COVID-19, Mask Use, and Vaccination Report

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1. Summary

This report examines the relationship between COVID-19 mortality and preventive behaviors—mask usage and vaccination—across U.S. counties in 2022. Using county-level data and regression analysis, we find that higher levels of mask usage are associated with significantly lower COVID-19 death rates, with an estimated reduction of approximately 113 deaths per 100,000 people. Similarly, higher vaccination rates are linked to lower mortality, with each one percentage point increase in vaccination associated with around 1.12 fewer deaths per 100,000. These findings highlight the critical impact of public health measures in reducing COVID-19 fatalities.

2. Data

2.1 Data Sources

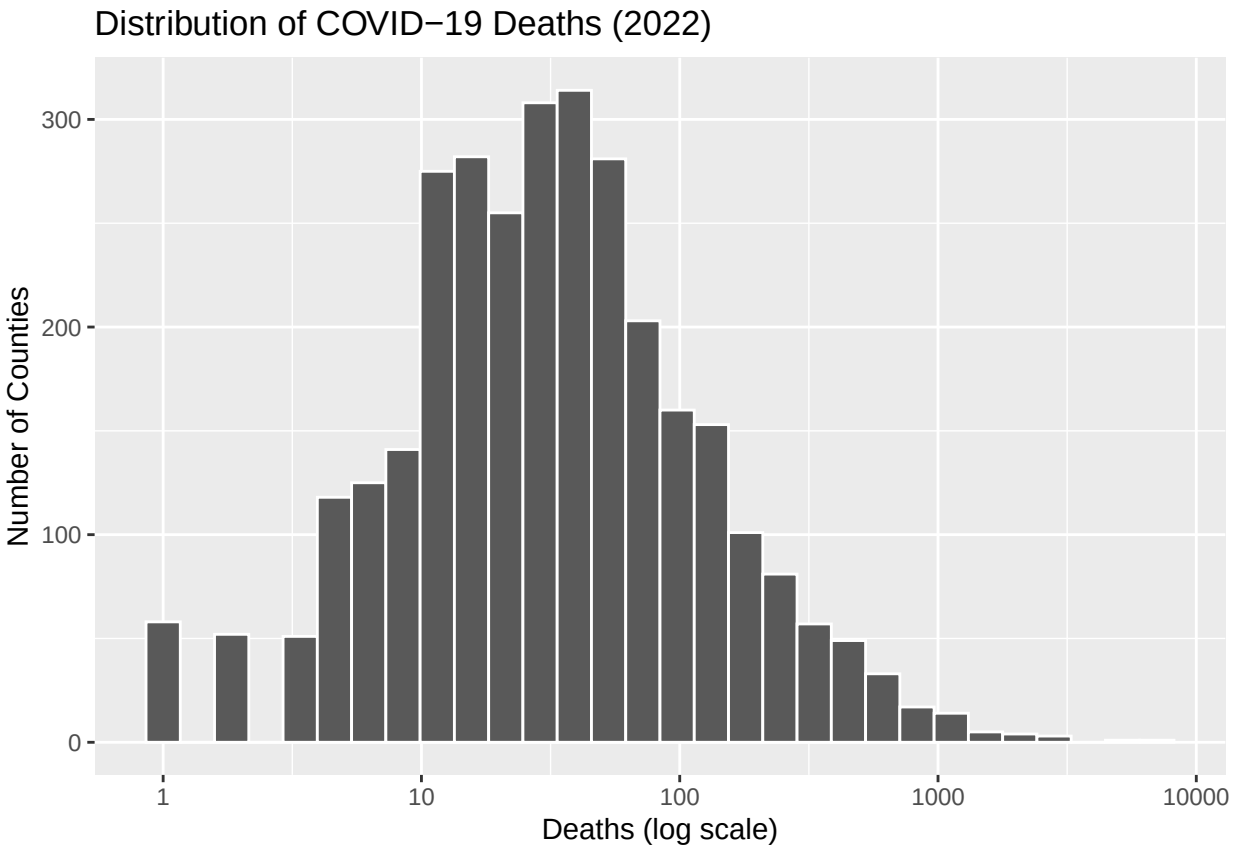
- COVID-19 county-level death data: NYT COVID-19 Repository
- Mask usage estimates: NYT July 2020 Mask Use Survey
- Vaccination data: CDC County-Level Vaccination Data

2.2 Data Preparation

2.3 Key Variables Summary

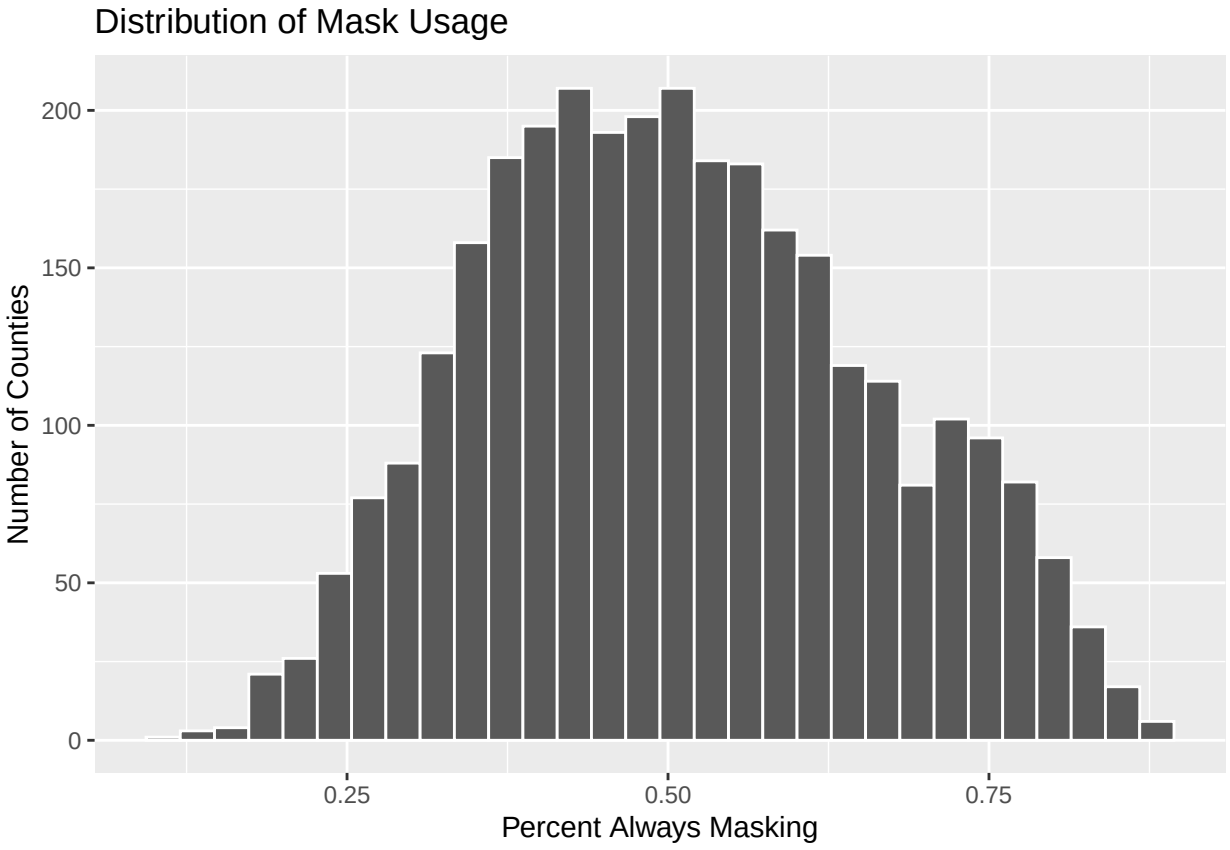
COVID-19 Deaths in 2022

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    0.00   12.00   29.00   84.14   70.00 7034.00
```



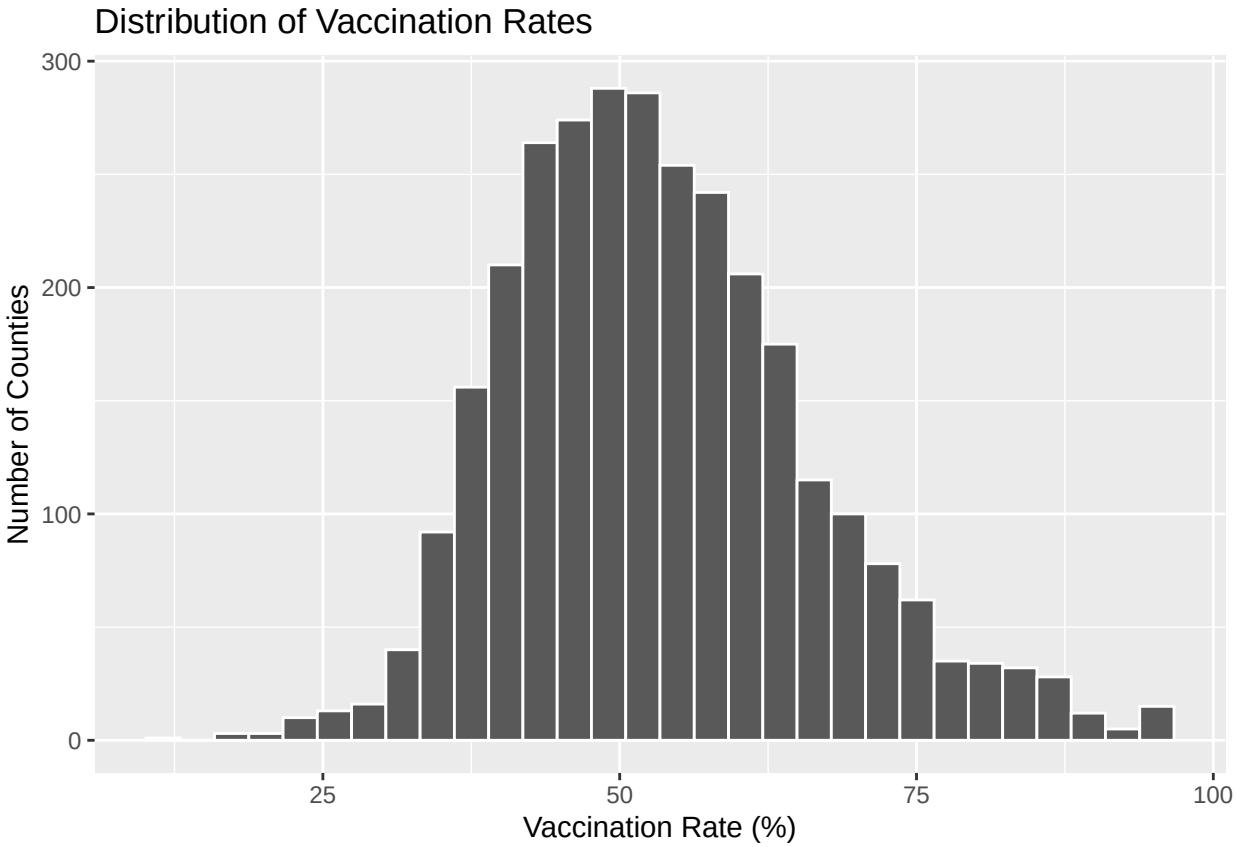
Mask Usage

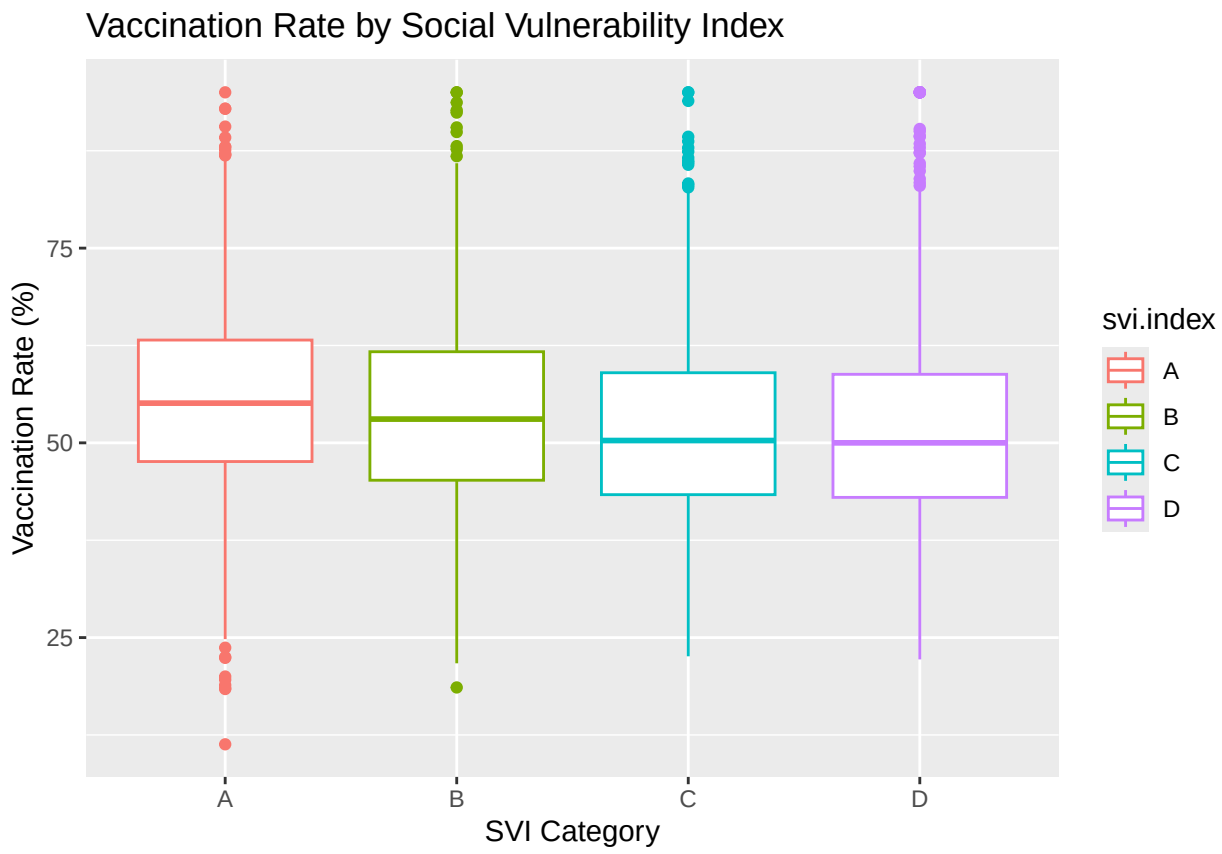
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##  0.1150  0.3930  0.4970  0.5077  0.6130  0.8890       9
```



Vaccination Rates

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##   11.30   44.30   52.10   53.43   61.00   95.00      93
```


Distribution of Vaccination Rates
Number of Counties
300
200
100
0
25
50
75
100
Vaccination Rate (%)



3. Regression Analysis

To evaluate the effects of mask usage and vaccination on COVID-19 mortality rates, we estimated three regression models. The dependent variable is COVID-19 deaths per 100,000 people (`deaths.scaled`).

In Model 1, higher levels of mask usage were significantly associated with lower COVID-19 death rates. Specifically, a one-unit increase in the proportion of individuals who always wear masks was associated with an estimated **reduction of approximately 113 deaths per 100,000 people** ($p < 0.001$).

In Model 2, higher vaccination rates were also significantly linked to lower death rates, with a **one percentage point increase in vaccination coverage corresponding to a reduction of approximately 1.12 deaths per 100,000 people** ($p < 0.001$).

Model 3 jointly confirms both effects, demonstrating that **both mask usage and vaccination independently contribute to reducing COVID-19 mortality**, even after controlling for population size and Social Vulnerability Index (SVI).

Furthermore, counties with higher SVI levels consistently experienced greater COVID-19 death rates across all models, emphasizing the role of structural and social factors in shaping health outcomes.

Appendix: Full Code

```
# Additional: Identify counties with lowest and highest vaccination rates
covid %>%
```

	m1	m2	m3
always.mask	-112.887***		-83.296***
	(10.212)		(10.834)
population	-0.000***	-0.000***	
	(0.000)	(0.000)	
svi.indexB	11.415***	9.968***	9.581***
	(2.884)	(2.878)	(2.859)
svi.indexC	15.142***	14.399***	13.128***
	(3.111)	(3.103)	(3.080)
svi.indexD	19.811***	18.353***	17.491***
	(3.401)	(3.393)	(3.367)
vax.complete		-1.123***	-0.923***
		(0.093)	(0.099)
Num.Obs.	3049	3049	3049

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

```
  select(vax.complete, state, county) %>%
  filter(vax.complete %in% c(min(vax.complete, na.rm = TRUE), max(vax.complete, na.rm = TRUE)))
```

```
## # A tibble: 15 x 3
##    vax.complete state        county
##           <dbl> <chr>        <chr>
##  1         95   Arizona      Apache
##  2         95   Arizona      Santa Cruz
##  3         95   California   Imperial
##  4         95   Colorado     San Juan
##  5         95   Georgia      Chattahoochee
##  6         95   Kansas       Geary
##  7         95   New Mexico   McKinley
##  8         11.3 North Dakota Slope
##  9         95   Texas        Brooks
## 10         95   Texas        Irion
## 11         95   Texas        Maverick
## 12         95   Texas        Presidio
## 13         95   Texas        Starr
## 14         95   Texas        Webb
## 15         95   Wyoming      Teton
```

```
# All code used above is consolidated here for reference.
```