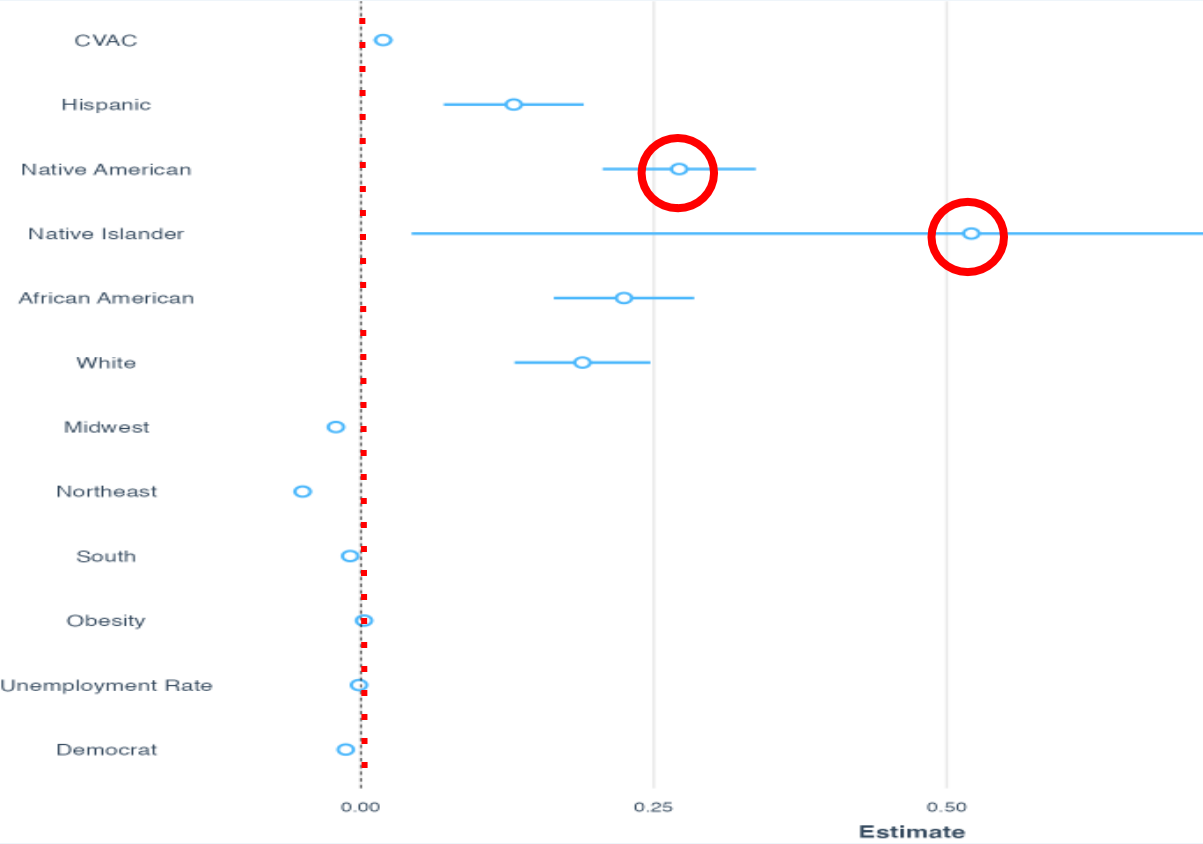
Regression Analysis



Independent Variables	Coefficient
CVAC	1.9%
Hispanic	13.1%
African Americans	22.5%
Native American	27.2%
Native Islander	52.1%
White	18.9%
Obesity	0.3%
Midwest	-2.1%
Northeast	-5.0%
South	-0.9%
UR	-0.1%
Democrat	-1.3%

RMSE=0.0344, Multiple R-squared of 41.2%

# Regression Analysis

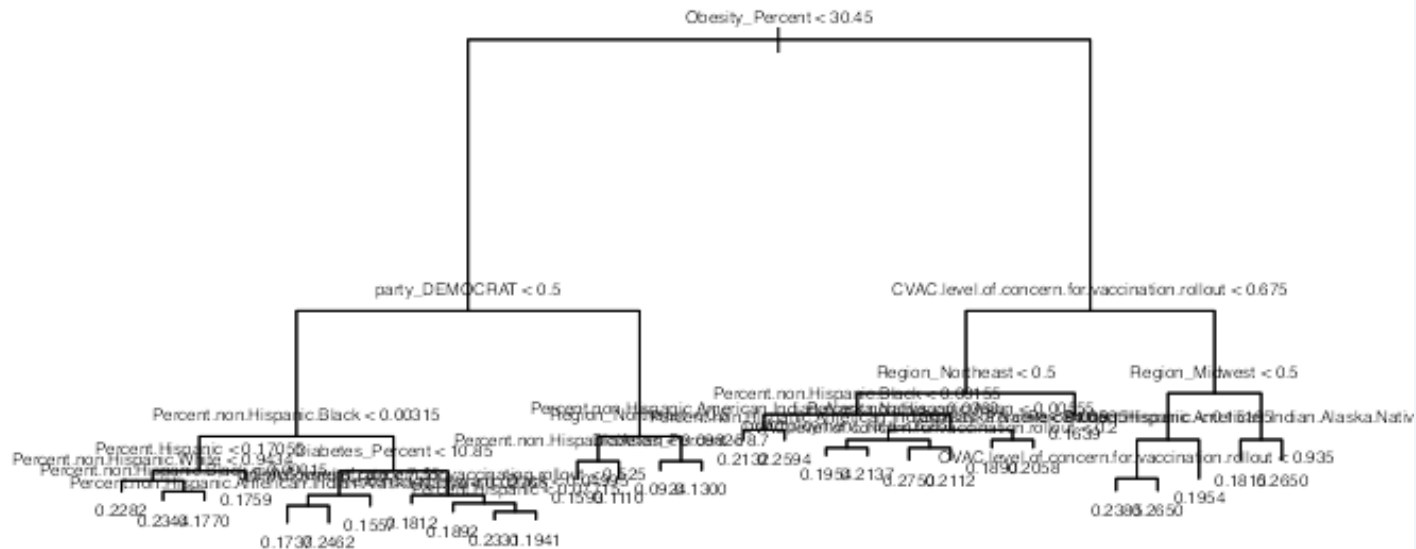


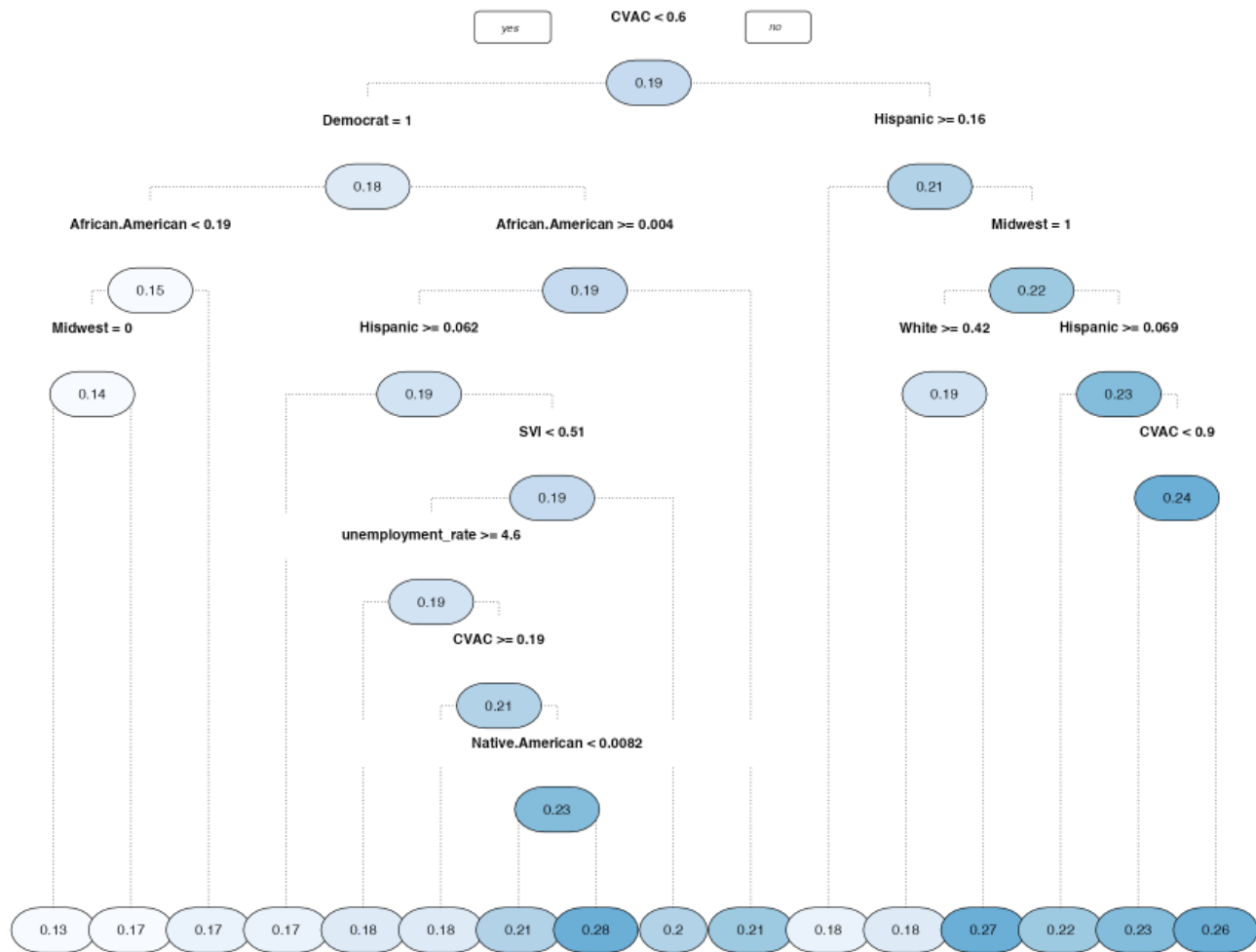
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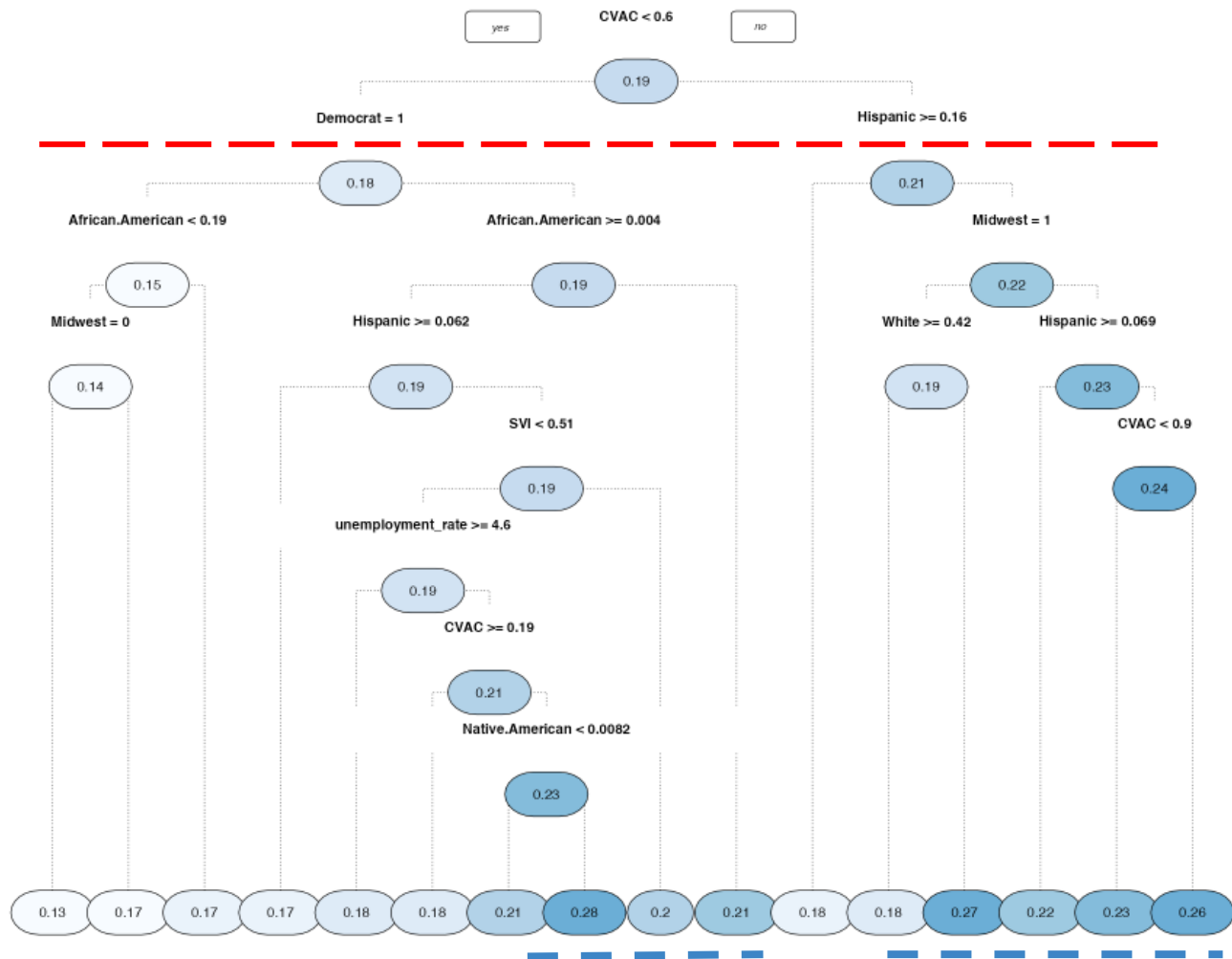
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# Regression Trees



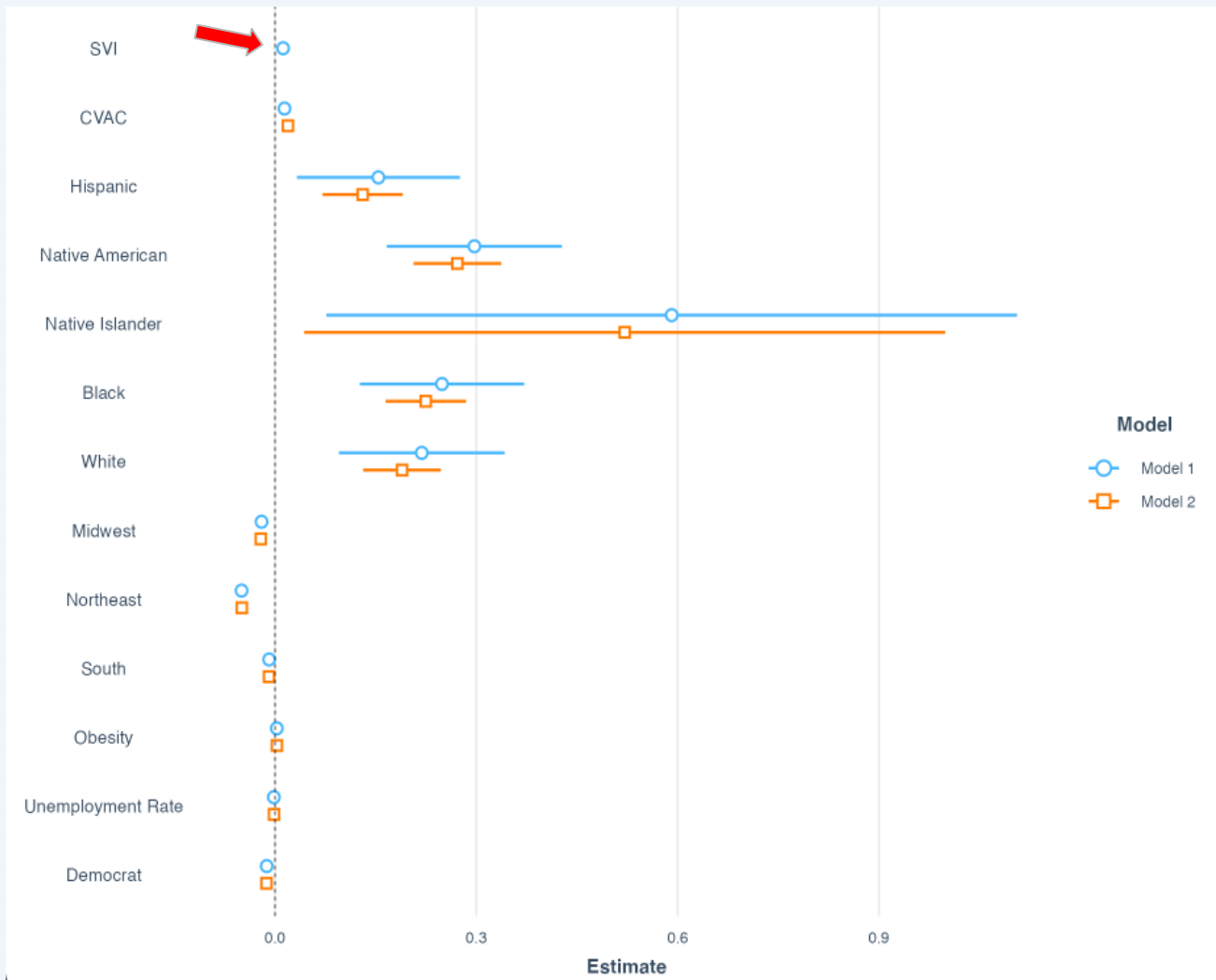




# Challenges we faced

- Social Vulnerability Index  
Intuitively very significant but statistically Insignificant
- Is social vulnerability not important in vaccine hesitancy?
- Multicollinearity with other variables

	With SVI	Without SVI
RMSE	0.034	0.0344
R squared	41.3%	41.2%



# Implications of Results

- Identify the counties and communities where vaccine hesitancy is high.
- Determine challenges or reasons for low vaccination rates
- Engage with community stakeholders to overcome the challenges related to vaccine Hesitancy

## Scope for Future Research

- Hesitancy in Booster shot
- Hesitancy in getting kids vaccinated
- Hesitancy due to mix and match of vaccine
- Impact of Omicron, specially on toddler

Thank  
you!!!  
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## The Five Vaccine Personas



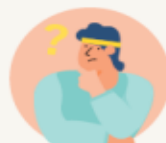
**The Enthusiasts**



**The Watchful**



**The Cost-Anxious**



**The System Distrusters**



**The COVID Sceptics**

### **Vaccine Hesitancy**

Are ready to get vaccinated

Want to wait and see, given their concerns on vaccine safety and effectiveness

Are concerned about the financial and time cost of getting vaccinated

Believe people of their race aren't treated fairly by the U.S. health care system

Have low COVID-19 risk perceptions and believe several COVID-specific conspiracy theories

### **Key Barriers**

Appointment availability

Community norms

Financial cost

Time

Trust

Access and inequity

Deeply-held beliefs around COVID-19

Vaccine Safety

Vaccine Safety

Vaccine Safety

Vaccine Safety

### **Targeted Solution Examples**

Make it easy for them to get the vaccine.

Make it visible that others are vaccinated or intend to be

Bring vaccines to people. Offer paid time off.

Listen and learn. Partner with trusted community organizations.

Don't try to debunk. Enlist trusted figures to persuade.