Project 1 Group 7 COVID-19 In the U.S

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Goal of our Project:

Analyze U.S COVID-19 Data to explore each of the following:

1 **Death Rates vs Vaccination Rate**

2 **Vaccination Age Breakdown**

3 **Available Providers vs Vaccination Rate**

4 **Employment vs Vaccination Rate**

5 **Education vs Vaccination Rate**

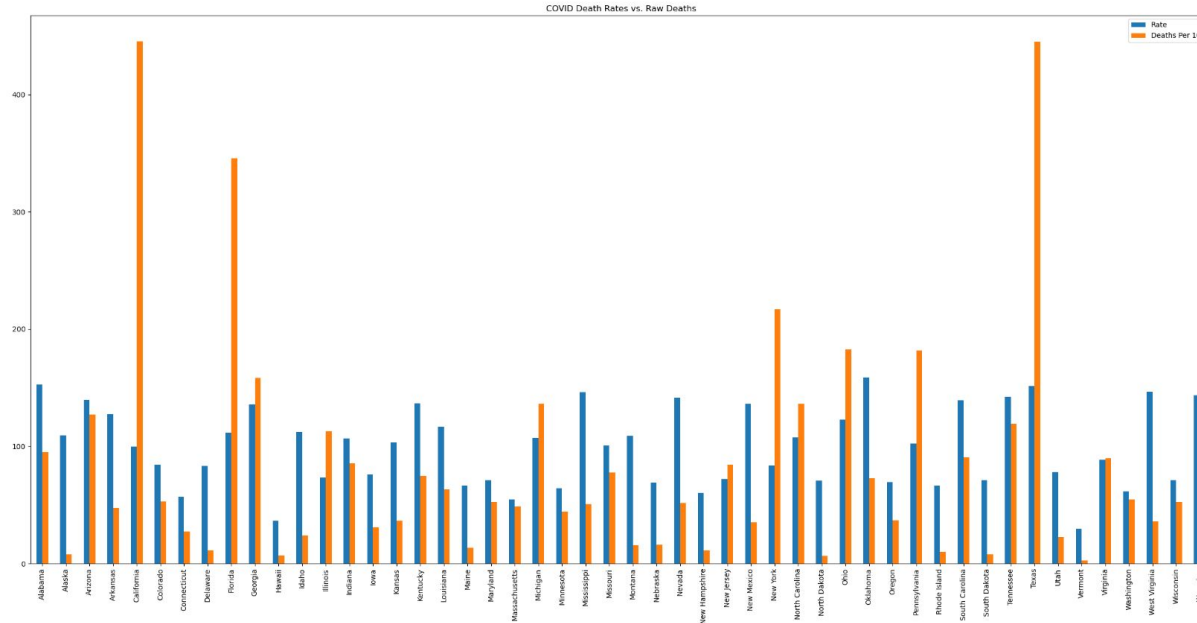**6** **Urban/Rural Environment vs Vaccination Rate**

Fully vaccinated in our study was defined as having the **complete two sequential shot** or **one singular based shot**

Census and CDC data was collected on the **years 2020-2023**

Death Rates vs Vaccination Rate


COVID Death Rates vs. Raw Deaths

- A multi-bar graph was created to directly compare the rate of death per state rather than the raw number.
- Some states have high death rates relative to their raw number of deaths and others have the highest raw deaths, but lower death rates relative to their populations.

Death Rates vs Vaccination Rate

Death Count vs Death Rate

Death Rate vs Vaccination Rate
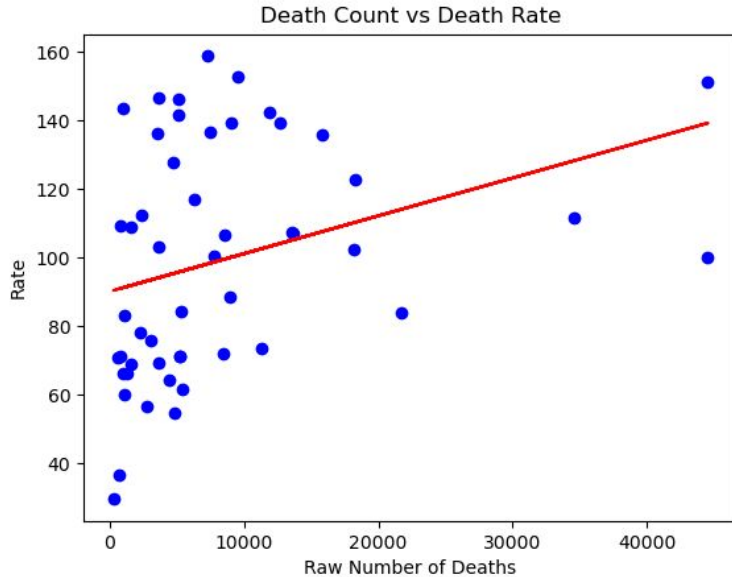
- R-value: 0.32 which is a weak positive correlation
- Death rates are different from raw deaths, effects on the population can drastically differ
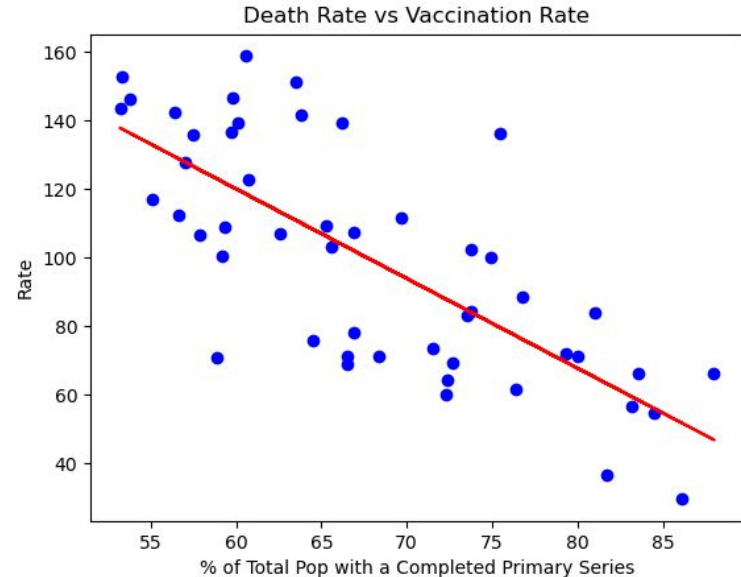
- R-value: -0.75 which is a strong negative correlation
- As the % of the total population with a completed primary series increases the death rate decreases

Vaccination Age Breakdown

Vaccination Rate by Age Group
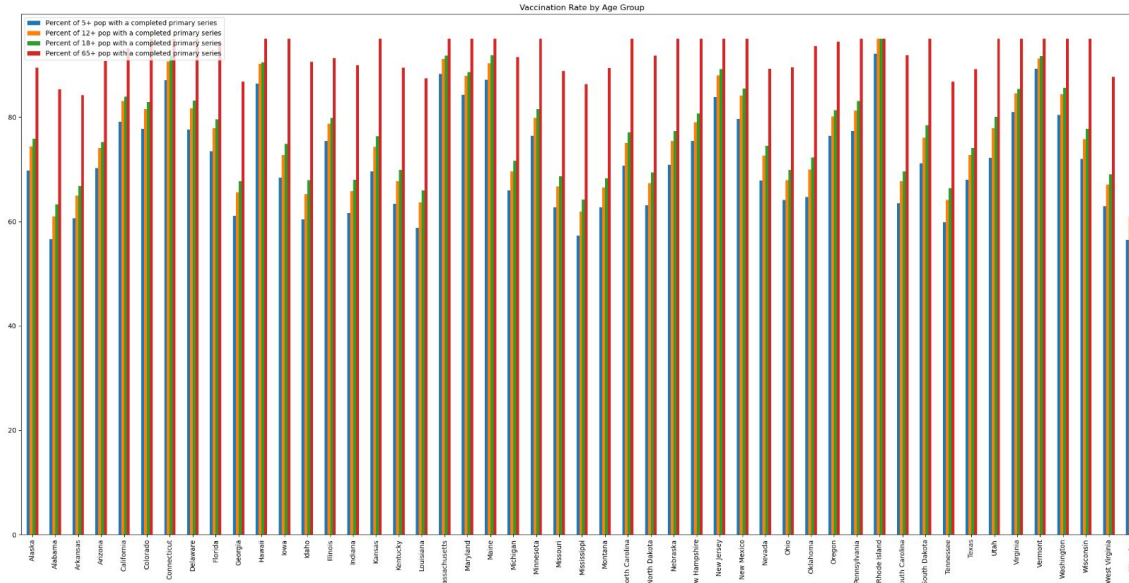
- A multi-bar graph was created to visualize a breakdown of vaccination rates by ages 5+,12+,18+, and 65+
- Can visually see that the older the age group is, there is a steady increase of the % of those vaccinated
- The age group with the highest vaccination rate are seniors 65+

Vaccination Age Breakdown

U.S Vaccination Rate by Age
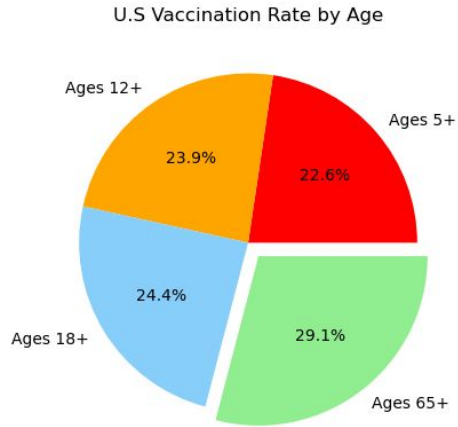
Categories	0
Jurisdiction (State/Territory) or Federal Entity	United States
Percent of total pop with a completed primary series	69.5
Percent of 5+ pop with a completed primary series	73.5
Percent of 12+ pop with a completed primary series	77.6
Percent of 18+ pop with a completed primary series	79.1
Percent of 65+ pop with a completed primary series	94.4

Pie chart segments:
- Ages 5+: 22.6%
- Ages 12+: 23.9%
- Ages 18+: 24.4%
- Ages 65+: 29.1%

- Exploring the same data at the national level
- Seniors are also the age group most represented across the vaccinated population

- Table visualizing the percent within the age group that are fully vaccinated
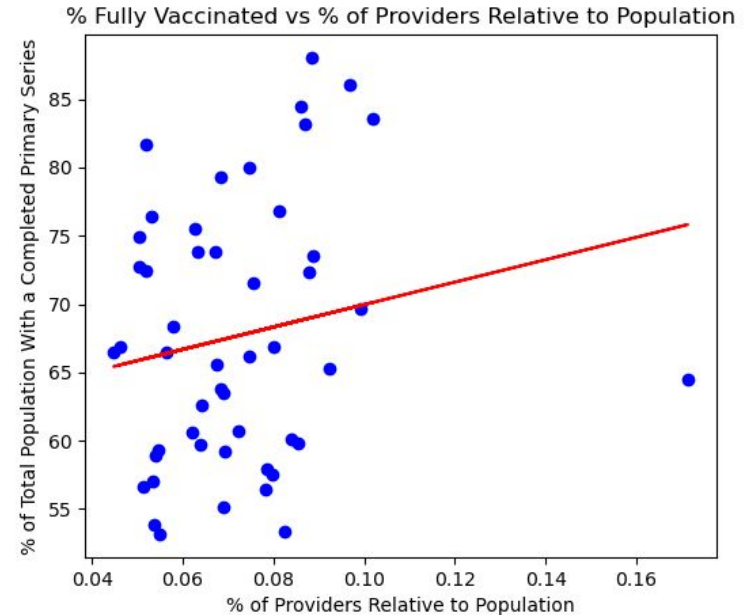
Available Providers vs Vaccination Rate

% of Providers Per State Population
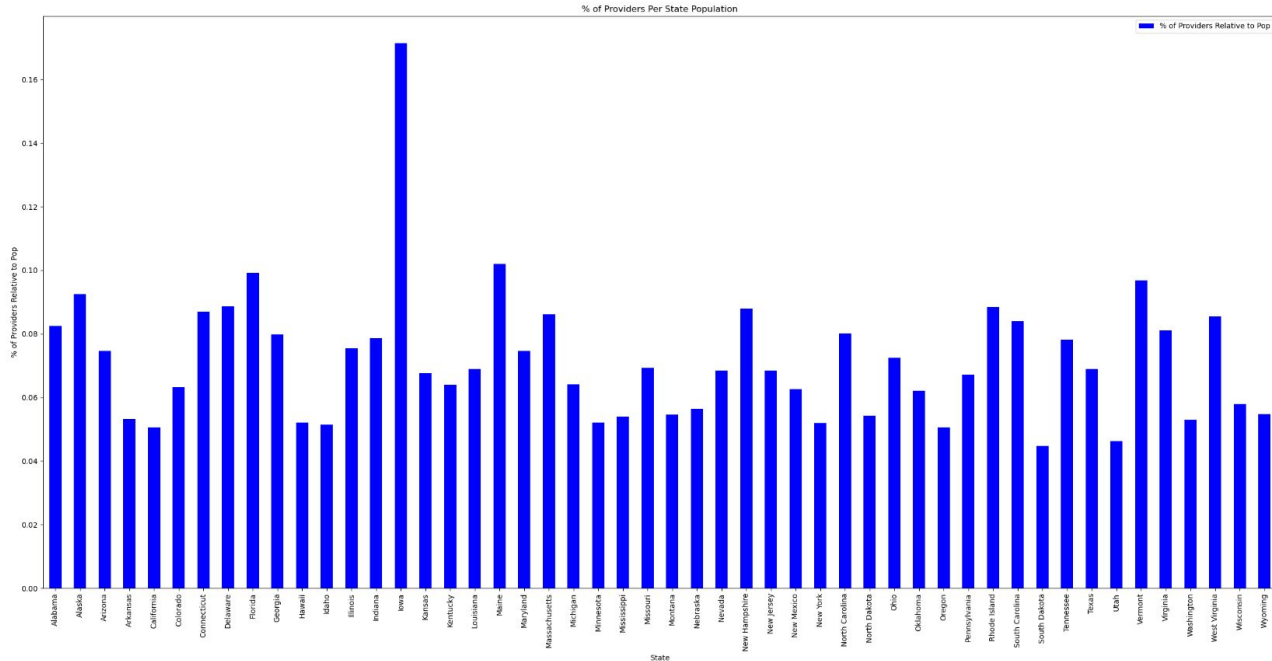
- **Visualizing the % of available COVID-19 healthcare centers per state relative to their population**

Available Providers vs Vaccination Rate

# of Total Providers Per State vs Death Rate

**% Fully Vaccinated vs % of Providers Relative to Population**
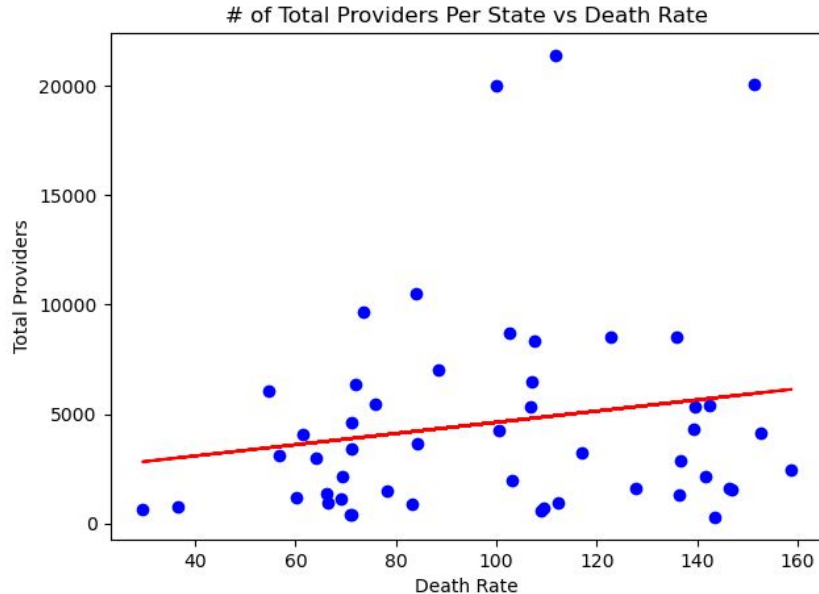
- The r-value was calculated to be 0.18.
- This is considered a weak correlation
- Conflicts with our hypothesis that states with more available vaccine providers will have a lower death rate.

- The r-value was calculated to be 0.18
- Similarly, this is also considered a weak correlation
- Conflicts with our hypothesis that states with more providers in proportion to their population have higher vaccination rates
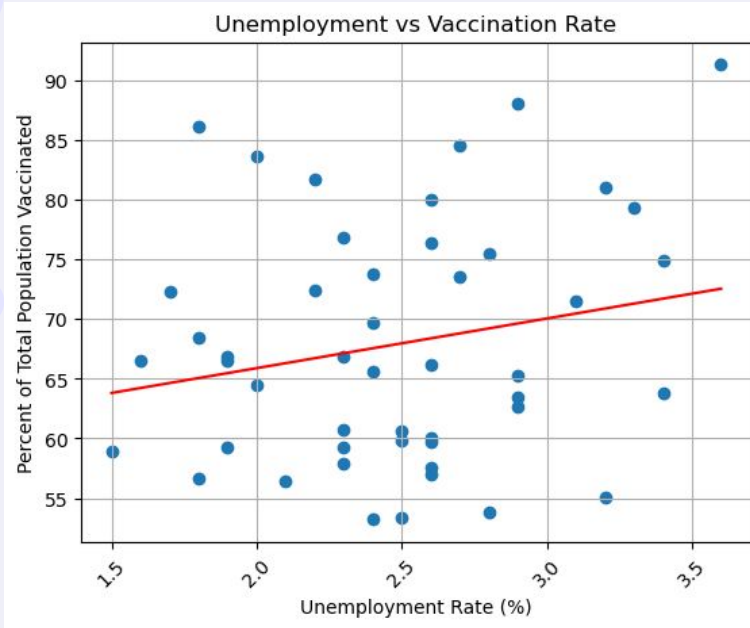
Employment vs Vaccination Rate

Vaccination Percentage vs Unemployment Rate by State
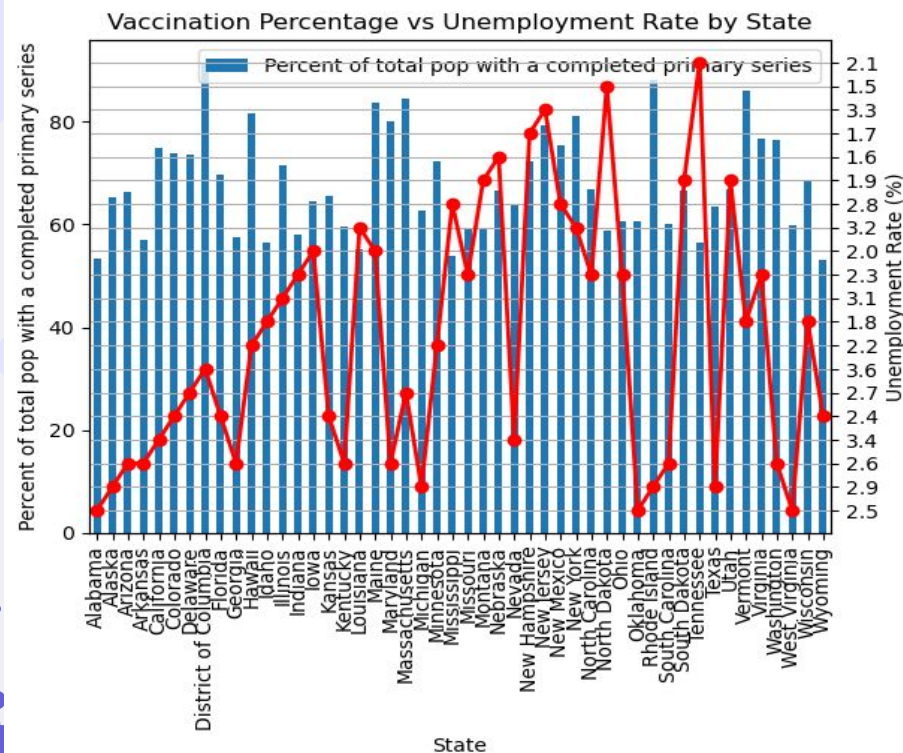
Bar graph showing the % fully vaccinated in a given state vs. its unemployment rate (%).

States CT, OR, and PN are omitted due to missing data from the raw dataset provided by CDC.

No obvious relationship between the two factors given the drastic inconsistency of the red line.

*There are 3 states without CDC vaccination data: Connecticut, Oregon, & Pennsylvania

Employment vs Vaccination Rate
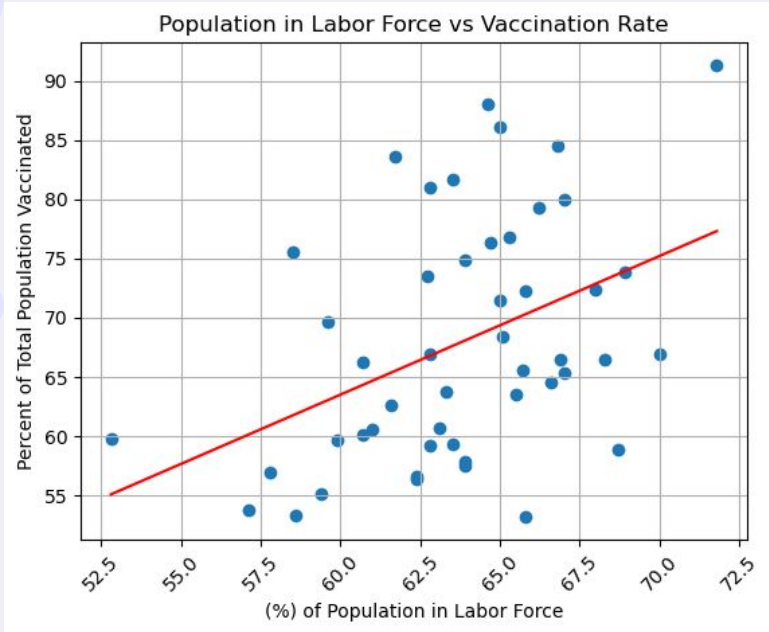

Unemployment vs Vaccination Rate

No direct correlation between unemployment rate and the percent of population vaccinated.

The R-value 0.21 indicates that there may be a slight positive correlation between the two factors, but it is too weak to make any statements.

This means that in the U.S. people are getting vaccinated regardless of employment status.

Employment vs Vaccination Rate

Comparing employment and vaccination by the size of the labor force per state to its vaccination rate:

Slight positive correlation between % population in labor force and % of total population vaccinated (R-value is 0.42) but not enough to make a conclusive statement.

This means that a greater % population in the labor force may be linked to a greater % of population vaccinated.
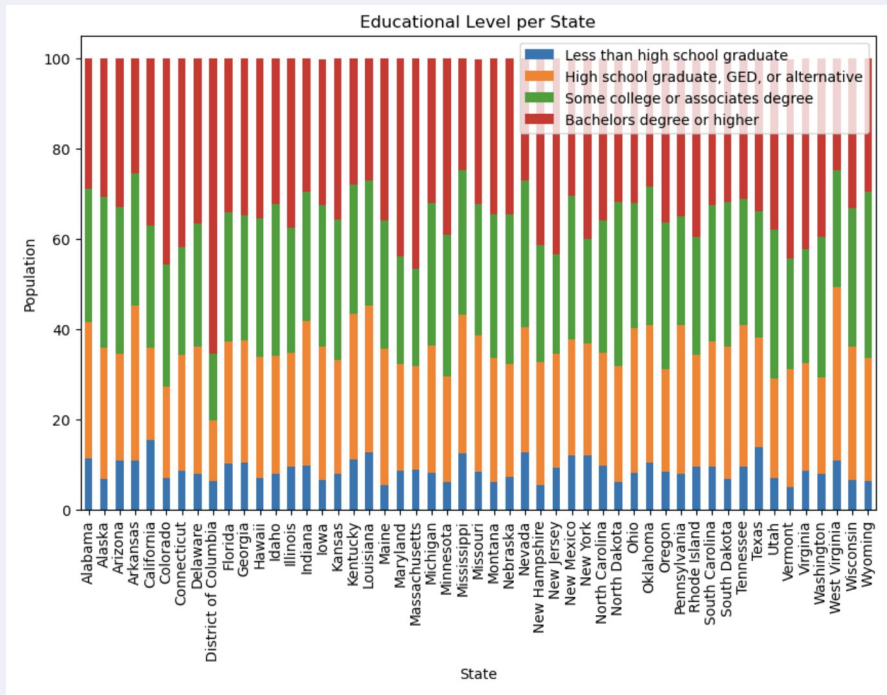
Education Level vs Vaccination Rate
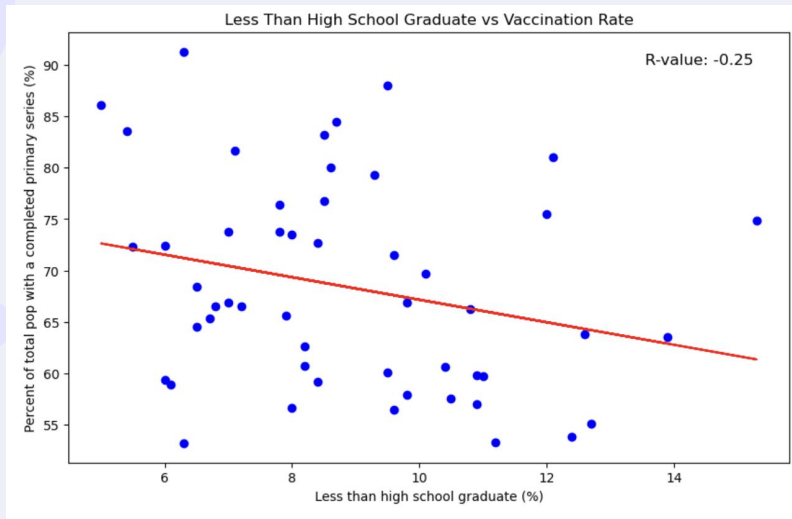
Less than high school graduate

High school graduate, GED, or alternative

Some college or associate's degree

Bachelor's degree or higher

Education Level vs Vaccination Rate

Less Than High School Graduate vs Vaccination Rate
R-value: -0.25

High school graduate, GED, or alternative vs Vaccination Rate
R-value: -0.59

Negative correlation

As the percentage of people with less than a high school education increases, the vaccination rate tends to decrease slightly, but the relationship is low and weak.
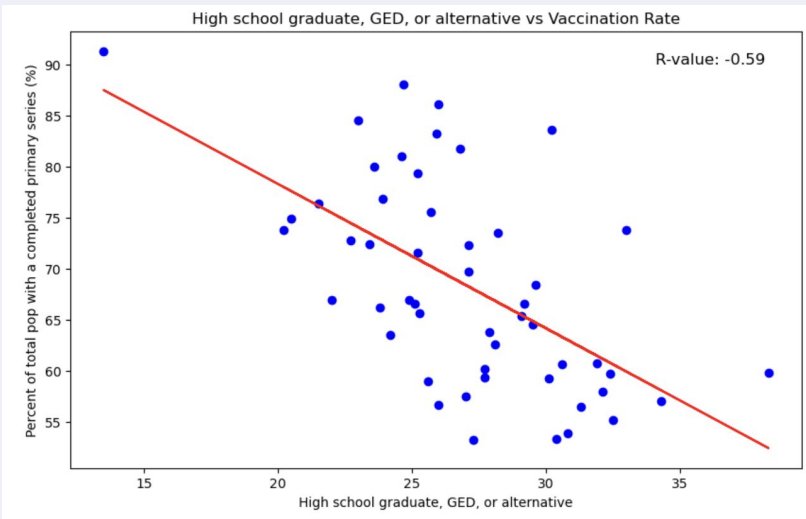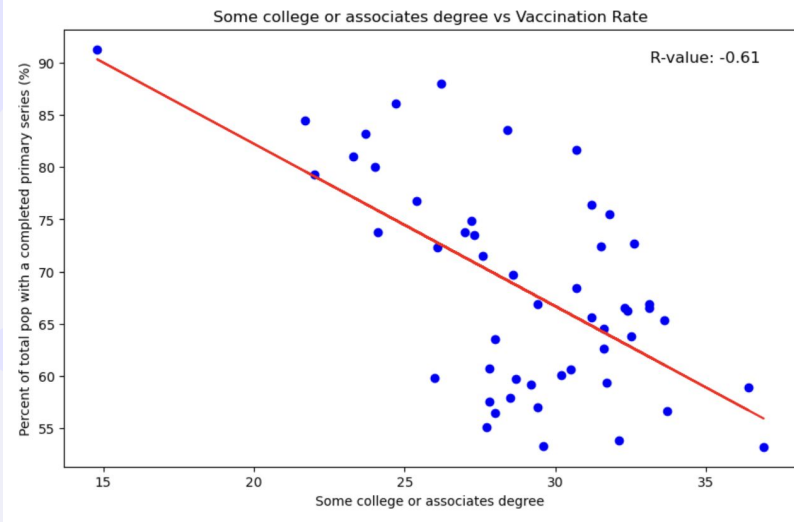
Negative correlation

There is indication that as the percentage of people with a high school education, GED, or alternative increases, the vaccination rate tends to decrease.
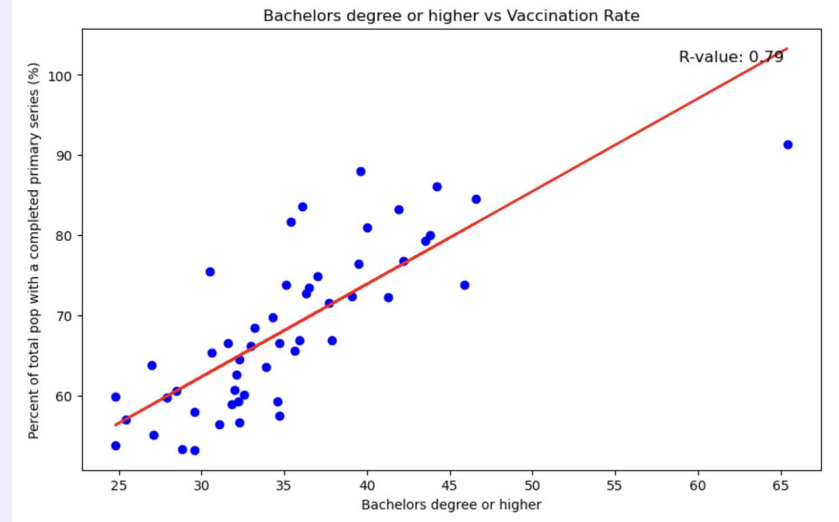
Education Level vs Vaccination Rate

Some college or associates degree vs Vaccination Rate

R-value: -0.61

Negative correlation

As the percentage of people with some college education increases, the vaccination rate tends to decrease.

Bachelors degree or higher vs Vaccination Rate

R-value: 0.79

Positive correlation

As the percentage of people with a bachelor's degree or higher increases, the vaccination rate tends to increase significantly, and the relationship is strong.

Urban- Theoretical Factors

Theoretical Positive Urban Factors:

- **Larger Populations**
- **More Resources**
  - **Wealth**
  - **Social Systems**
- **Easier to Gather Data**
- **More/Easier Access to Healthcare**
- **More Educated Population**

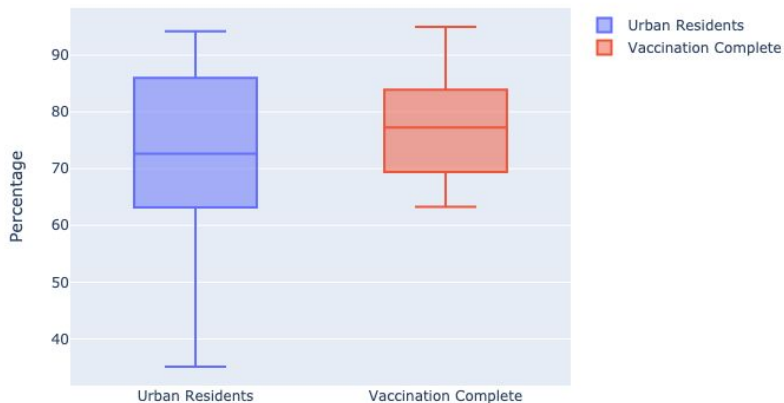**Theoretical Negative Urban Factors:**

- **Population Density**
- **More Indoor and service Sector Work**
- **Additional Transmission Avenues**
  - **Transportation**
  - **Housing**
- **Higher Income Inequality**
- **Fewer "Safe" Outdoor Opportunities**

Urban Populations vs Vaccination Rates

Urban and Vaccinated % of Residents Across US States

Urban Residents
Vaccination Complete

| Statistic	Percent of Population in Urban Areas	Percent of Adult Population Completed Primary Vaccination Series
Max	94.2	95
Mean	72.434	77.552
Median	72.65	77.25
Min	35.1	63.3
Standard Deviation	14.82	8.94

Most Urban: California
Least Urban: Vermont

Highest Vaccination Rate: Rhode Island
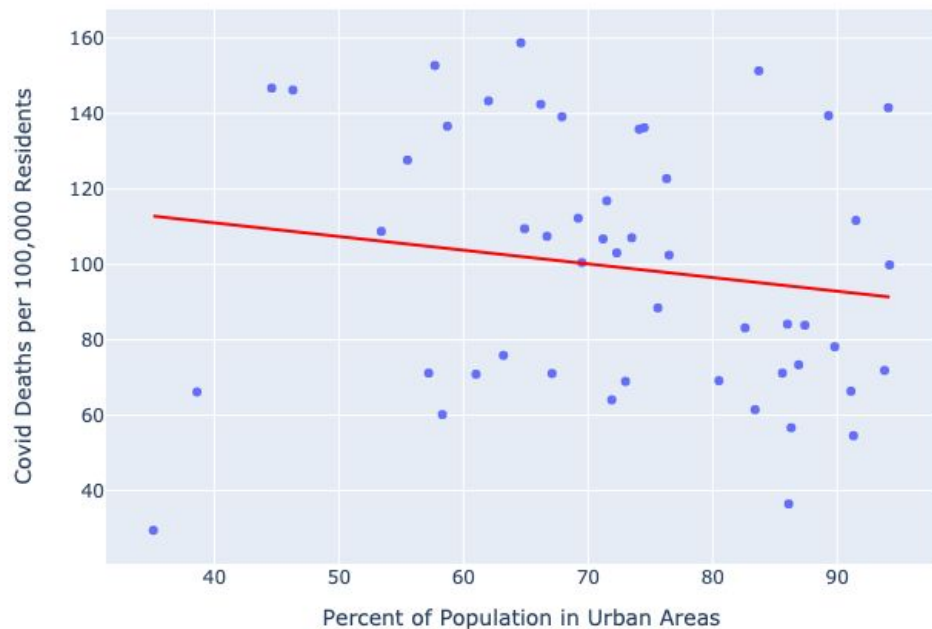**Lowest Vaccination Rate: Wyoming**

Highest Covid Death Rate: Oklahoma
Lowest Covid Death Rate: Vermont

Urban Populations vs Vaccination Rates
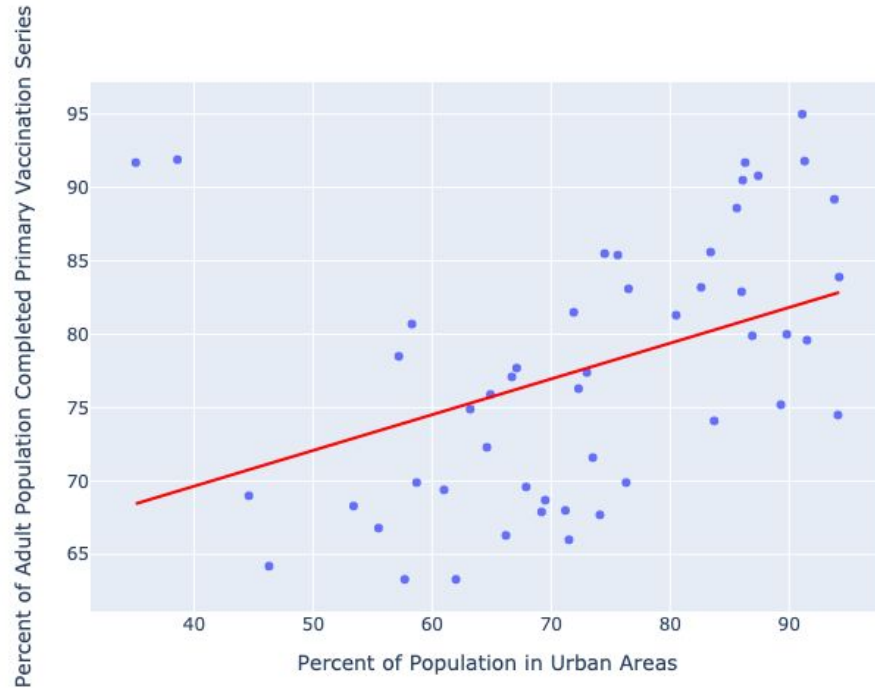
Pearson's Correlation Coefficient: 0.404

Urban Population vs Covid Death Rates

Pearson's Correlation Coefficient:
-0.159

Conclusions of the Study

- Some states had **higher death rates relative to their population**
- **Higher the % of fully vaccinated**, the **lower the death rate**
- The **older the age group**, the **% of fully vaccinated** within that group **increases**
- Amount and proportion of **available providers** relative to state population has a **minimal effect on vaccination and death rates**
- **Employment status** has **little** to do with **vaccination rates**, people are still getting vaccinated regardless of employment status
- **Vaccination rates** are **highest** between populations who have earned a **Bachelor's degree or higher**
- **Urban** areas tend to have **higher vaccination rates**, however, between states **varied in death rates** which may be attributed to other factors

Limitations of the Study

Attitudes towards vaccination can be influenced by factors such as **cultural groups**, which may not be captured in the analysis.

External events, such as **public health campaigns** or **changes in healthcare policies** can change vaccination behaviors, independently of education levels.

Data **availability and cleanliness**

More in **depth analysis** can be conducted on populations at a **smaller scale**, such as county levels which may vary from state-wide data.

Similarly, an analysis based on **population densities** could be evaluated further **which may result in different outcomes** of the elements we analyzed.

Citations and Acknowledgements

Age, Unemployment, and Education Data
https://data.census.gov/table/ACSST1Y2022.S0102?q=age%20by%20state

Administered Vaccination Data:
https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-people-booster-percent-pop5

COVID-19 Death Rates Data:
https://www.cdc.gov/nchs/pressroom/sosmap/covid19_mortality_final/COVID19.htm

Provider Locations by State Data:
https://data.cdc.gov/Vaccinations/Vaccines-gov-COVID-19-vaccinating-provider-locatio/5jp2-pgaw

Household Income Data:
https://data.census.gov/table/ACSST1Y2022.S1901?q=median%20household%20income%20by%20state

Urban vs Rural Data:
Vaccine Provider by State: (https://data.cdc.gov/Vaccinations/Vaccines-gov-COVID-19-vaccinating-provider-locatio/5jp2-pgaw)