

THE MEASLES PROJECT

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Road Map

01

The Data +
Research

02

Exploratory
Data Analysis

03

Numerical
Analysis

04

Conclusion

THE DATA: Measles Vaccination Rates

- US Only
- Data collected in 2018-19 School Year
- Variables:
 - Type of school (public v private)
 - State, City, County, Year
 - Vaccination Rates
 - Enrollment numbers



Motivation

- Many schools have dangerously low MMR Vaccination rates → increasing risk of measles outbreak.
- Measles cases have been on the rise.

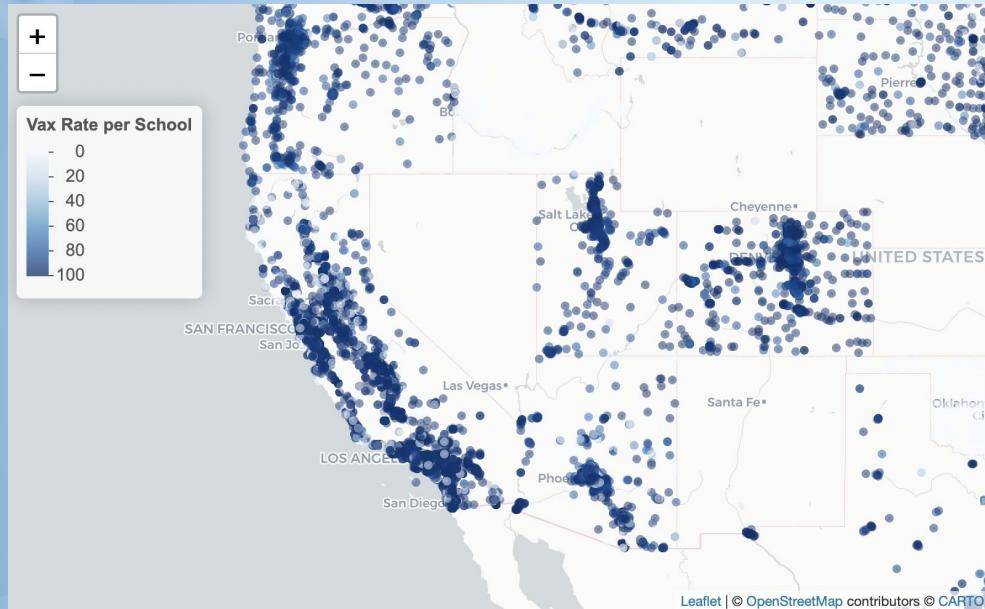


Research Question

- Are schools' vaccination rates influenced by the type of school, state it's located in, and it's enrollment numbers?
- If so, can valid predictions on vaccination rates be made from these variables?



MMR Vaccination Map



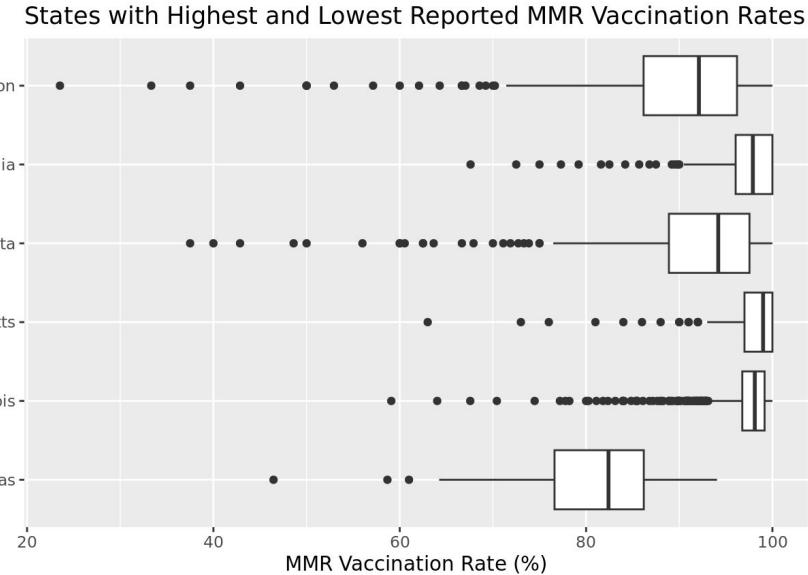
Each data point represents a school, and the color represents the mmr vaccination rate at that school (reported) - where a light blue would represent low vaccination rates (if any) and dark blue would represent almost 100% (if not 100%) vaccination rates.

What does it display?

- General map of how mmr vaccination rates differ across different regions in the US.
- High/low percentage of mmr vaccination rates across different schools



Rural vs. Urban Vaccination Rates



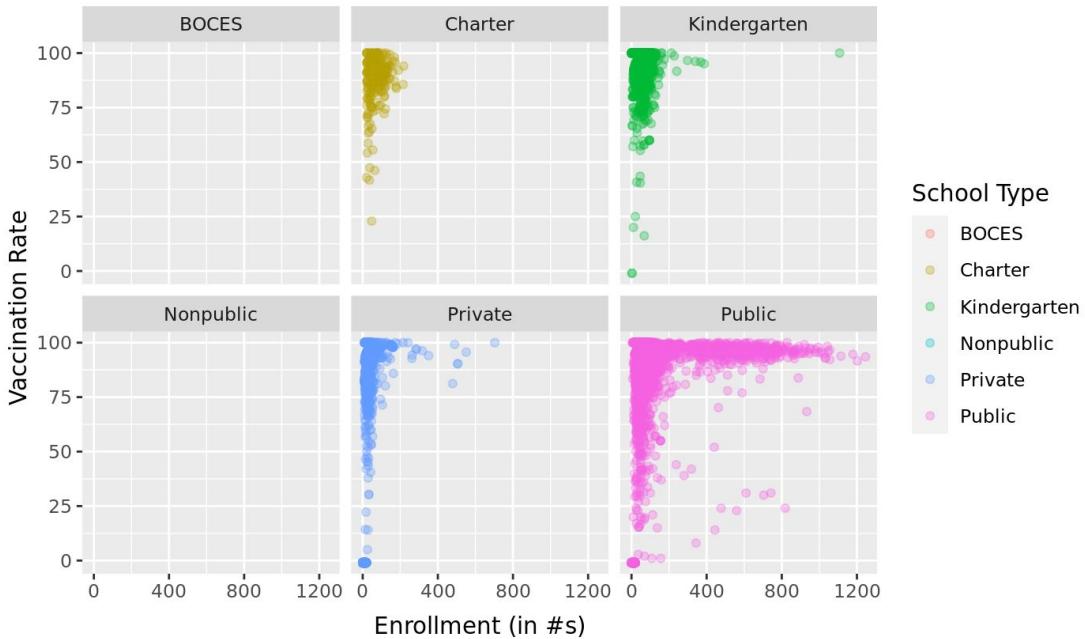
States with the highest (Massachusetts, Illinois, & Pennsylvania) and lowest (Arkansas, Washington, & Minnesota) mean MMR vaccination rates plotted

- % of the total population in urban areas per each state was found:
 - Massachusetts (92%)
 - Illinois (88.5%)
 - Pennsylvania (78.7%)
 - Arkansas (56.2%)
 - Washington (84.1%)
 - Minnesota (73.3%)
- Moderate relationship between urban/rural status of each state and MMR vaccination rate, but to a slight degree there is a trend.



Enrollment Number Effect on Vaccination Rate

Does enrollment number effect vaccination rates?

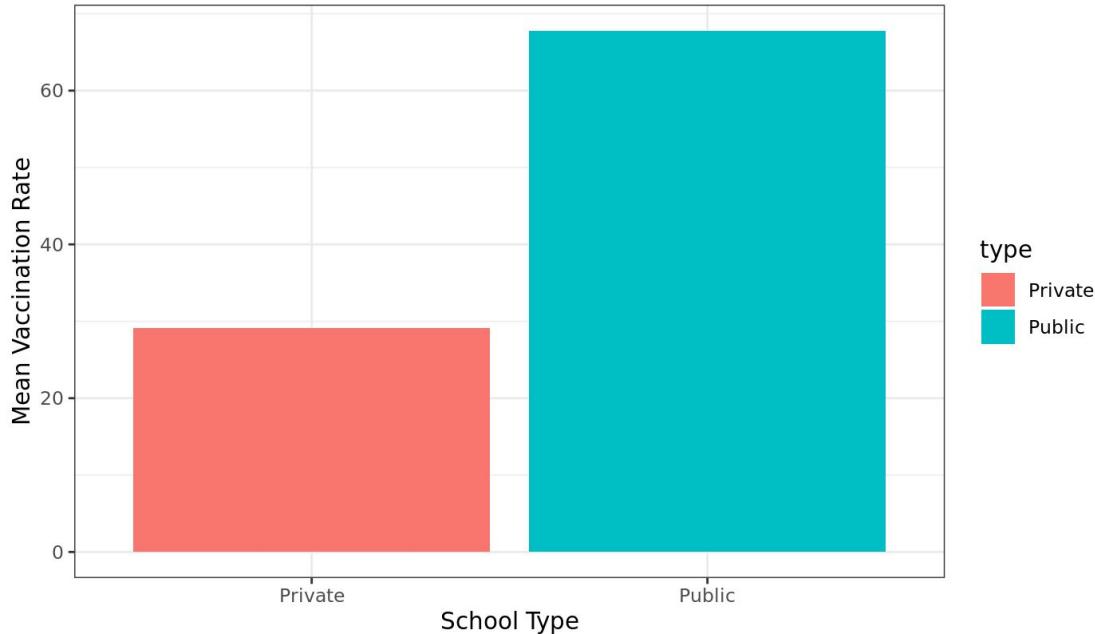


- Refutes the idea that enrollment numbers influence reported MMR vaccination rates
- Gives reason for just analyzing between public vs private schools



Vaccination Rates by School Type

Figure 2 Vaccination Rates by School Type



- Show a higher average vaccination rate for public schools
- Connections
 - Public schools: local government rules and control vaccination mandates
 - Private schools: potentially up to choice and out of government control

Inference Testing

Additive:

Adjusted r-squared: 0.24

Interactive:

Adjusted r-squared: 0.47

term	estimate	std.error	statistic	p.value
<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1 (Intercept)	81.2	1.57	51.9	0
2 typeKindergarten	-13.1	5.34	-2.45	1.42e- 2
3 typePrivate	-18.8	1.77	-10.6	2.37e- 26
4 typePublic	7.86	1.72	4.57	4.93e- 6
5 enroll	0.0923	0.00274	33.7	1.62e-242
6 stateCalifornia	-5.87	0.764	-7.68	1.69e- 14
7 stateColorado	21.0	5.07	4.14	3.43e- 5
8 stateOhio	4.45	0.858	5.18	2.21e- 7
9 stateUtah	-37.6	1.65	-22.8	6.82e-114

term	estimate	std.error	statistic	p.value
<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1 (Intercept)	83.6	2.64	31.7	3.16e-215
2 typeKindergarten	4.05	7.03	0.576	5.65e- 1
3 typePrivate	4.42	4.84	0.913	3.61e- 1
4 typePublic	8.87	3.25	2.73	6.37e- 3
5 enroll	0.0597	0.0313	1.91	5.67e- 2
6 stateCalifornia	-14.1	1.93	-7.27	3.74e- 13
7 stateColorado	7.06	6.47	1.09	2.75e- 1
8 stateOhio	-3.96	2.06	-1.92	5.51e- 2
9 stateUtah	1.28	2.71	0.471	6.38e- 1
10 typeKindergarten:enroll	-0.0426	0.0942	-0.452	6.51e- 1
# ... with 30 more rows				

Variables: Enroll, Type, State



Hypothesis Testing

$H_0 : \bar{x}_{public} - \bar{x}_{private} = 0$ difference in mean vaccination rate is 0, there is no significant difference

$H_A : \bar{x}_{public} - \bar{x}_{private} \neq 0$ difference in mean vaccination rate is not 0, there is a significant difference

type	m
Private	62.43583
Public	91.78767

- P-value = 0
- Evidence to reject the null hypothesis
 - (p-value < .05)
- Strong evidence for the alternative hypothesis:
 - Vaccination rate in public schools is significantly higher than in private schools.

Conclusion & Future Directions

- Vaccination rate is influenced by school type
- Our model has average power as a predictive measure
- Expanding the range of the study
- Looking into better variables for creating a predictive model

THANK YOU!



VACCINES