COVID-19 Vaccination Uptake Modeling and Predictors

Division of Immunization

Virginia Department of Health

May 7th, 2024

Presentation Overview

1. Conduct Parental Attitudes and Beliefs Survey
2. Analyze Survey Results to Identify Potential Predictors
3. Using Regression Analysis to Evaluate Predictors
4. Build the Uptake Model
5. Future Work

Attitudes and Beliefs Survey

Attitudes and Beliefs Survey: Goals

Goal: Gauge Virginia Parents' Attitudes and Beliefs about:

- Vaccine Efficacy
- Vaccine Safety
- Consequences of Not Vaccinating
- Reasons For or Against Vaccinating
- Possible Access Barriers

Attitudes and Beliefs Survey: Survey Design Overview

Parents were asked several demographic questions before proceeding to the vaccine related questions:

- Age/Sex/Race
- Locality
- Education and Employment Status
- Insurance Status

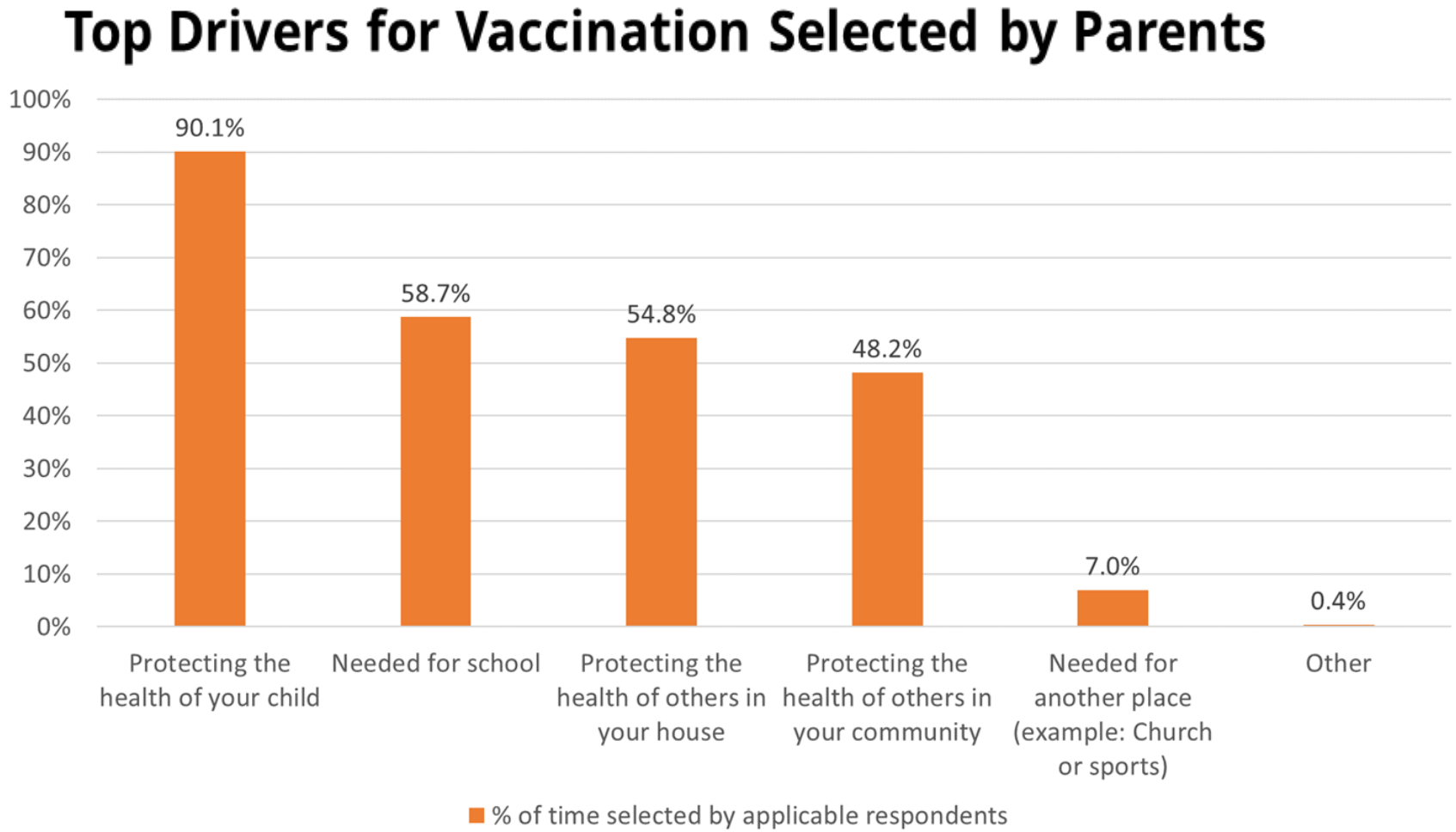
Most questions utilized Likert scale design

- Example: How confident do you feel about the following sentence ? - I know the purpose of vaccines? Very Confident, Somewhat Confident, Neutral, Not Very Confident, Not At All Confident, or Prefer Not To Say

Parents were asked about routine childhood vaccinations, COVID-19 Vaccine, and Flu Vaccine

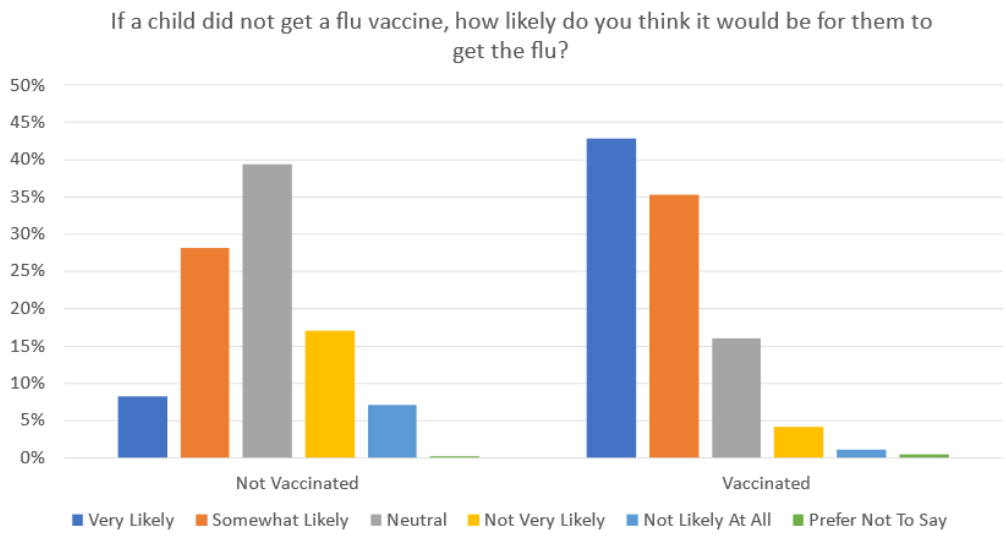
Attitudes and Beliefs Survey: Key Insights

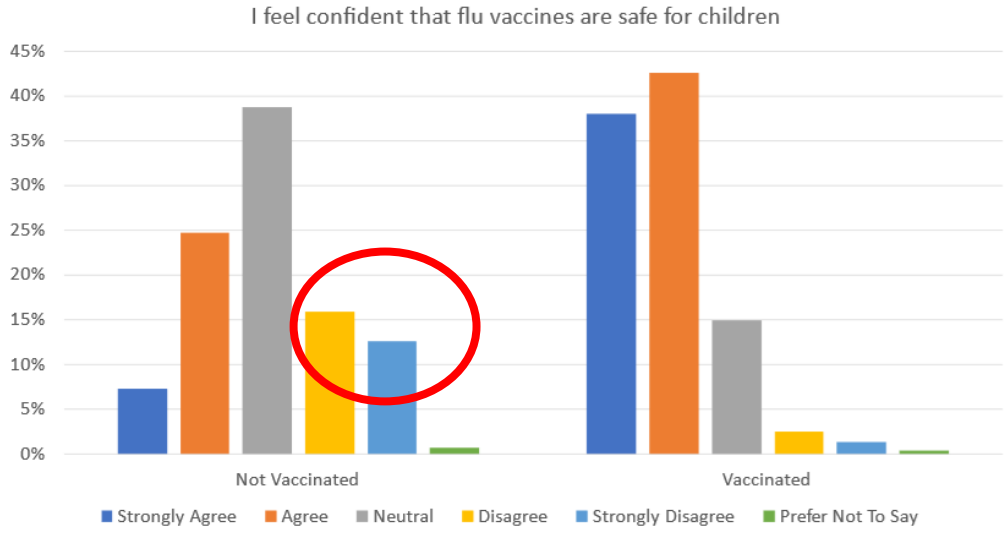
- Parents who had already or plan to get their children vaccinated were asked what their most important reasons were for vaccinating their children. Respondents were allowed to select up to three reasons.

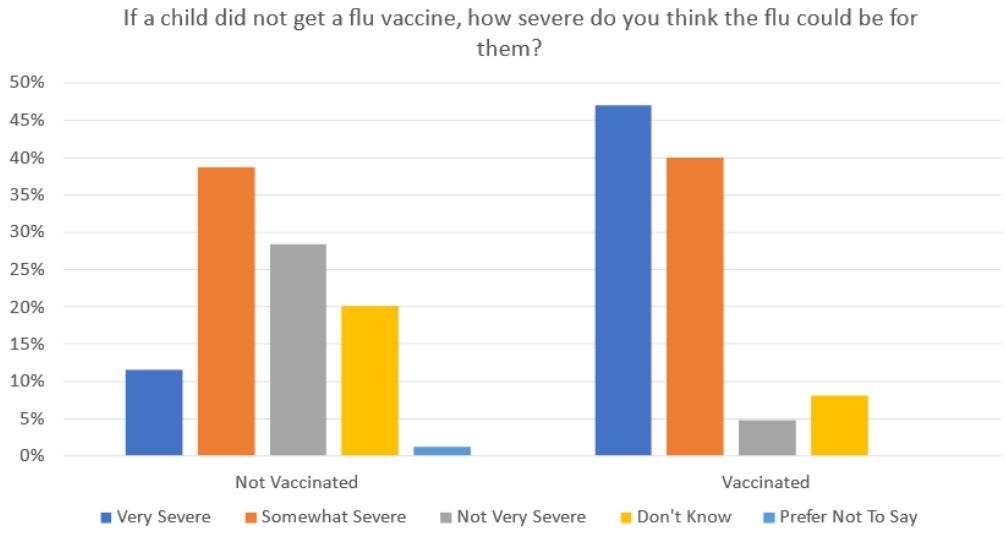


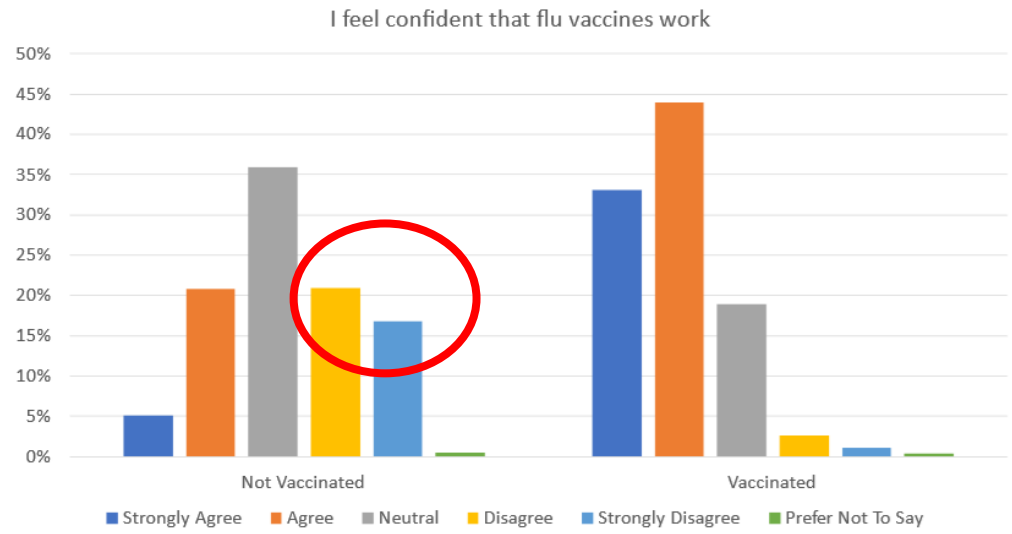
Attitudes and Beliefs Survey: Key Insights

- Hesitancy and Efficacy by Flu Vaccination Status



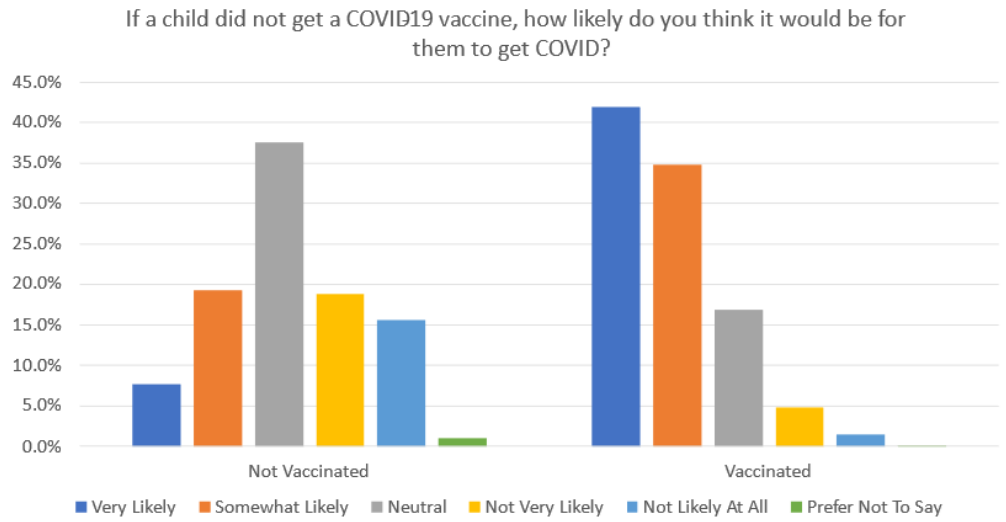


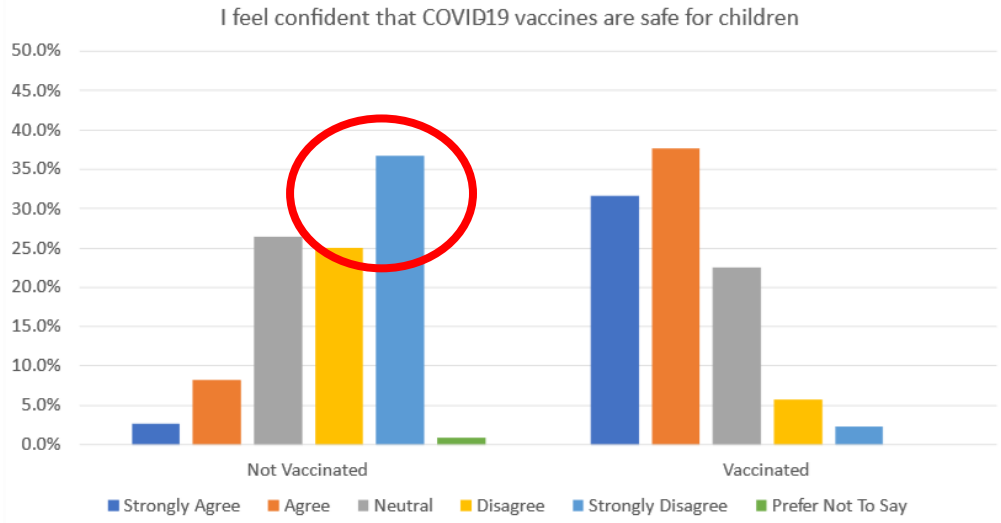


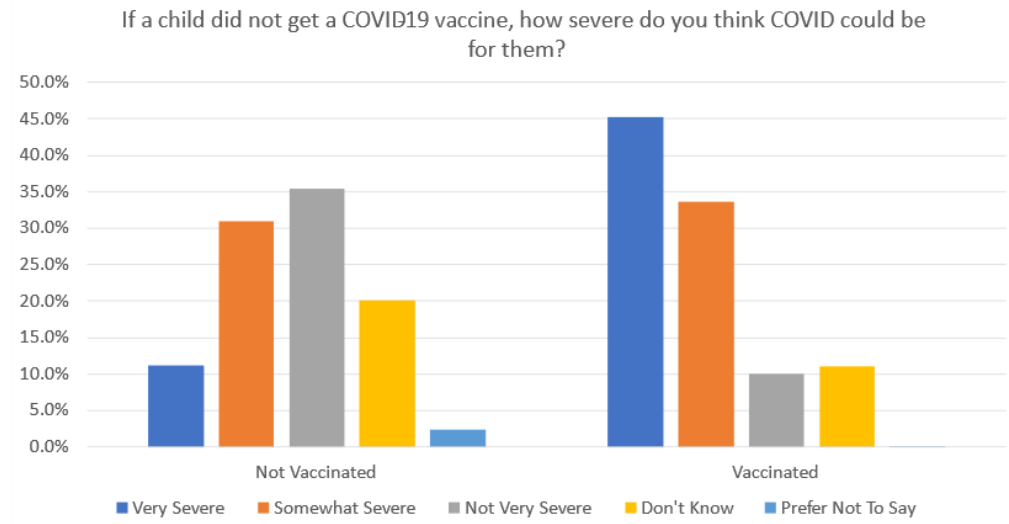


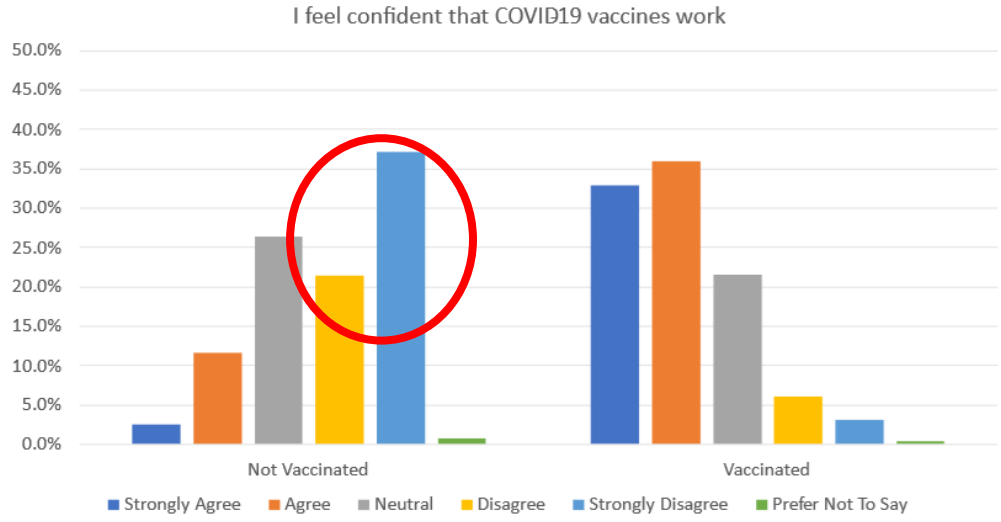
Attitudes and Beliefs Survey: Key Insights

- Hesitancy and Efficacy by COVID-19 Vaccination Status



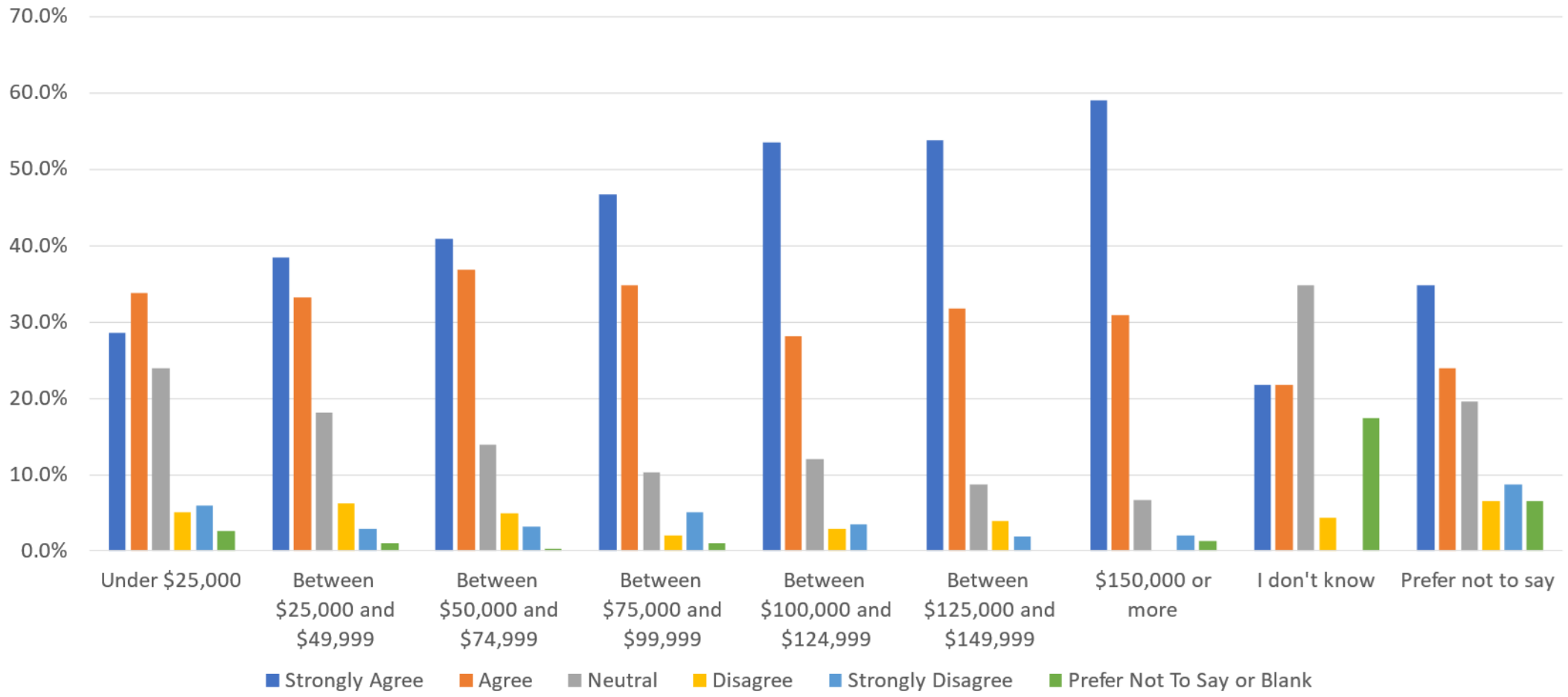






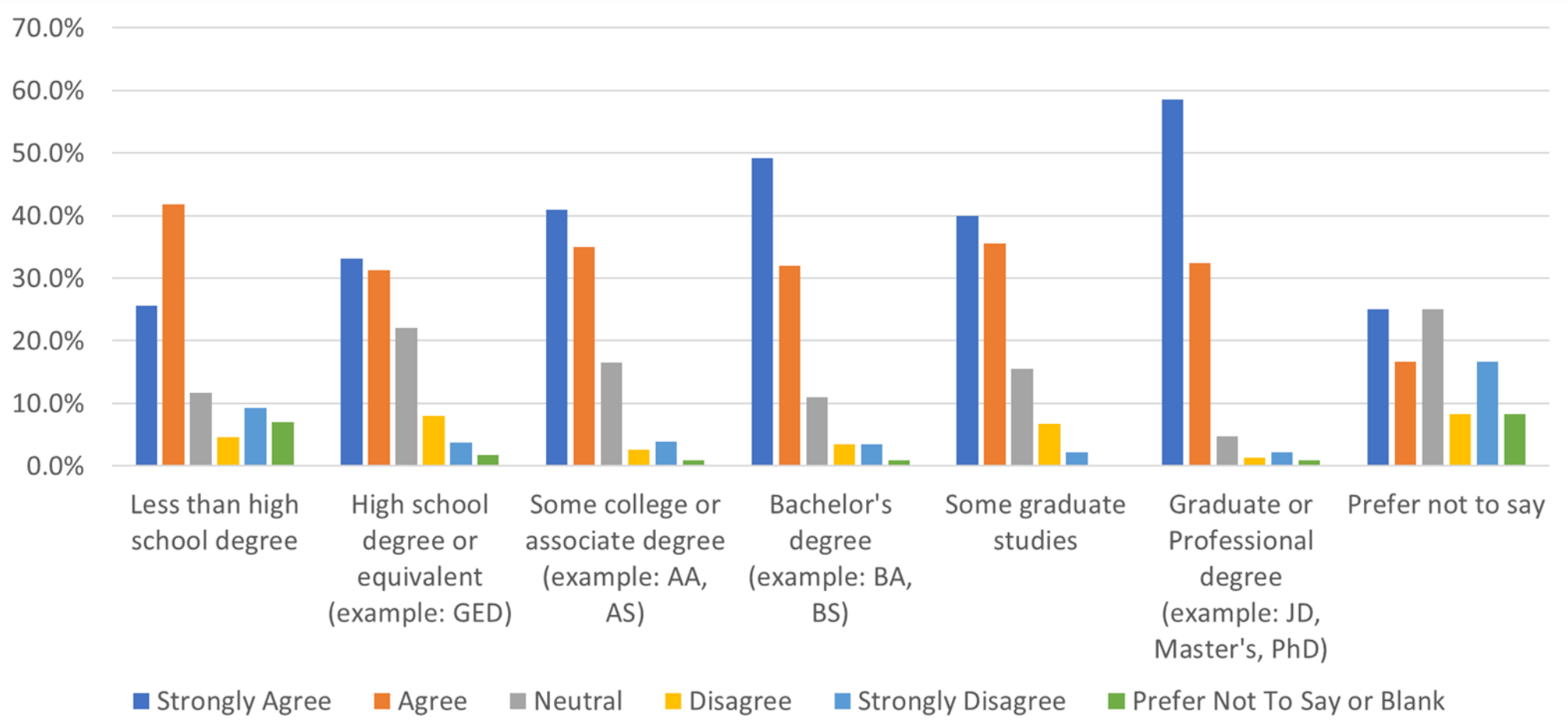
Attitudes and Beliefs Survey: Key Insights

- As household income goes up, the more confident the parent was in the safety of vaccines recommended for children 8 years old and younger.



Attitudes and Beliefs Survey: Key Insights

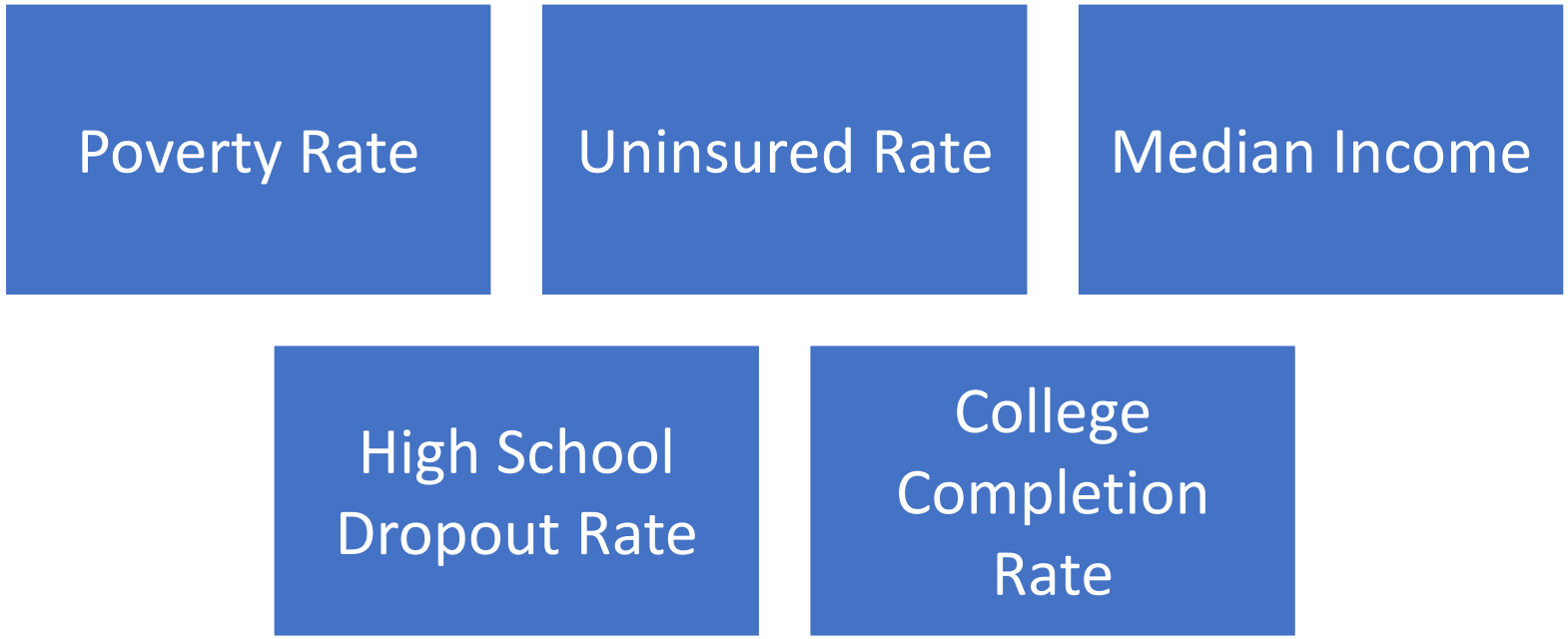
- In general, we see more confidence in the safety of vaccines recommended for children 8 years old and younger the higher the level of parental education.



Regression Analysis

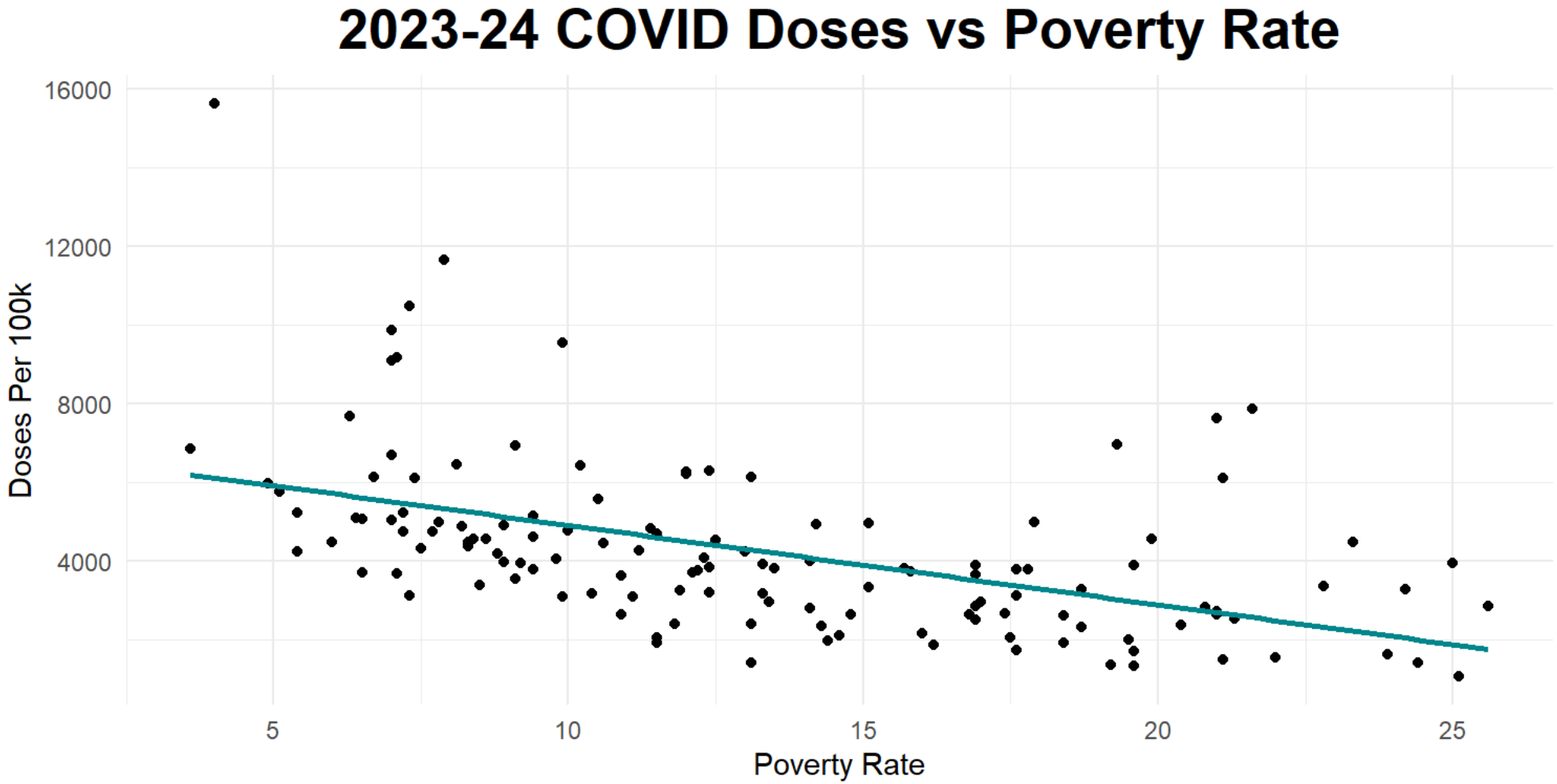
2023-24 COVID Vaccine Predictors

- We selected several potential predictors informed by the survey to investigate.
- These factors were individually regressed against locality level 23-24 COVID-19 Vaccination Rates from the Virginia Immunization Information System (VIIS).



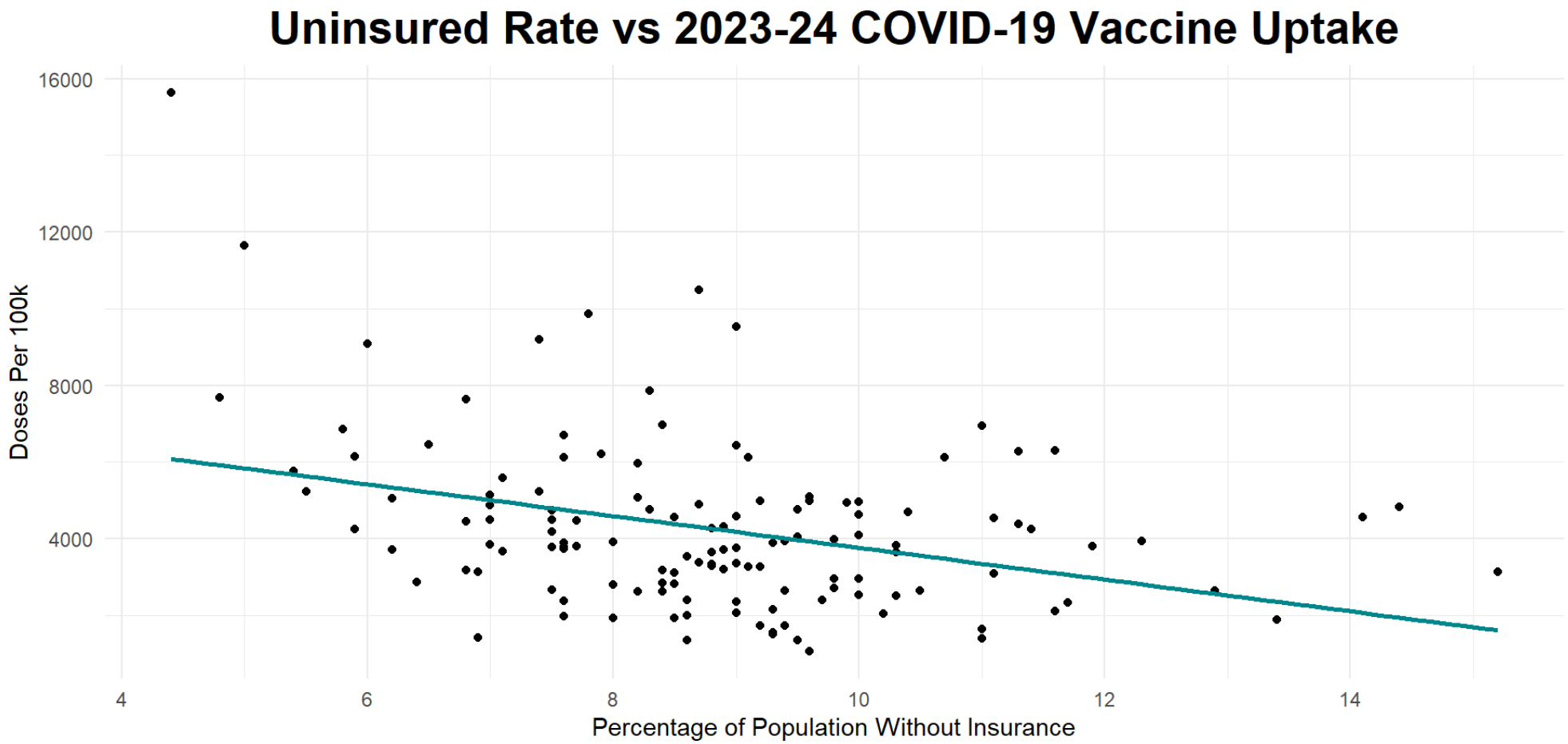
2023-24 COVID Vaccine Uptake vs Poverty Rate

- Poverty rate data sourced from USDA-County level dataset
- The R^2 between the poverty rate and doses per 100k of 2023-24 COVID Vaccine administered in Virginia localities (from VIIS) was 0.2511.



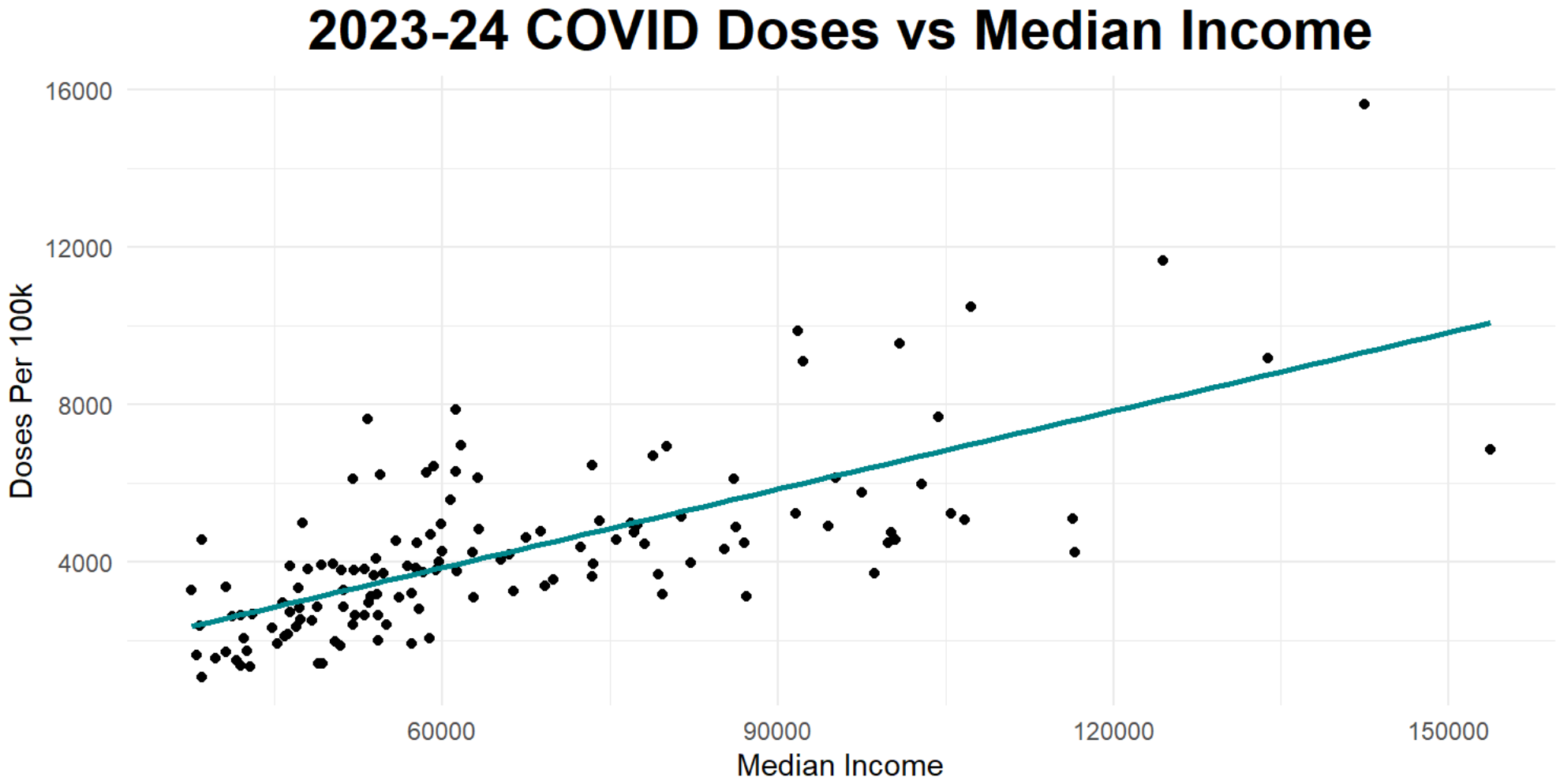
2023-24 COVID-19 Vaccine Uptake vs Uninsured Rate

- Insurance Rate data drawn from the Small Area Health Insurance Estimates Program (https://www.census.gov/programs-surveys/sahie.html)
- The R^2 between the percent of population without insurance and doses per 100k of 2023-24 COVID-19 Vaccine administered in Virginia localities (from VIIS) was 0.1246**.**



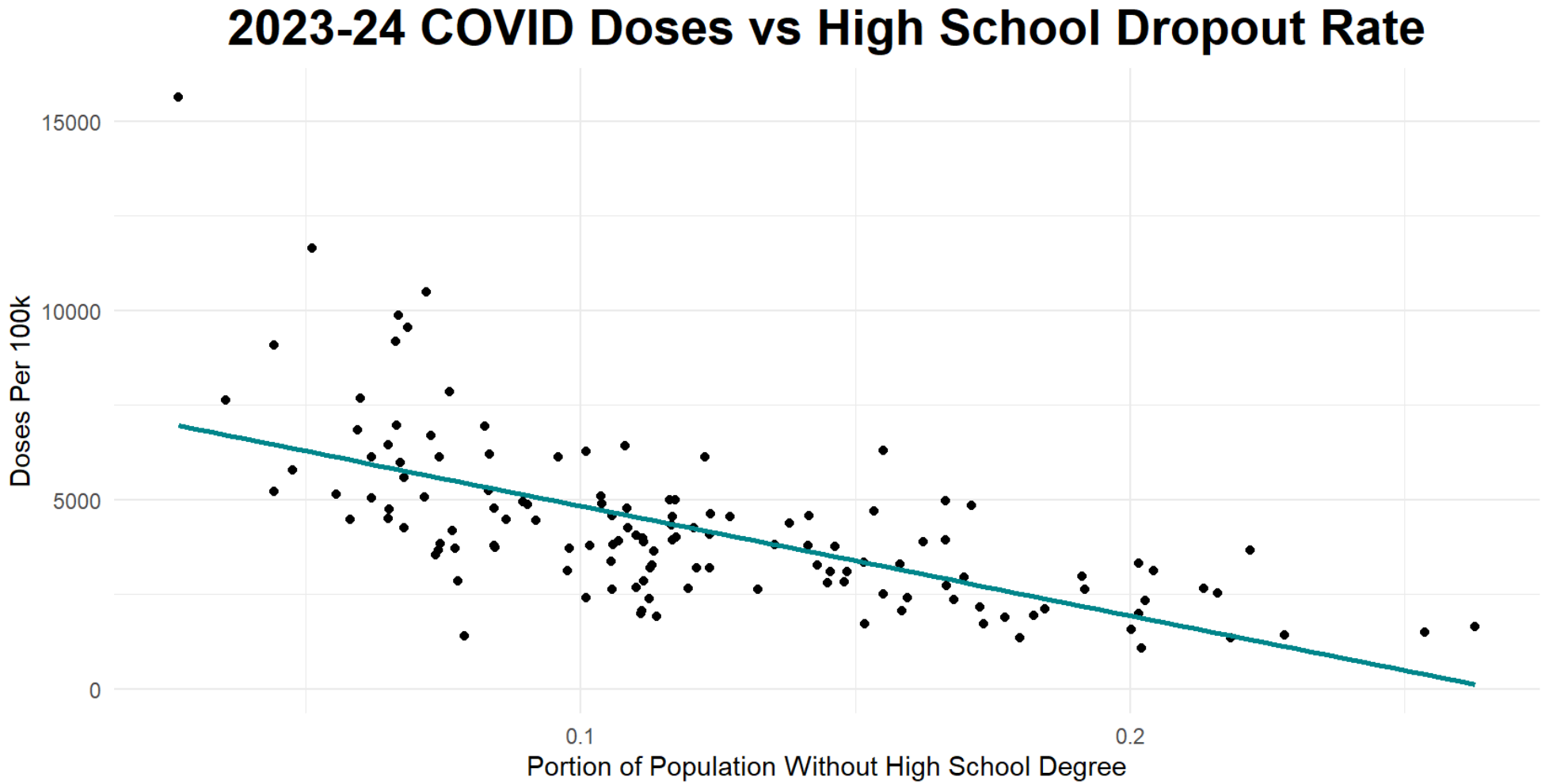
2023-24 COVID Vaccine Uptake vs Median Income

- Income data sourced from USDA-County level dataset
- The R^2 between median income and doses per 100k of 2023-24 COVID Vaccine administered in Virginia localities (from VIIS) was 0.4905.



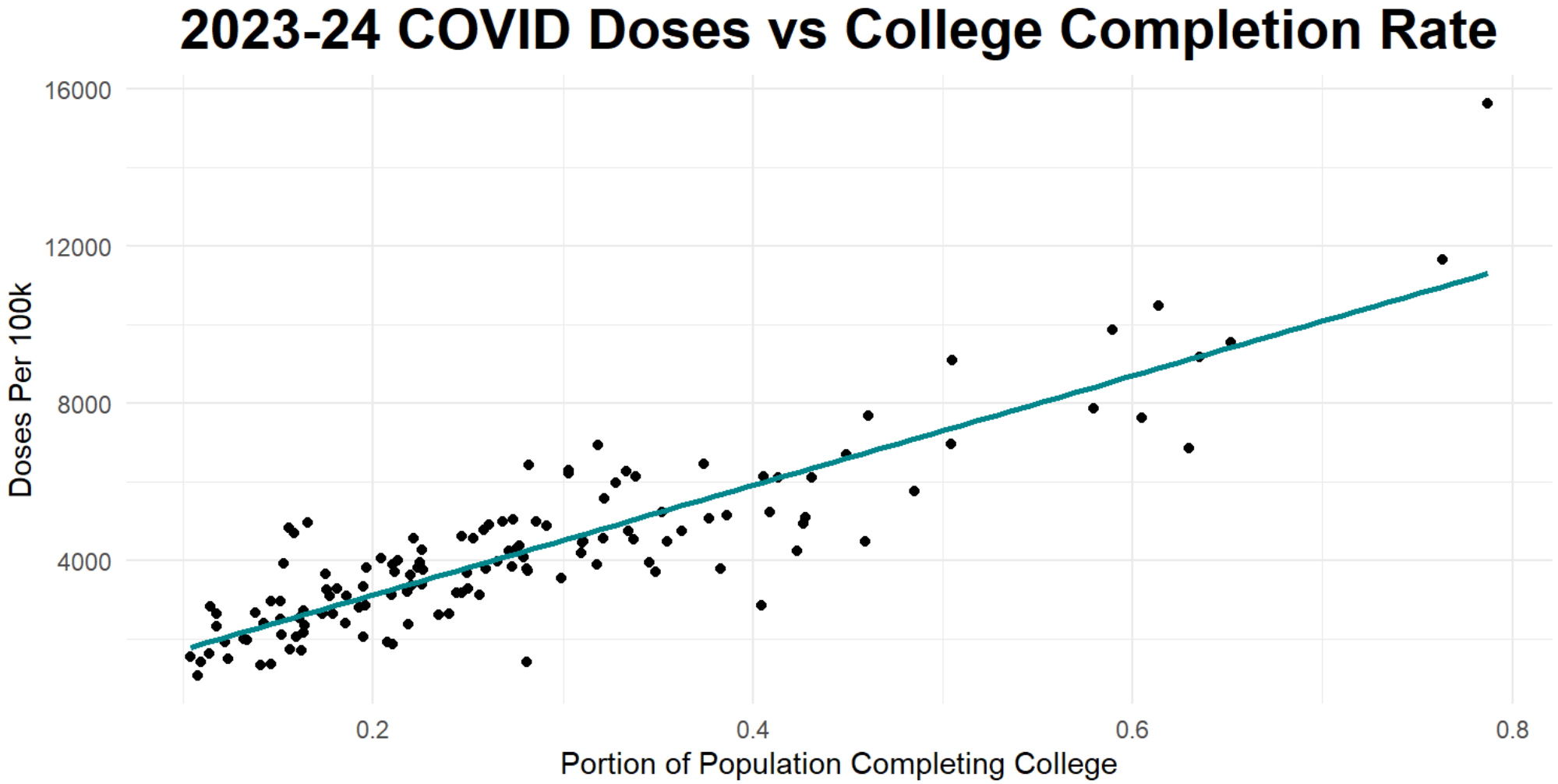
2023-24 COVID Vaccine Uptake vs HS Dropout Rate

- High school graduation rate data sourced from USDA-County level dataset
- The R^2 between the percent of population who dropped out of high school and doses per 100k of 2023-24 COVID Vaccine administered in Virginia localities (from VIIS) was 0.4197.



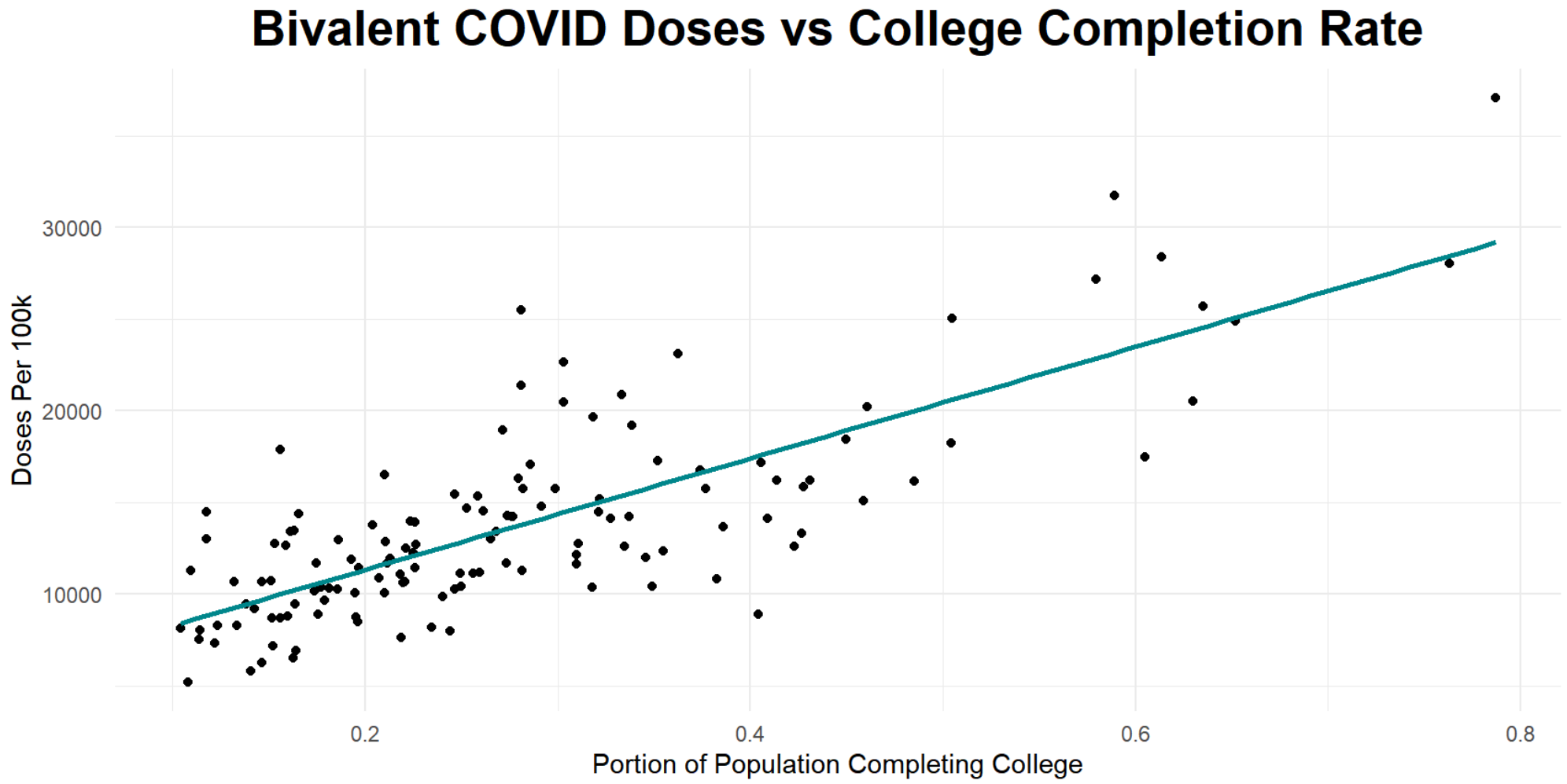
2023-24 COVID Vaccine Uptake vs College Completion Rate

- College Completion rate data sourced from USDA-County level dataset
- The R^2 between the percent of population who has completed college and doses per 100k of 2023-24 COVID Vaccine administered in Virginia localities (from VIIS) was **0.7734.**



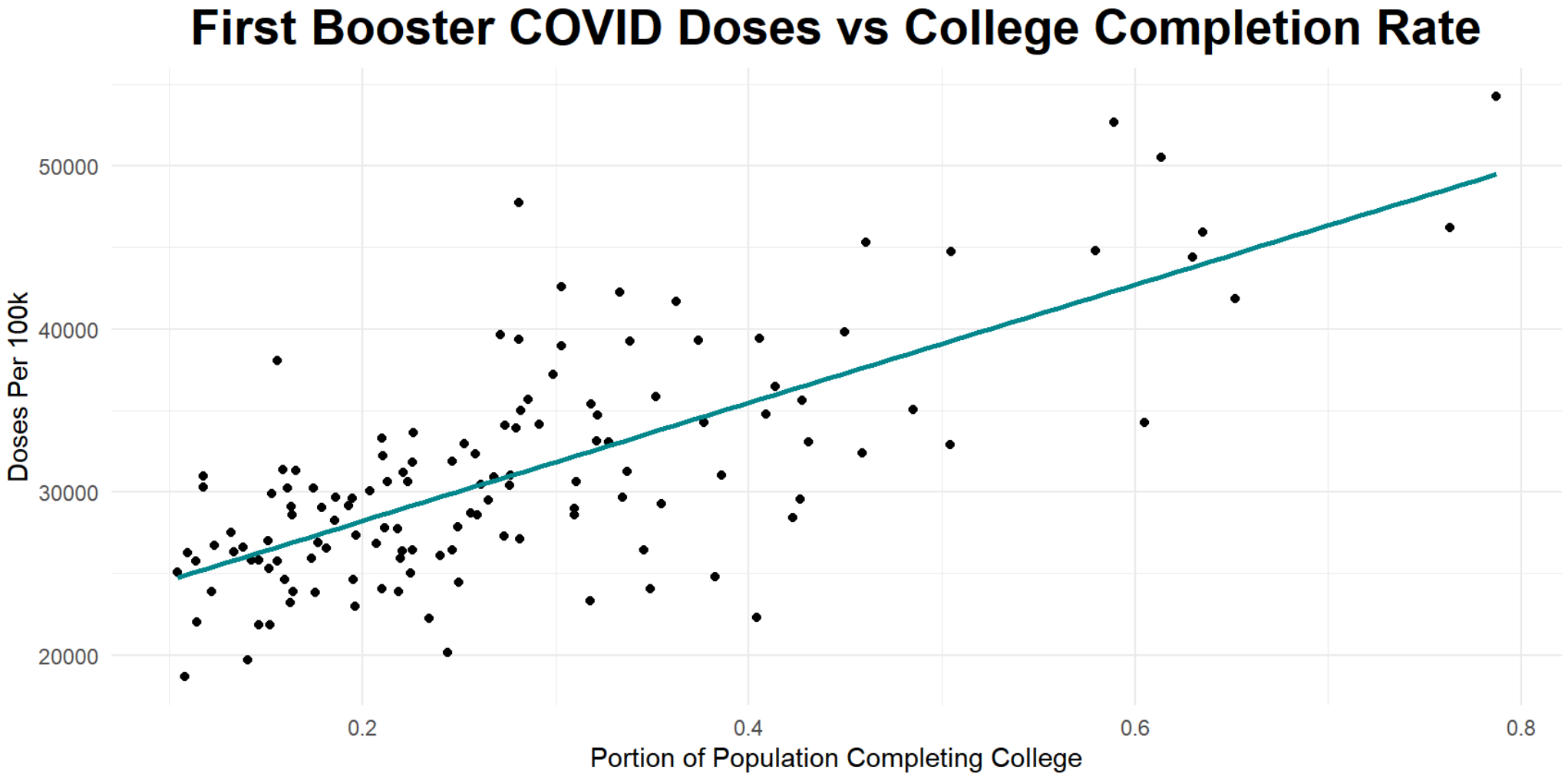
Bivalent COVID Vaccine Uptake vs College Completion Rate

- College Completion rate data sourced from USDA-County level dataset
- The R^2 between the percent of population who has completed college and doses per 100k of Bivalent COVID Vaccine administered in Virginia localities (from VIIS) was 0.6104



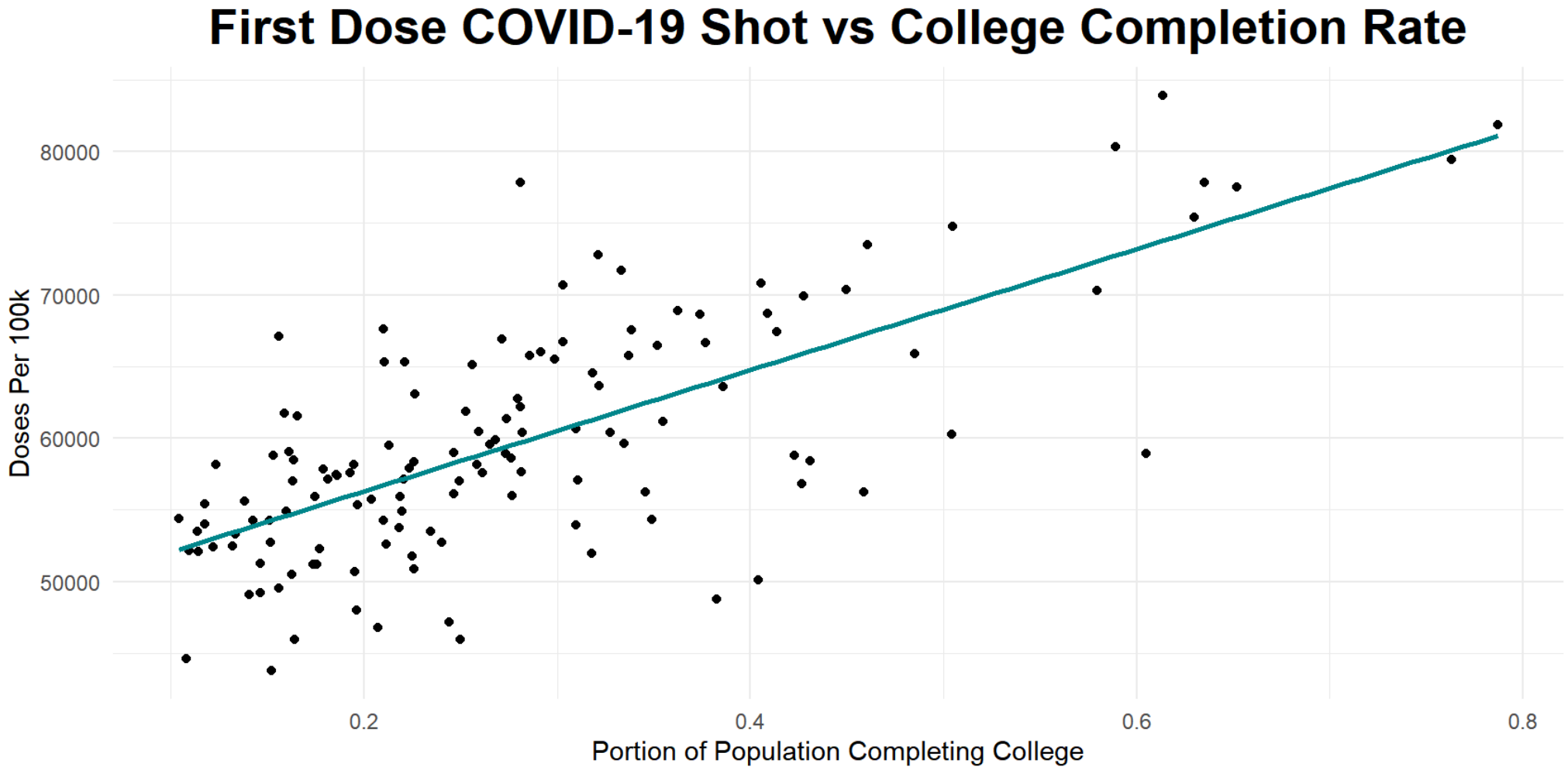
First COVID Booster Vaccine Uptake vs College Completion Rate

- College Completion rate data sourced from USDA-County level dataset
- The R^2 between the percent of population who has completed college and doses per 100k of Bivalent COVID Vaccine administered in Virginia localities (from VIIS) was 0.5281



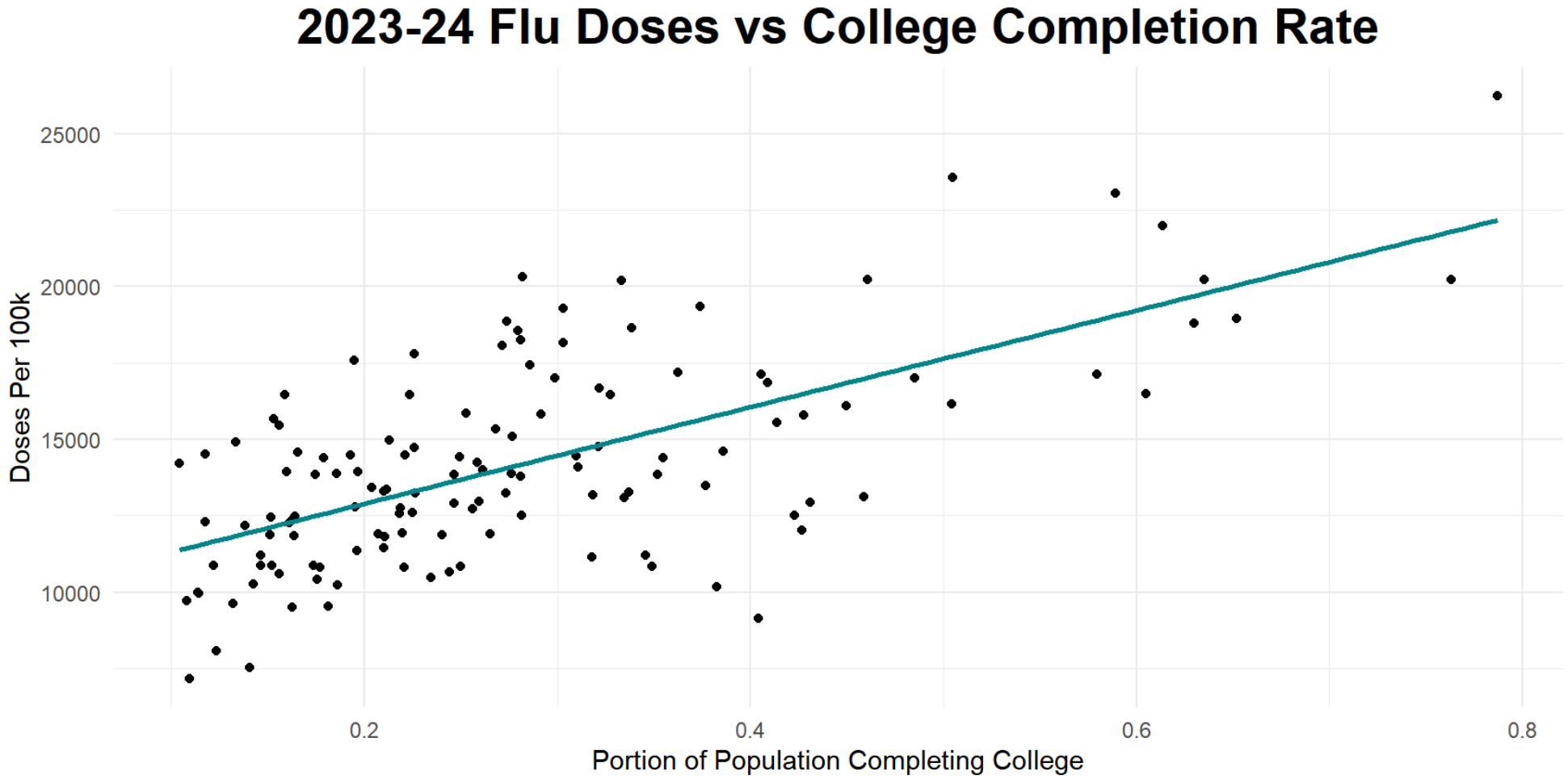
First COVID Dose Vaccine Uptake vs College Completion Rate

- College Completion rate data sourced from USDA-County level dataset
- The R^2 between the percent of population who has completed college and doses per 100k of first dose COVID Vaccine administered in Virginia localities (from VIIS) was 0.5067.



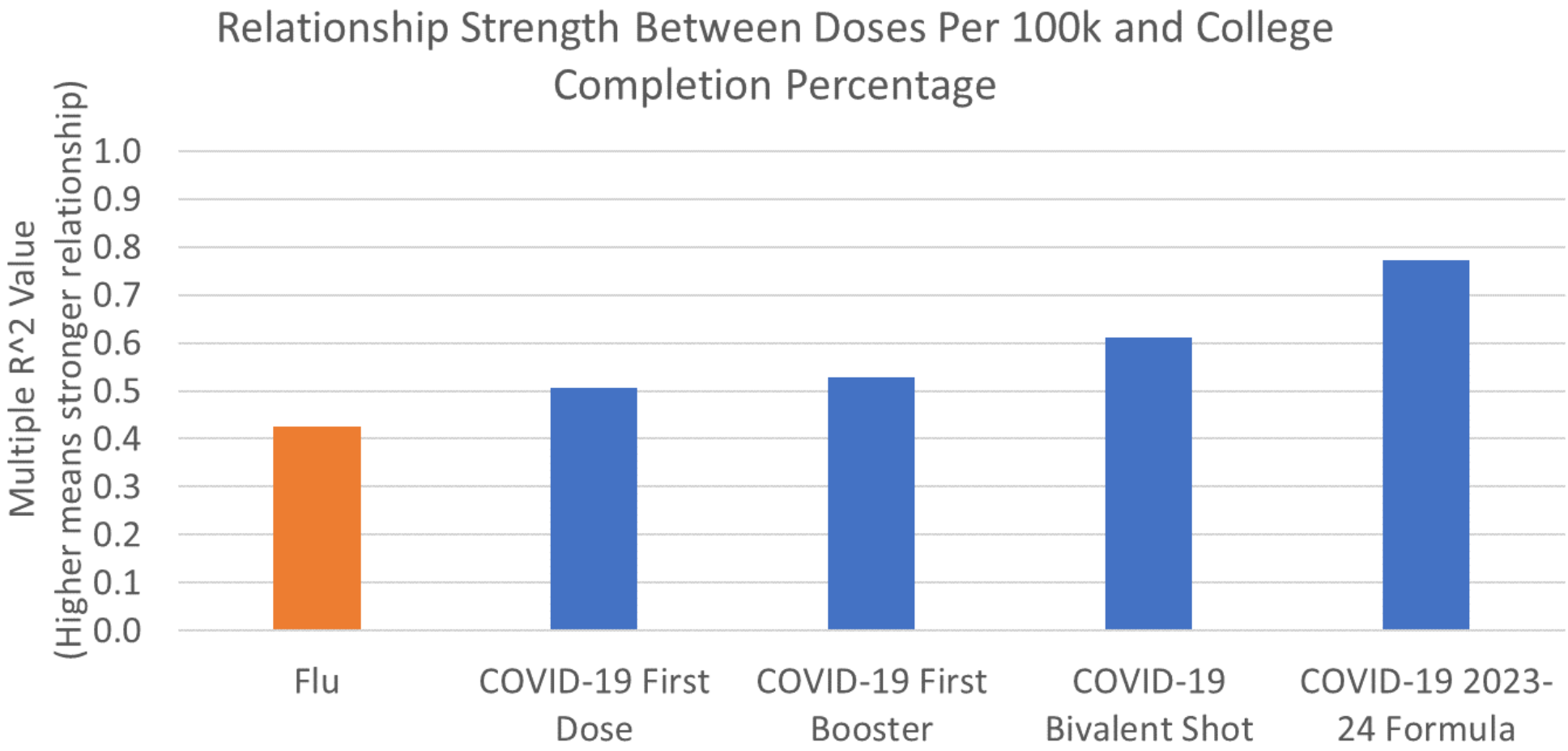
2023-24 Flu Vaccine Uptake vs College Completion Rate

- College Completion rate data sourced from USDA-County level dataset
- The R^2 between the percent of population who has completed college and doses per 100k of 2023-24 Flu Vaccine administered in Virginia localities (from VIIS) was 0.4257.



COVID-19 Vaccine Polarization in College Education

- COVID-19 Vaccines have become increasingly polarized by college education status over time.
- We see a much stronger relationship between college education rates and COVID-19 vaccines than we see with flu vaccines. Additionally, the relationship seems to be growing stronger over time.



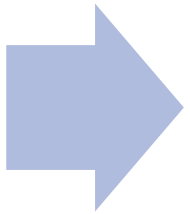
Final Model and Future Work

Building an Uptake Model: 2023-24 COVID Vaccine

- We found the best performing model consisted of using the college completion rate data and the uptake of flu vaccine in the current season as predictors. Many of the variables were colinear, meaning they were high correlated with each other. This is why the final model consisted of just two variables.
- The R^2 of the model was 0.8643, representing a well-performing model.

List of Predictors

- Poverty Rate
- Median Income
- High School Dropout Rate
- College Completion Rate
- Previous COVID-19 Vaccine Uptake
- Current Flu Vaccine Uptake



Final Model Inputs

- College Completion Rate
- Current Flu Vaccine

Future Work

COVID-19 vaccination is highly polarized by college education status, at least in Virginia. Therefore, we need to target outreach and education programs in localities with lower college completion rates.

This model can be used to help predict locality-level demand for vaccinations in the next COVID-19 vaccination cycle.

Acknowledgements

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Dennis Kim, Vaccine Data Lead

Sam Miller, Jiang Ding, Varsha Kommala, Piyush Patil, and the rest of the database team

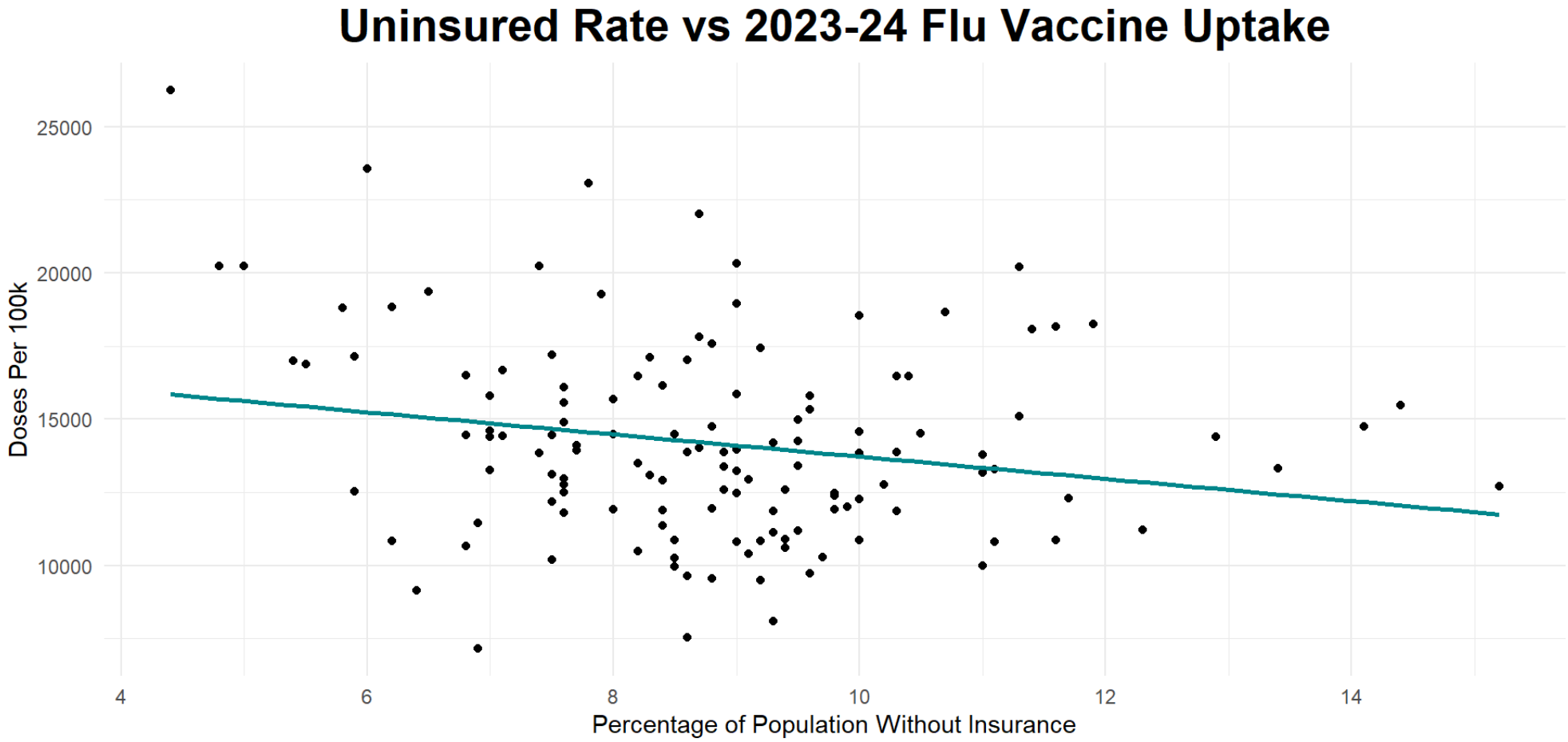
Questions

Questions?

Appendix

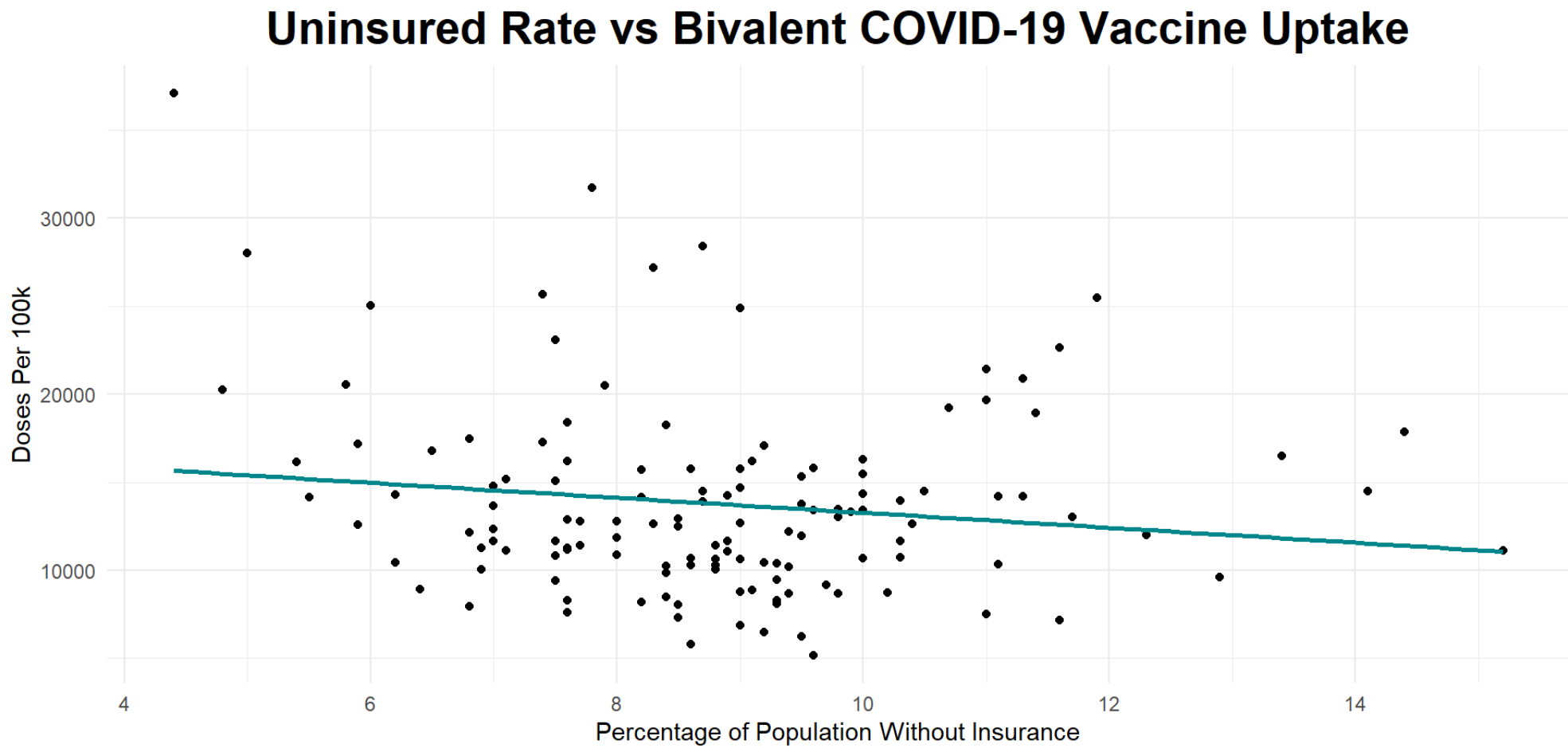
2023-24 Flu Vaccine Uptake vs Uninsurance Rate

- Insurance Rate data drawn from the Small Area Health Insurance Estimates Program (https://www.census.gov/programs-surveys/sahie.html)
- The R^2 between the percent of population without insurance and doses per 100k of 2023-24 Flu Vaccine administered in Virginia localities was just 0.04468.

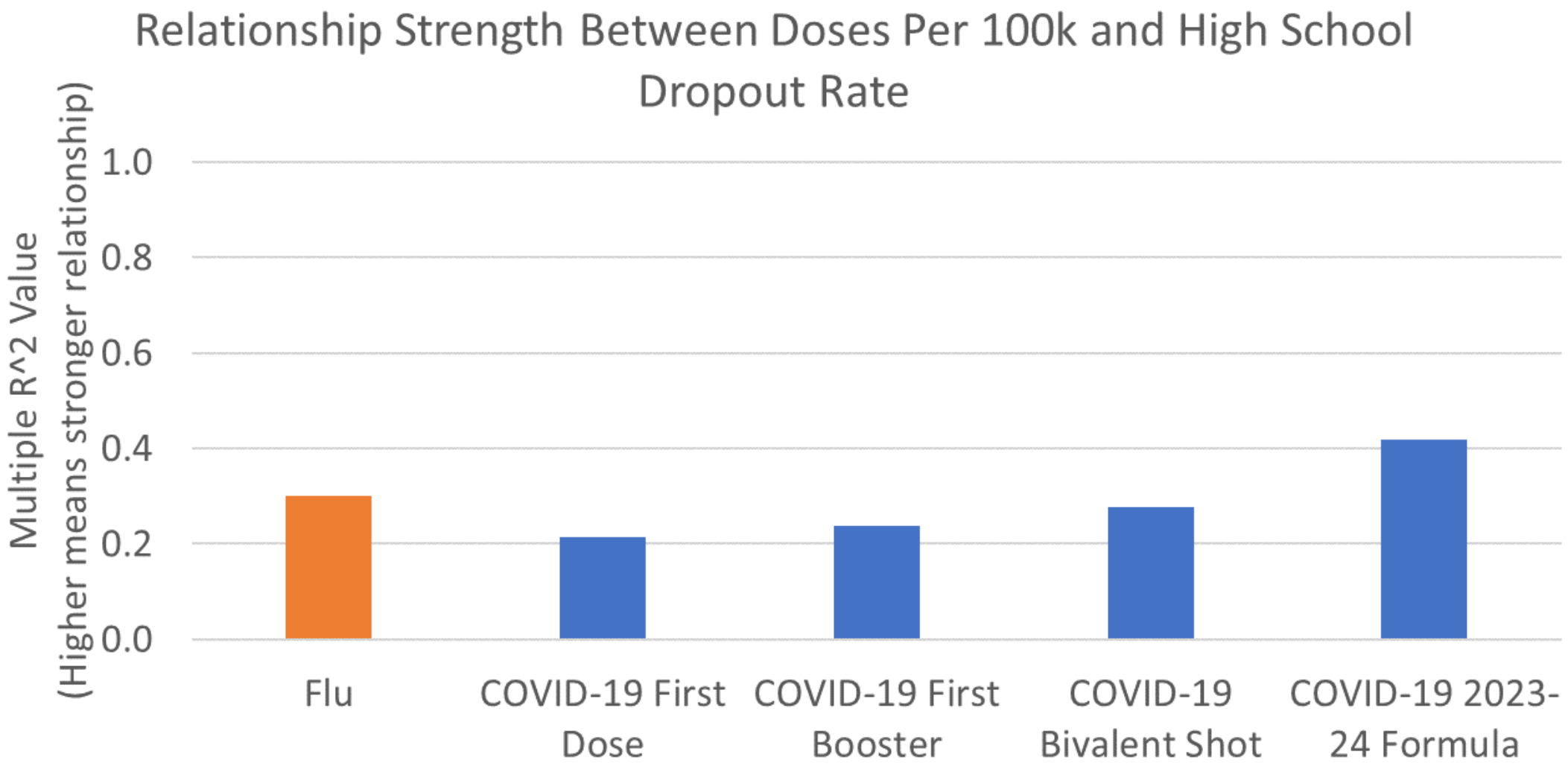


Bivalent COVID-19 Uptake vs Uninsurance Rate

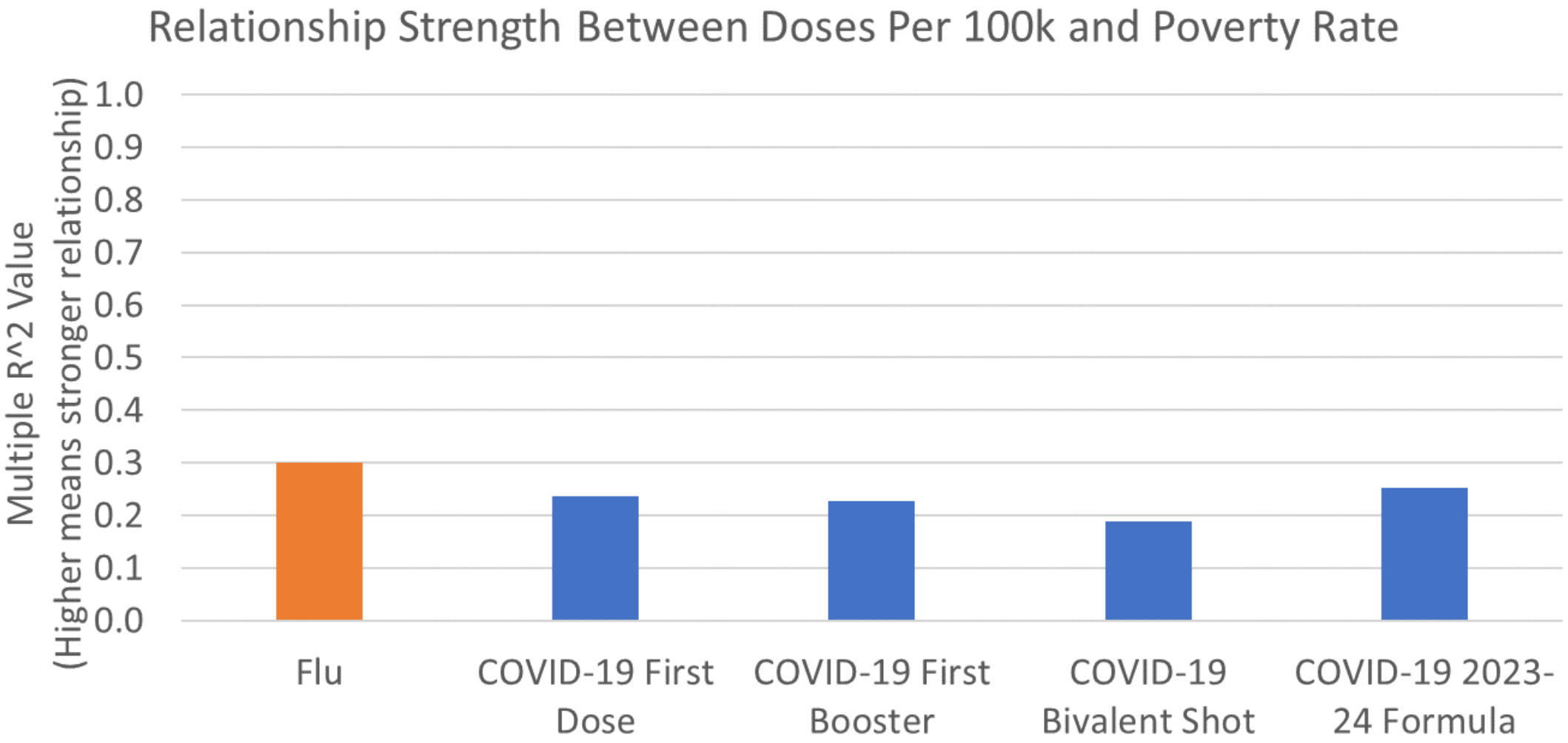
- Insurance Rate data drawn from the Small Area Health Insurance Estimates Program (https://www.census.gov/programs-surveys/sahie.html)
- The R^2 between the percent of population without insurance and doses per 100k of Bivalent COVID-19 Vaccine administered in Virginia localities was just 0.02174.



COVID-19 Vaccine Rates vs High School Dropout Rate



COVID-19 Vaccine Rates vs Poverty Rate Over Time



COVID-19 Vaccine Rates vs Median Income Over Time