

Final Report

due November 16, 2021 by 11:59 PM

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11/16/21

#Load Data

```
census_api_key("abc8289fa2ba274ced76d97c7f8ee31666a2c931", overwrite = TRUE, install = TRUE)
```

Your original .Renviron will be backed up and stored in your R HOME directory if needed.

Your API key has been stored in your .Renviron and can be accessed by Sys.getenv("CENSUS_API_KEY").

To use now, restart R or run `readRenviron("~/Renviron")`

[1] "abc8289fa2ba274ced76d97c7f8ee31666a2c931"

```
if (FALSE) {  
  census_api_key("abc8289fa2ba274ced76d97c7f8ee31666a2c931", install = TRUE)  
  # First time, reload your environment so you can use the key without restarting R.  
  readRenviron("~/Renviron")  
  # You can check it with:  
  Sys.getenv("CENSUS_API_KEY")  
}
```

#Research Question:

How do measles vaccination rates vary across the country and demographics in schools?

overall vaccination status vs. state, overall vaccination status vs. type of school, each type of exemption (personal, religious, and medical) vs. state exemption vs. type of school. To analyze vaccination and exemption rates by states, we will use spatial data to show the change in these rates across the country. Then, we can use two-sample t-tests to test for significance of vaccination and exemption rates between different types of schools. If there are significantly lower vaccination rates in private schools vs. other types of schools, this will support our main hypothesis.

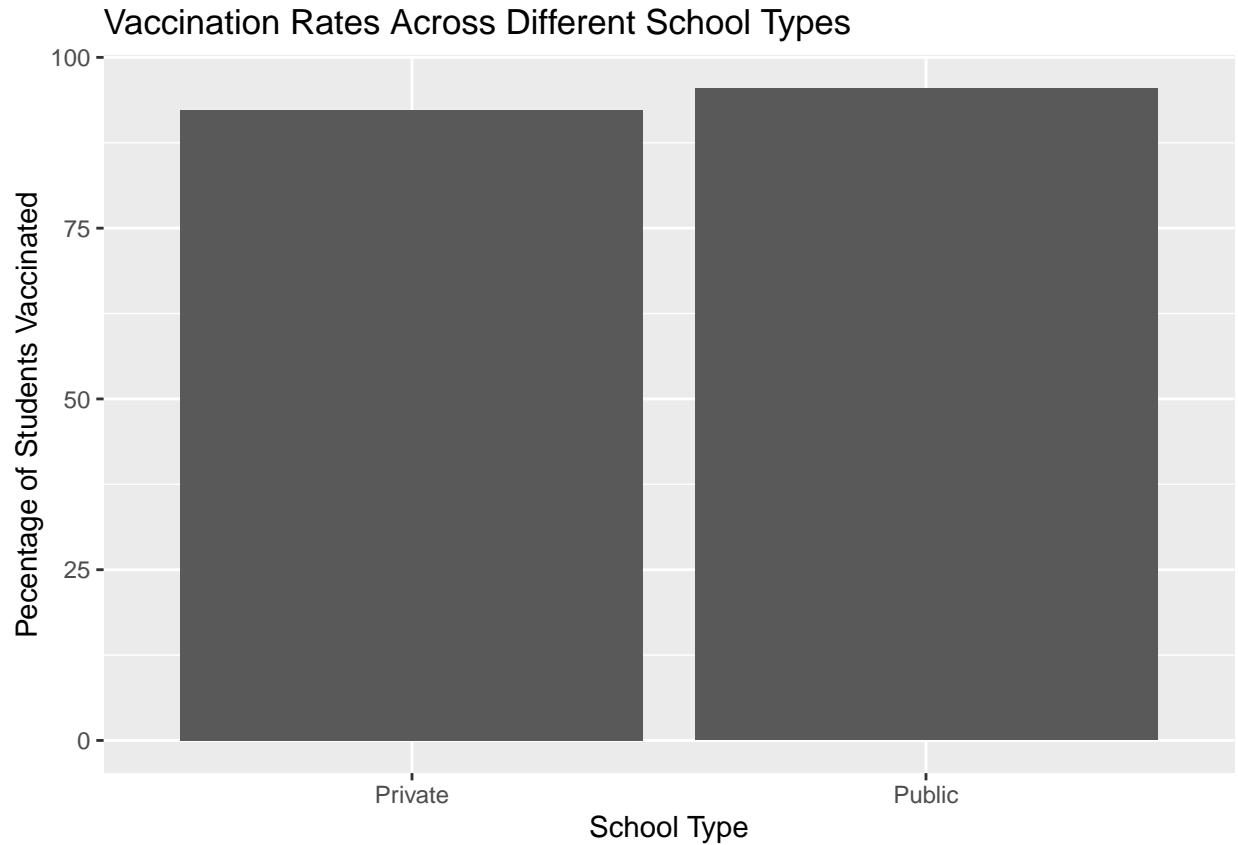
#Variable Manipulation

```
measles <- measles %>%  
  filter(overall != (-1)) %>%  
  mutate(numvaxx = round(enroll*overall*.01)) %>%  
  mutate(unvaxx = enroll - numvaxx) %>%  
  mutate(statefac = as.factor(state))
```

```
measles2 <- measles %>%  
  filter(!is.na(overall), !is.na(type), !is.na(state))
```

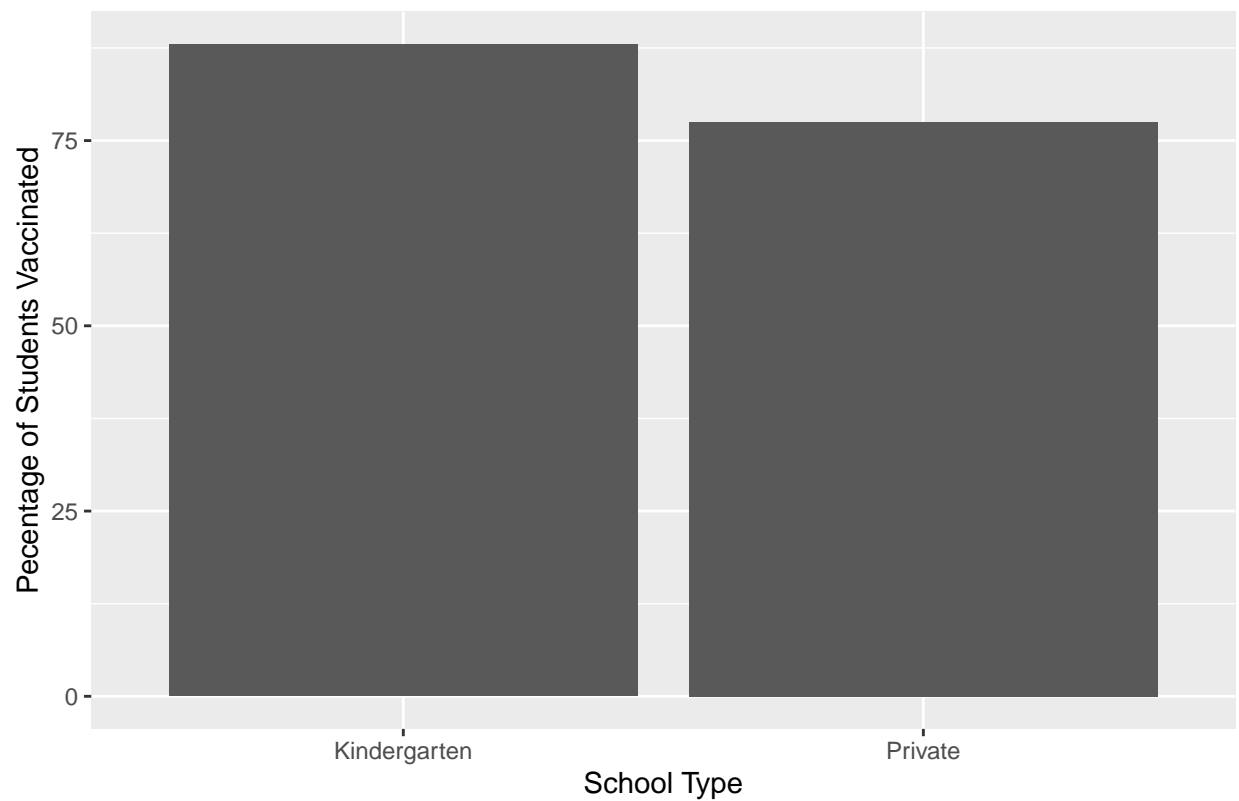
```
measles2 %>%  
  filter(state == "California") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%
```

```
distinct() %>%
ggplot(aes(x = type, y = averagevax)) +
geom_col() +
labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```



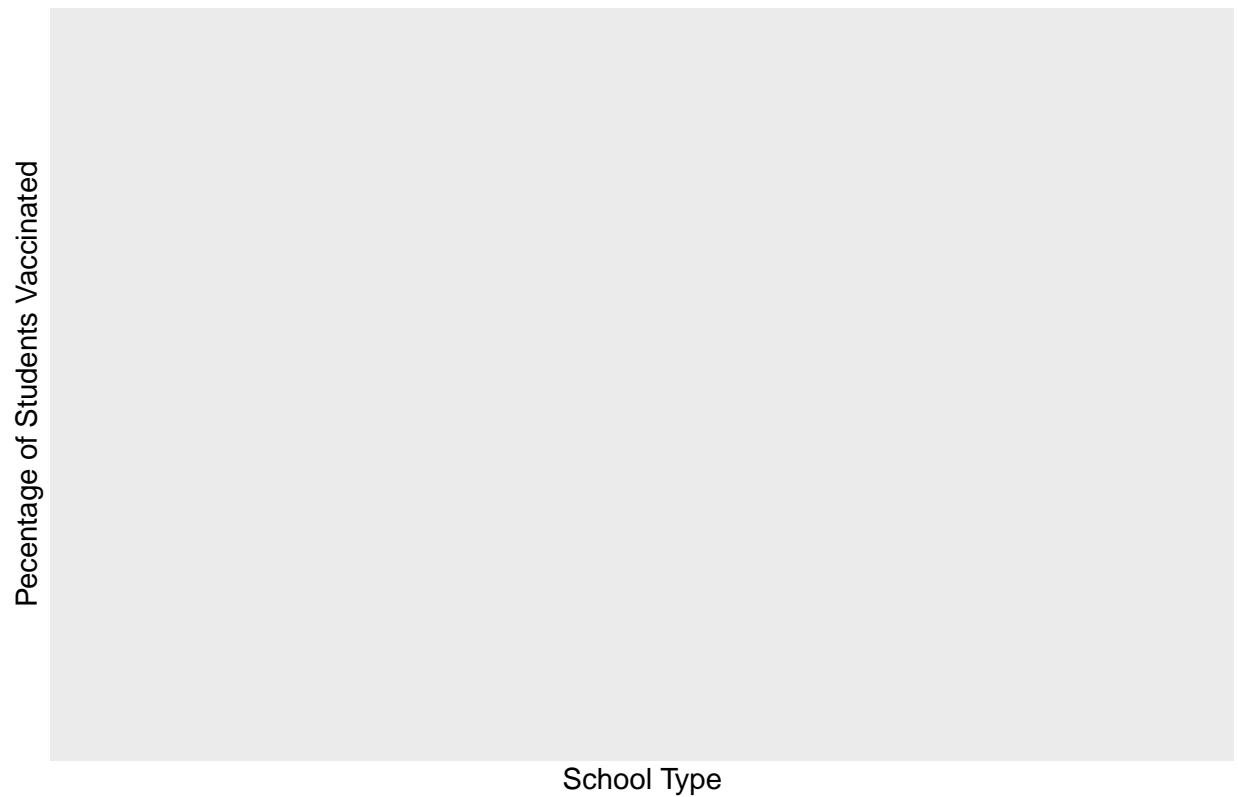
```
measles2 %>%
  filter(state == "Colorado") %>%
  group_by(type) %>%
  mutate(averagevax = mean(overall)) %>%
  select(type, averagevax) %>%
  distinct() %>%
  ggplot(aes(x = type, y = averagevax)) +
  geom_col() +
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



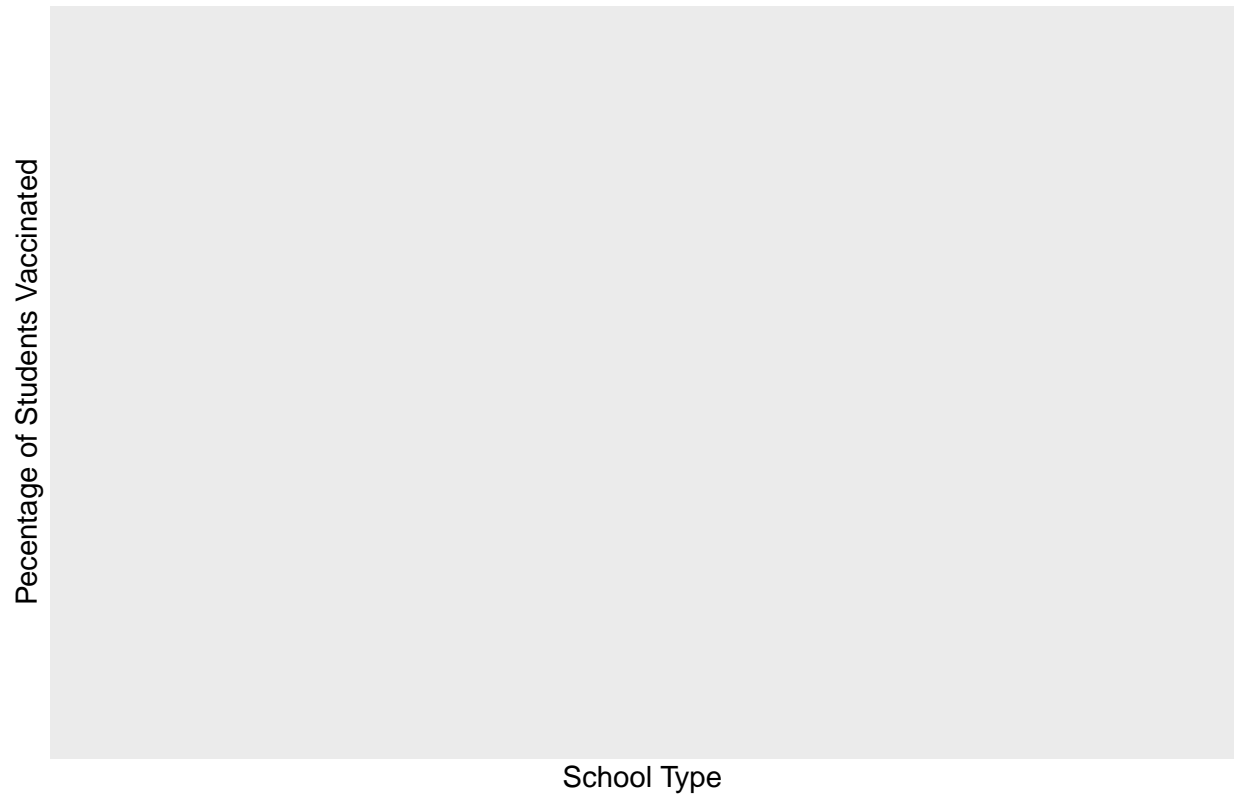
```
measles2 %>%  
  filter(state == "Florida") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



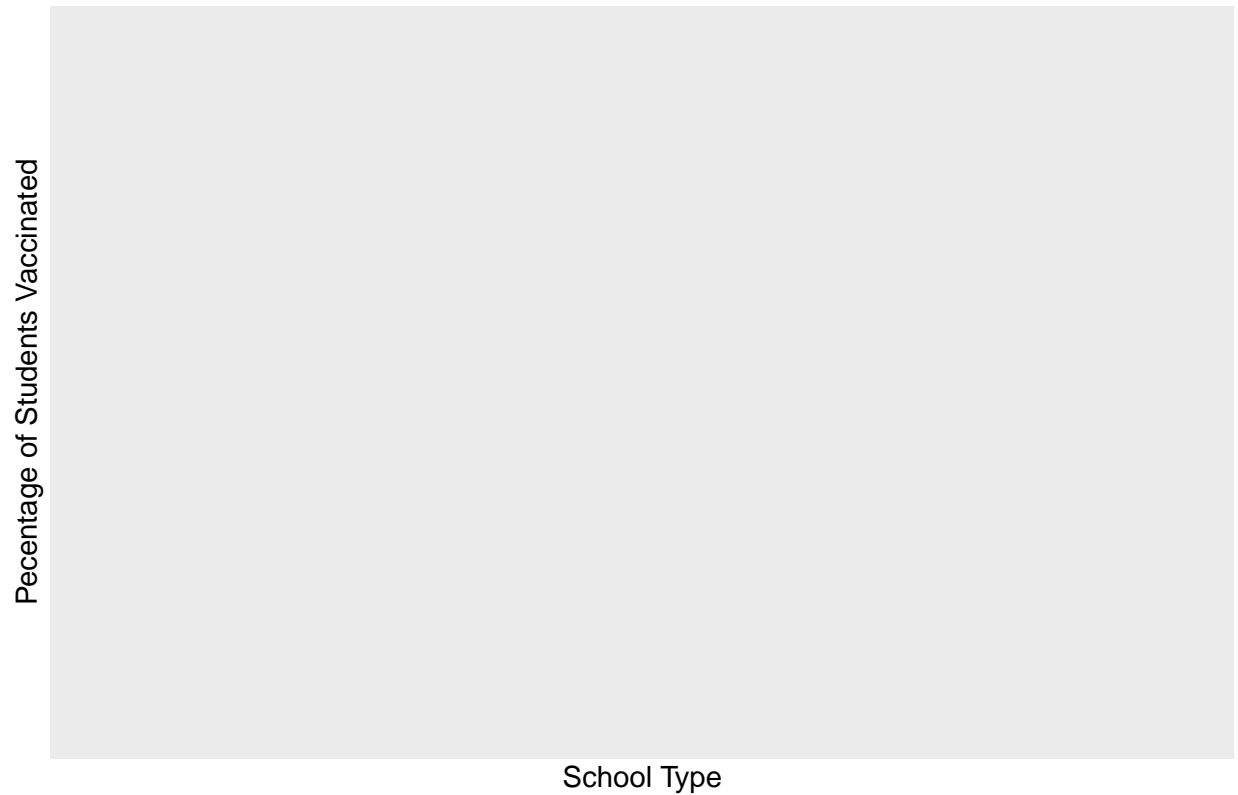
```
measles2 %>%  
  filter(state == "Idaho") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



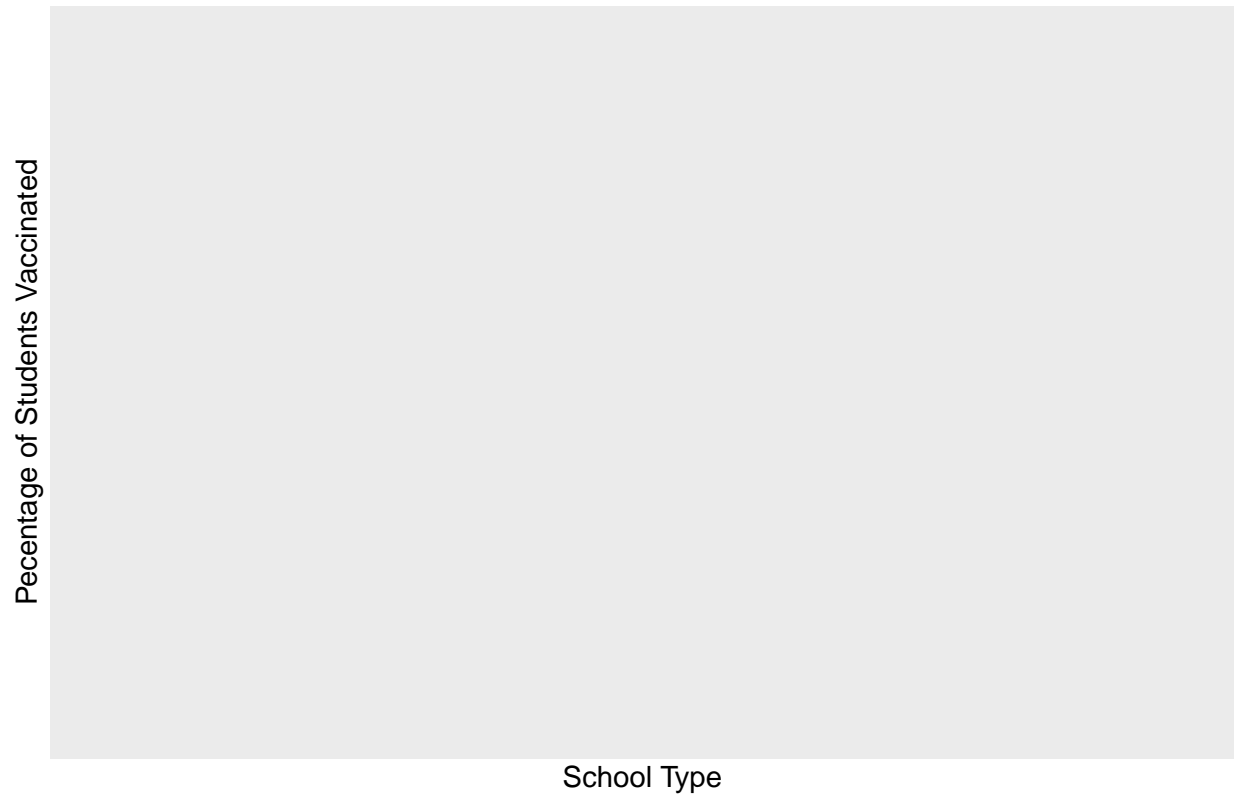
```
measles2 %>%  
  filter(state == "Iowa") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



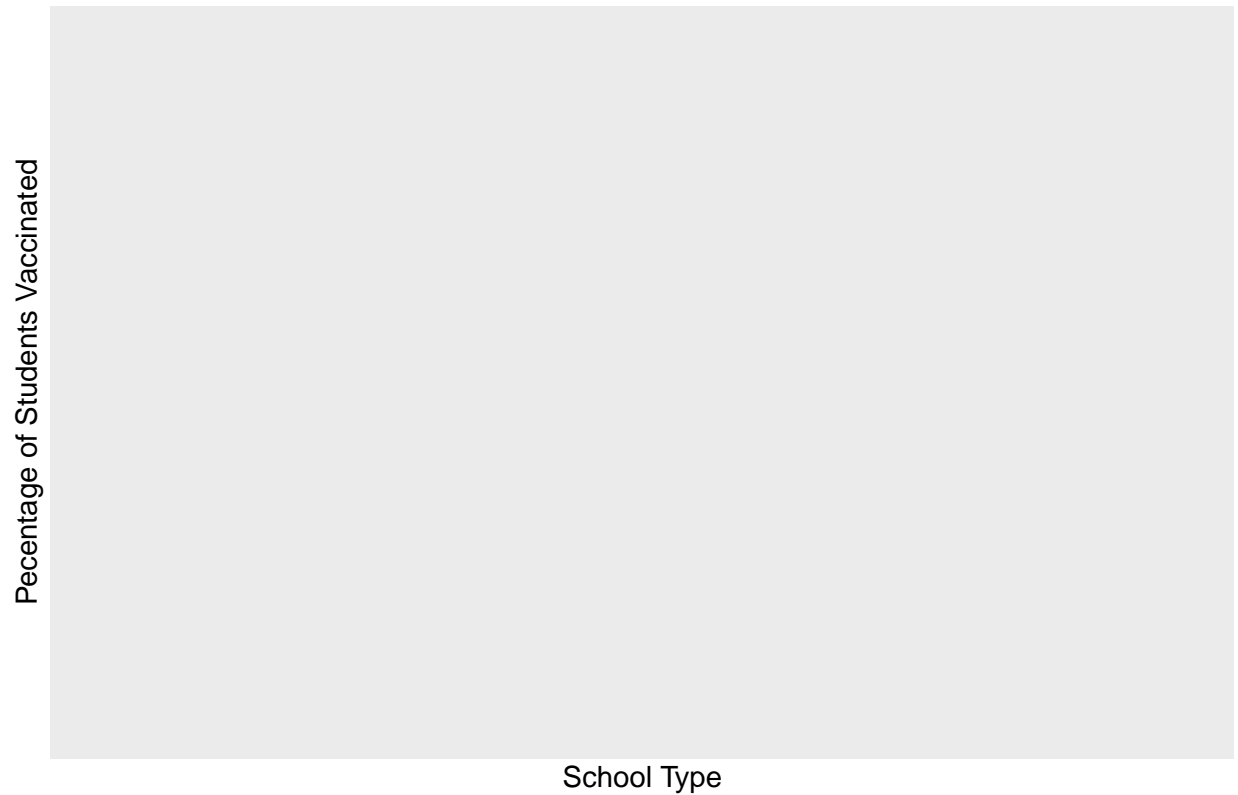
```
measles2 %>%  
  filter(state == "Michigan") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



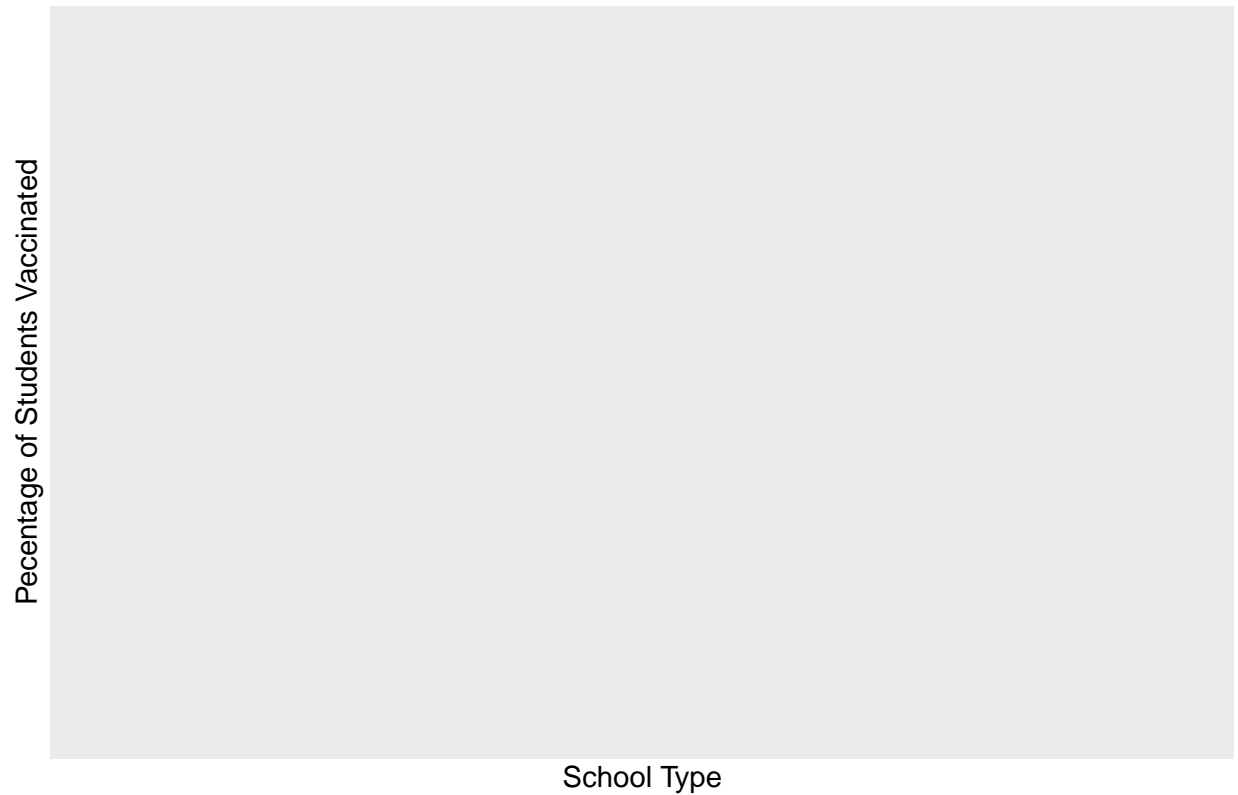
```
measles2 %>%  
  filter(state == "New Jersey") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



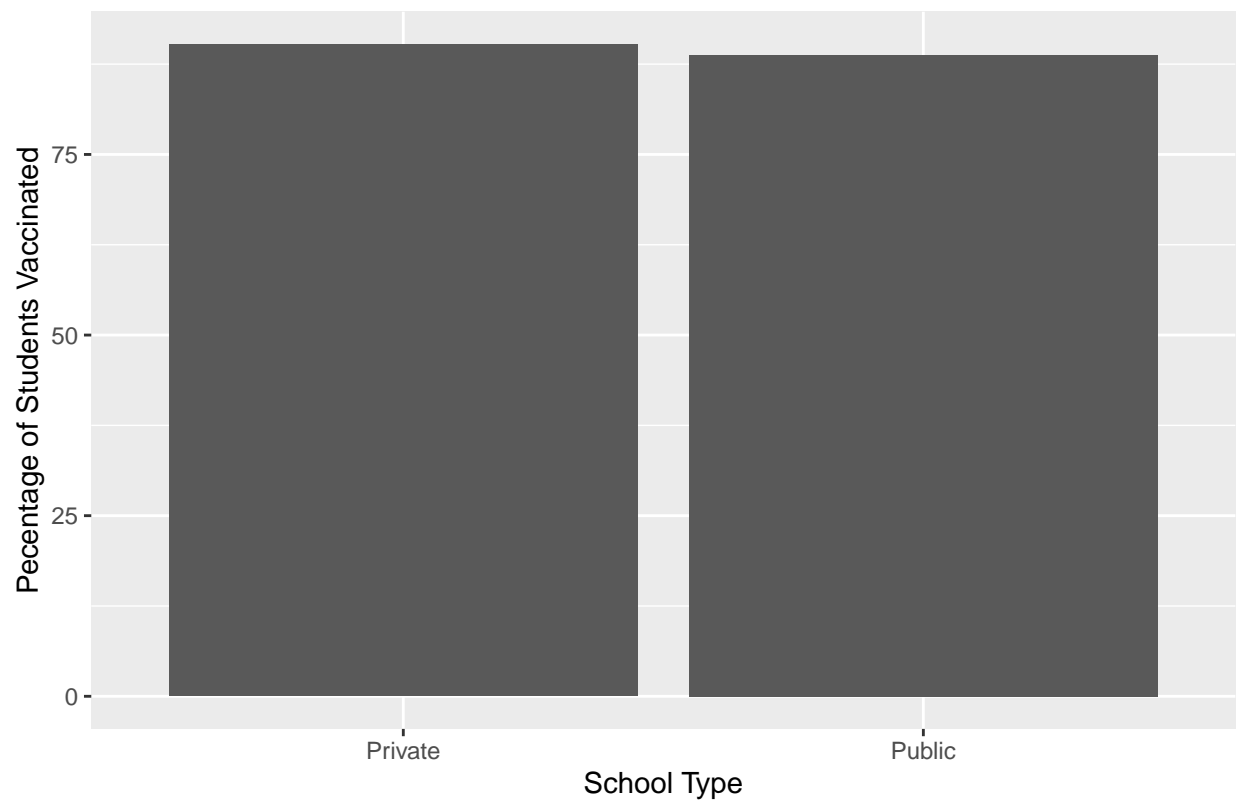
```
measles2 %>%
  filter(state == "North Carolina") %>%
  group_by(type) %>%
  mutate(averagevax = mean(overall)) %>%
  select(type, averagevax) %>%
  distinct() %>%
  ggplot(aes(x = type, y = averagevax)) +
  geom_col() +
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```


Vaccination Rates Across Different School Types



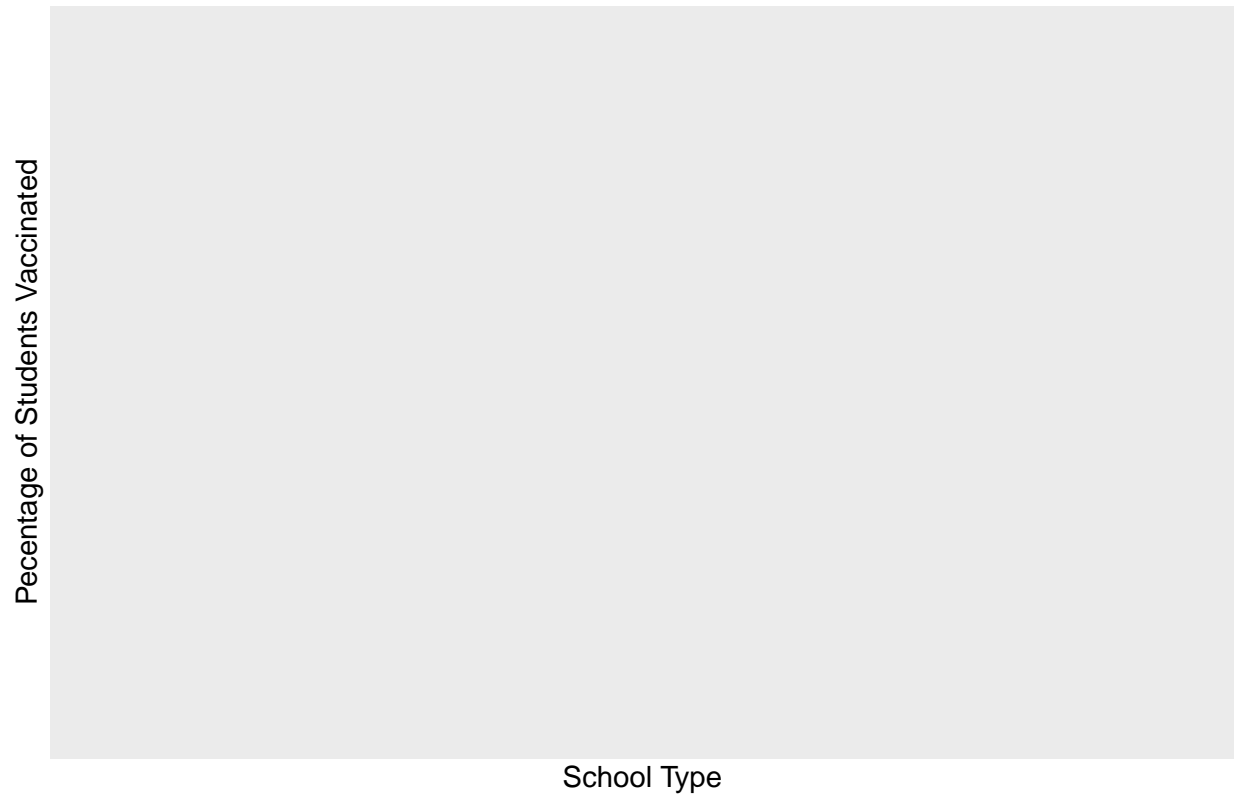
```
measles2 %>%  
  filter(state == "Ohio") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



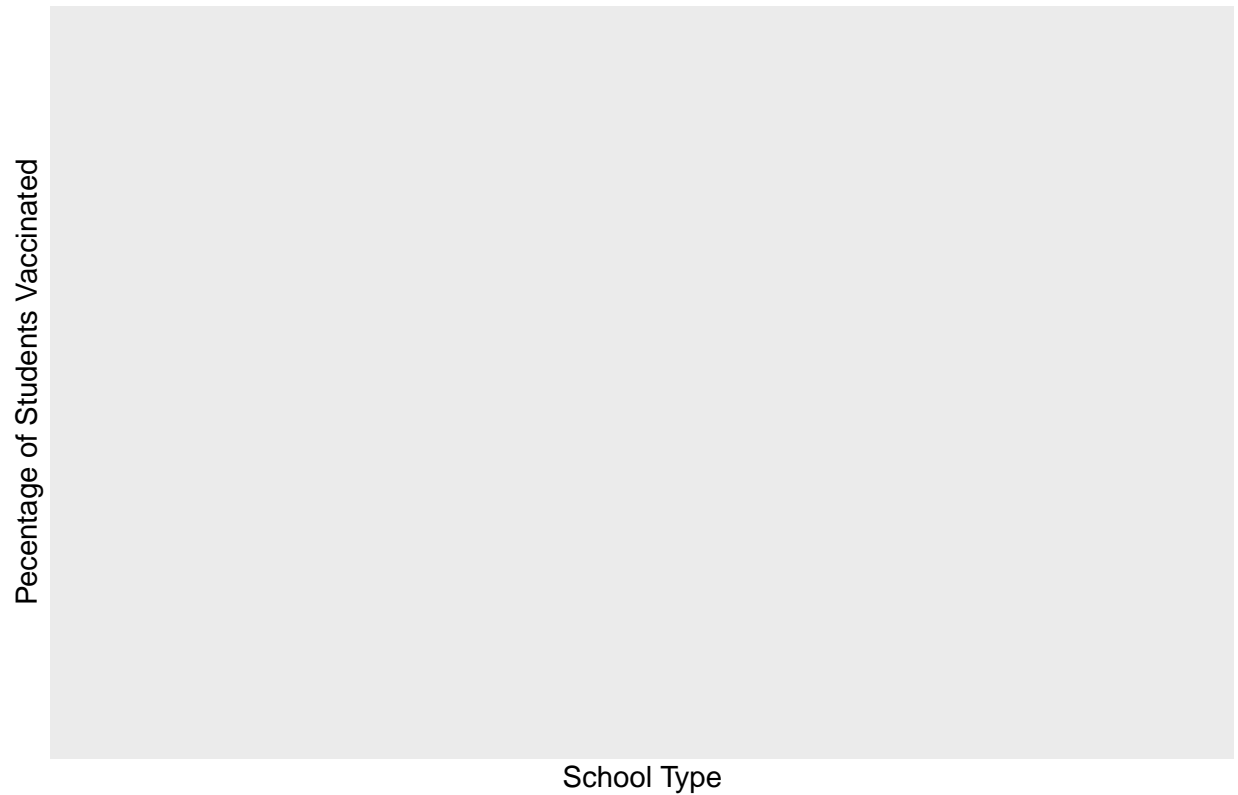
```
measles2 %>%
  filter(state == "Oklahoma") %>%
  group_by(type) %>%
  mutate(averagevax = mean(overall)) %>%
  select(type, averagevax) %>%
  distinct() %>%
  ggplot(aes(x = type, y = averagevax)) +
  geom_col() +
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



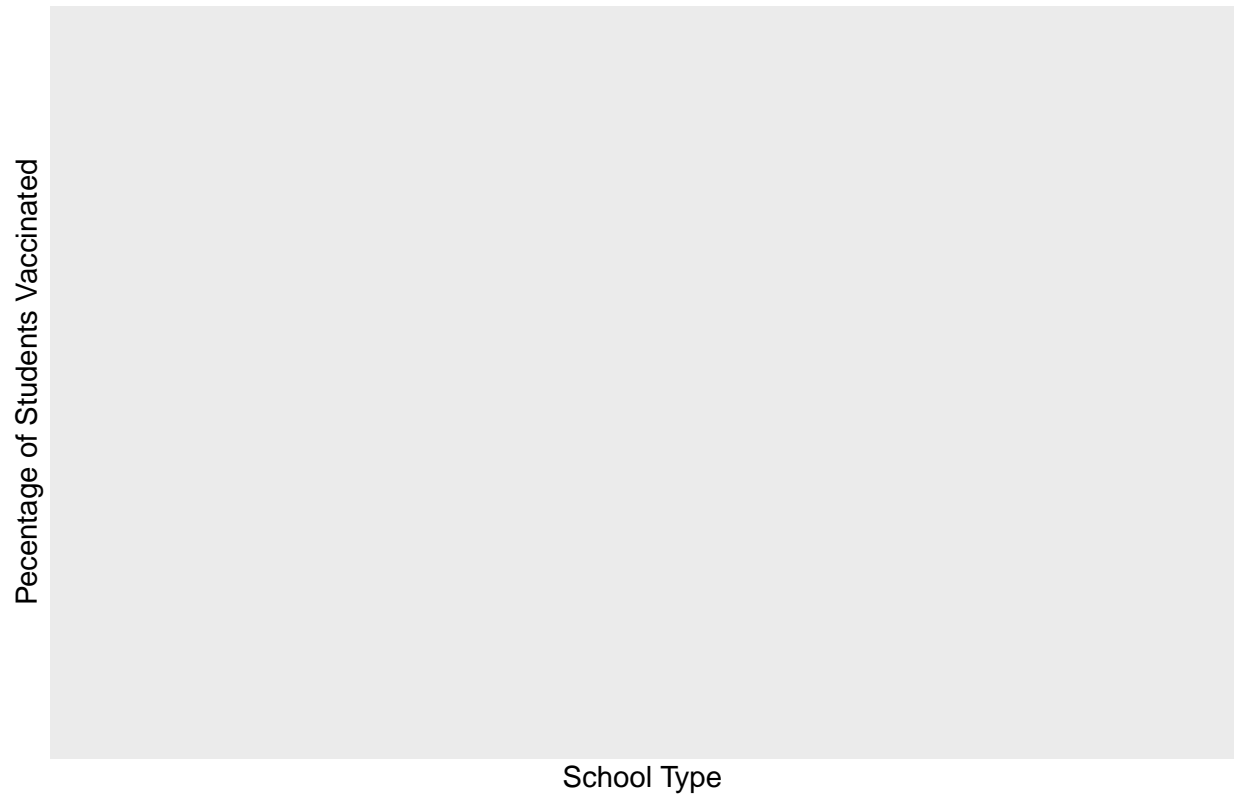
```
measles2 %>%  
  filter(state == "Oregon") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



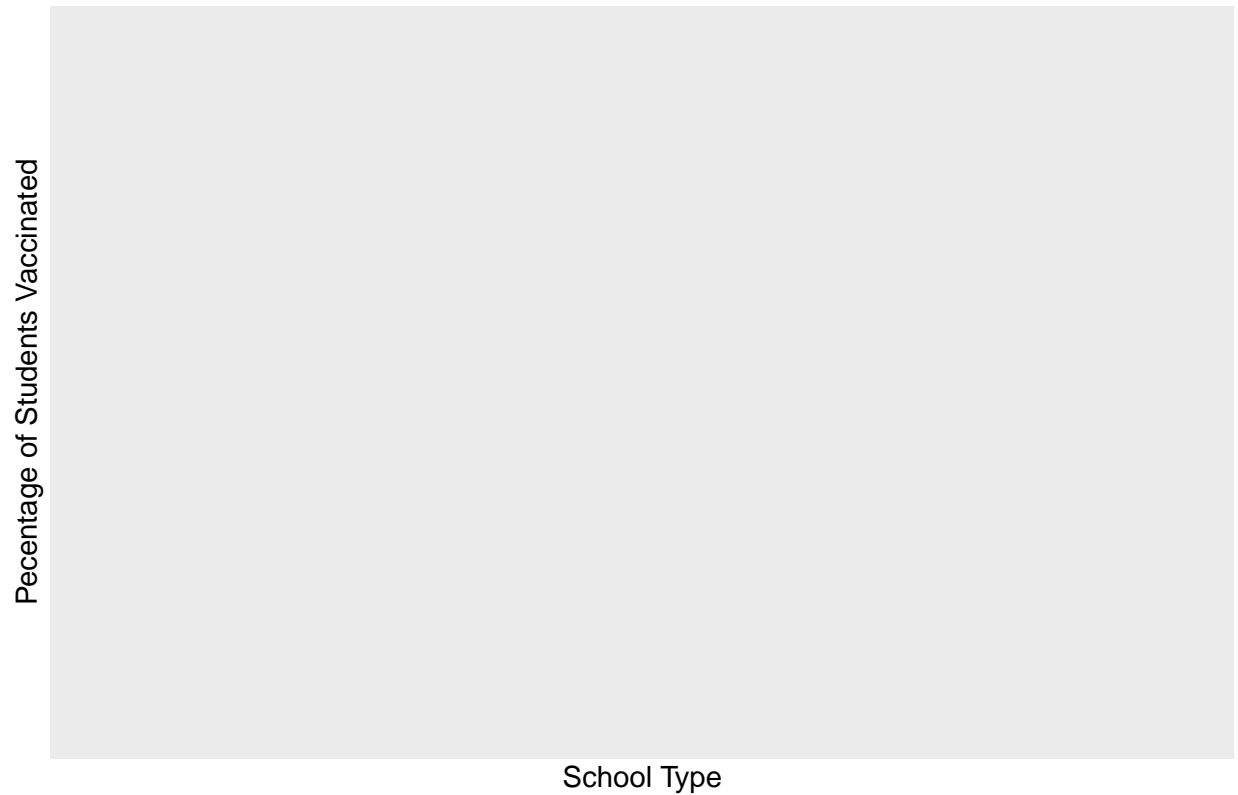
```
measles2 %>%  
  filter(state == "Rhode Island") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



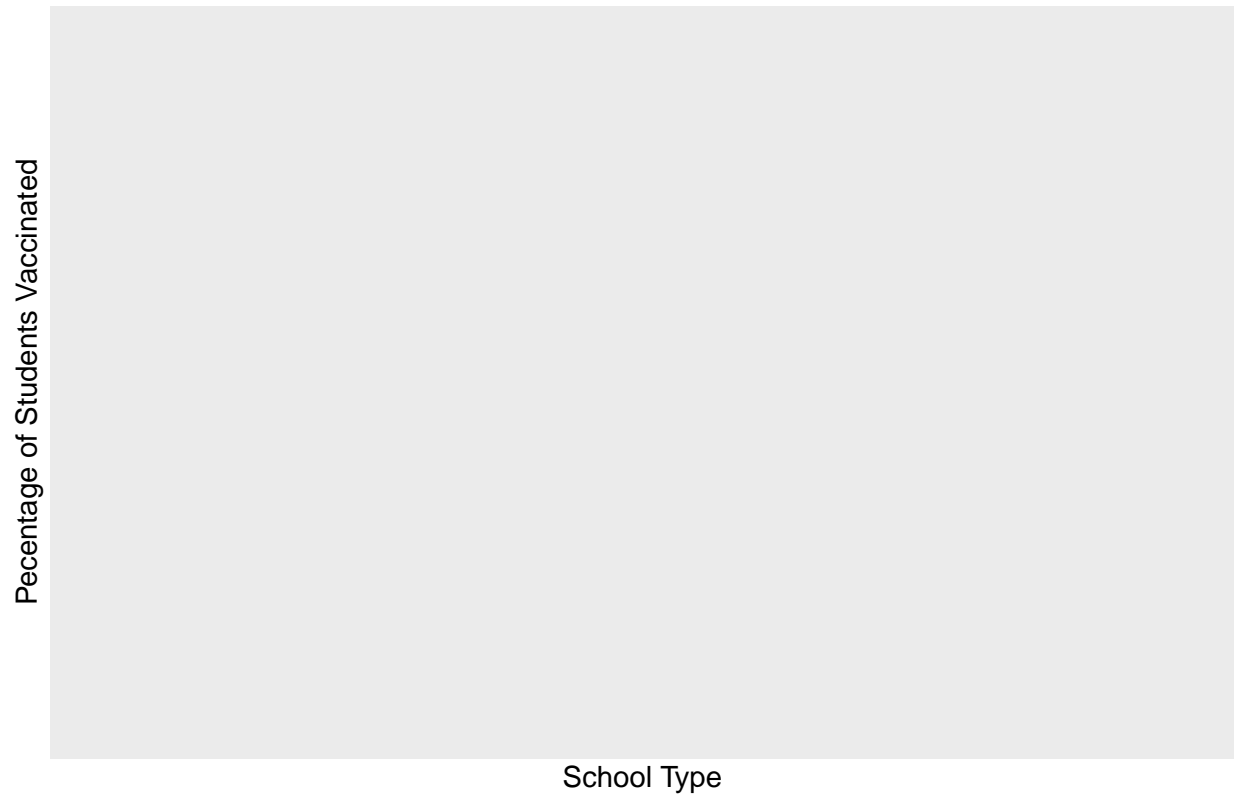
```
measles2 %>%  
  filter(state == "Tennessee") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



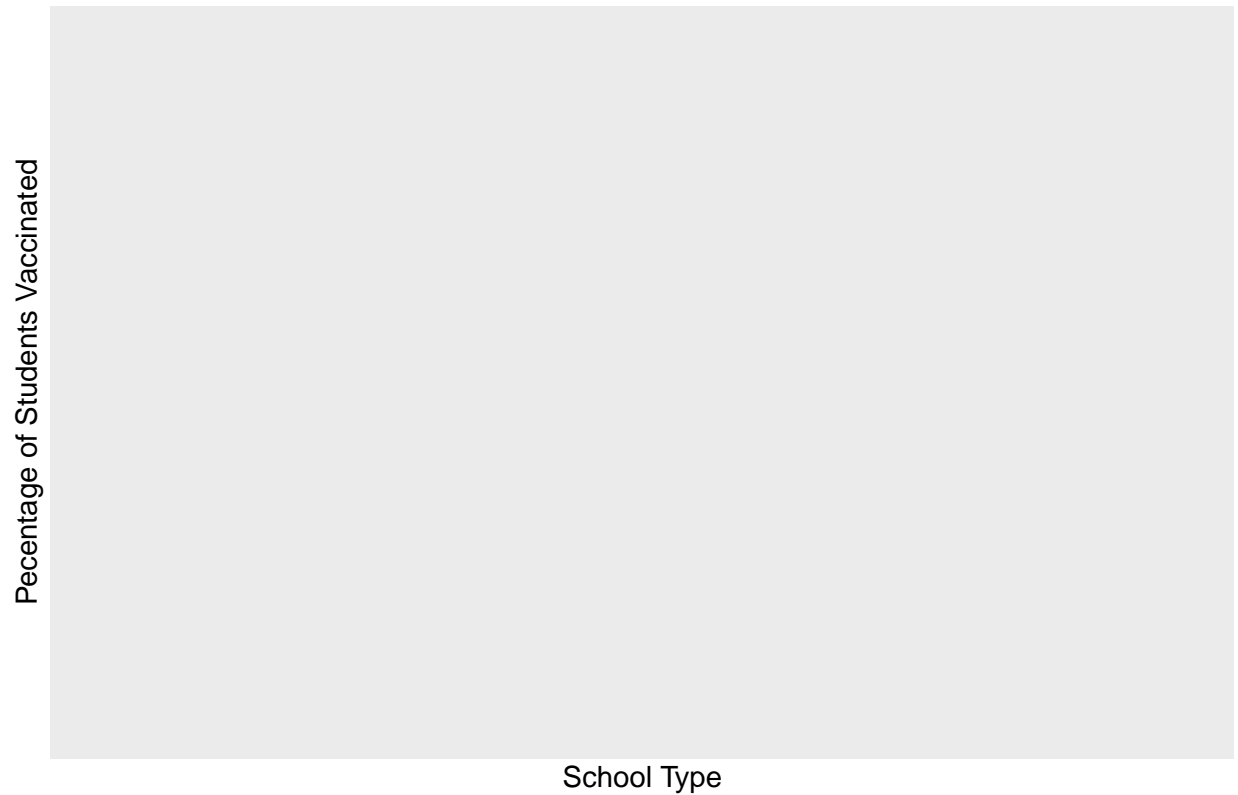
```
measles2 %>%  
  filter(state == "Vermont") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



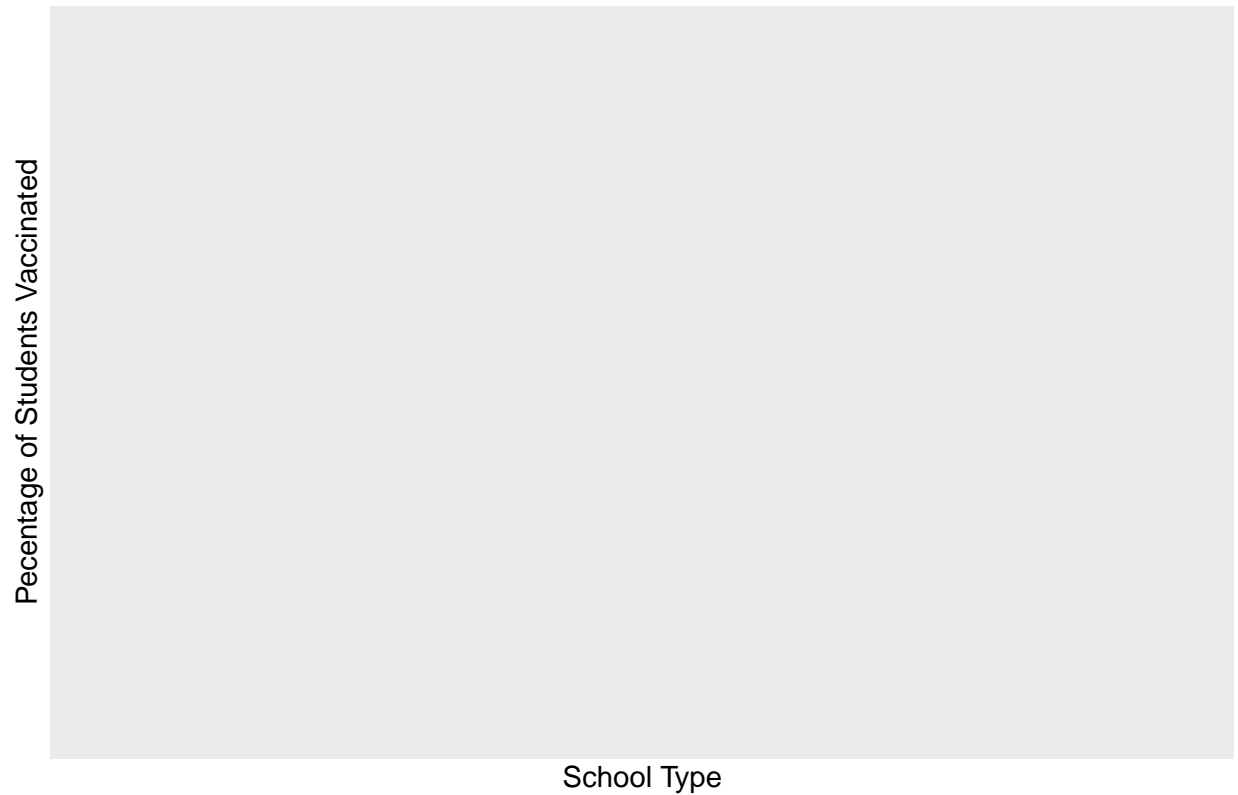
```
measles2 %>%
  filter(state == "Virginia") %>%
  group_by(type) %>%
  mutate(averagevax = mean(overall)) %>%
  select(type, averagevax) %>%
  distinct() %>%
  ggplot(aes(x = type, y = averagevax)) +
  geom_col() +
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

Vaccination Rates Across Different School Types



```
measles2 %>%  
  filter(state == "Washington") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```


Vaccination Rates Across Different School Types



```
measles2 %>%  
  filter(state == "Wisconsin") %>%  
  group_by(type) %>%  
  mutate(averagevax = mean(overall)) %>%  
  select(type, averagevax) %>%  
  distinct() %>%  
  ggplot(aes(x = type, y = averagevax)) +  
  geom_col() +  
  labs(title = "Vaccination Rates Across Different School Types", x = "School Type", y = "Percentage of S
```

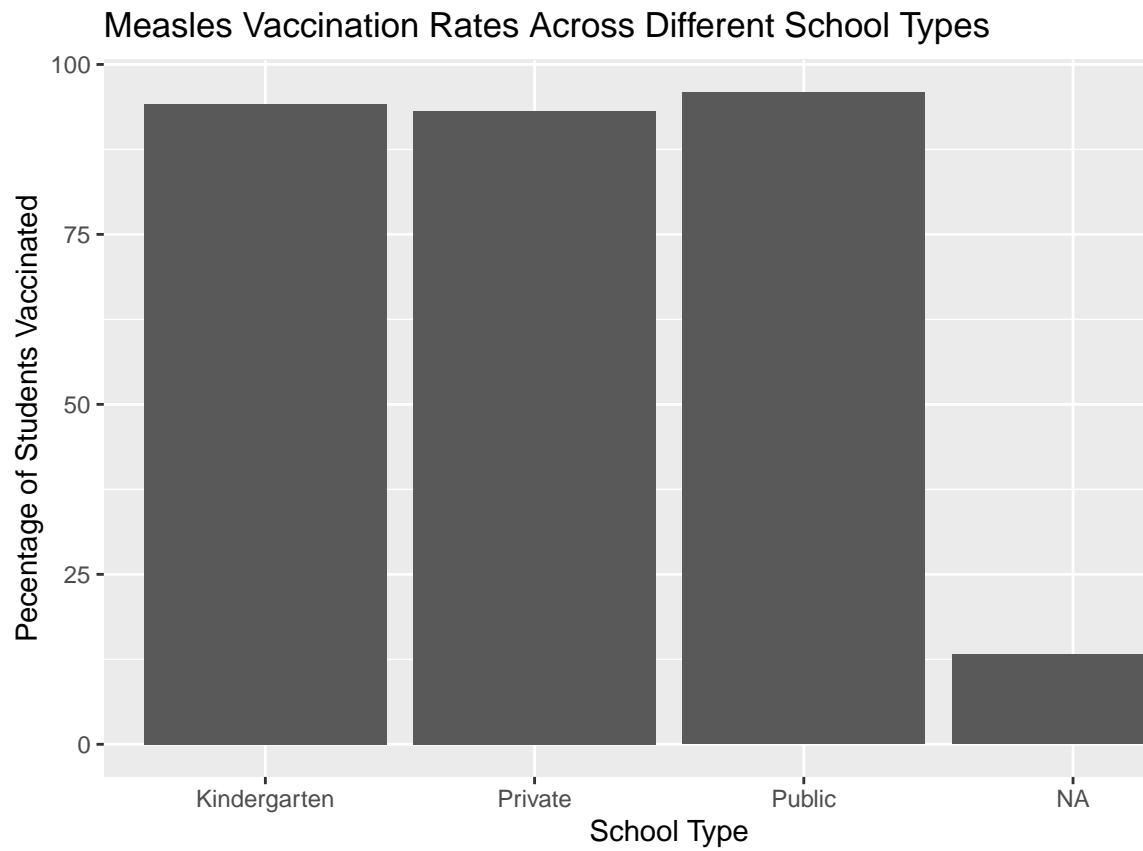
Vaccination Rates Across Different School Types

Percentage of Students Vaccinated

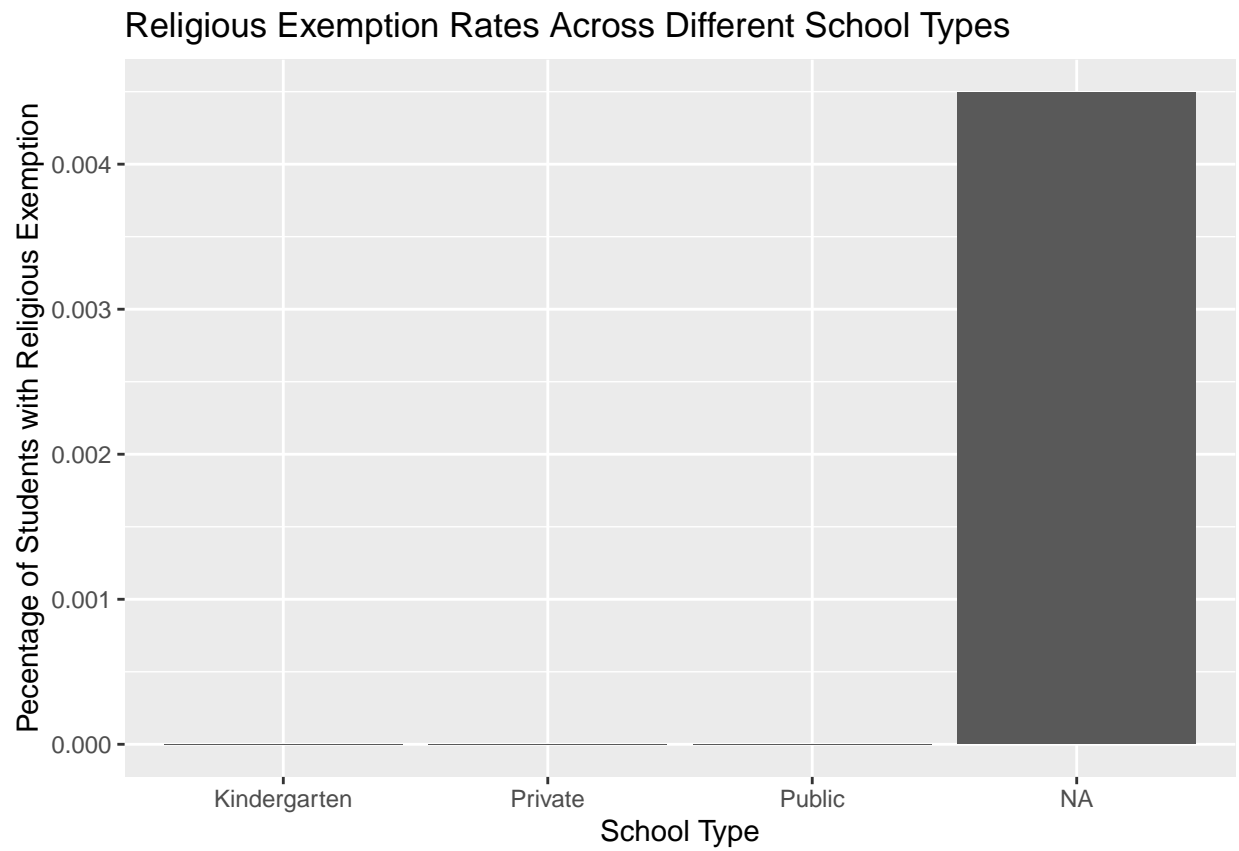
School Type

```
measlereg <- glm(cbind(numvaxx, unvaxx) ~ type + statefac, data=measles, family = binomial)
measlereg
```

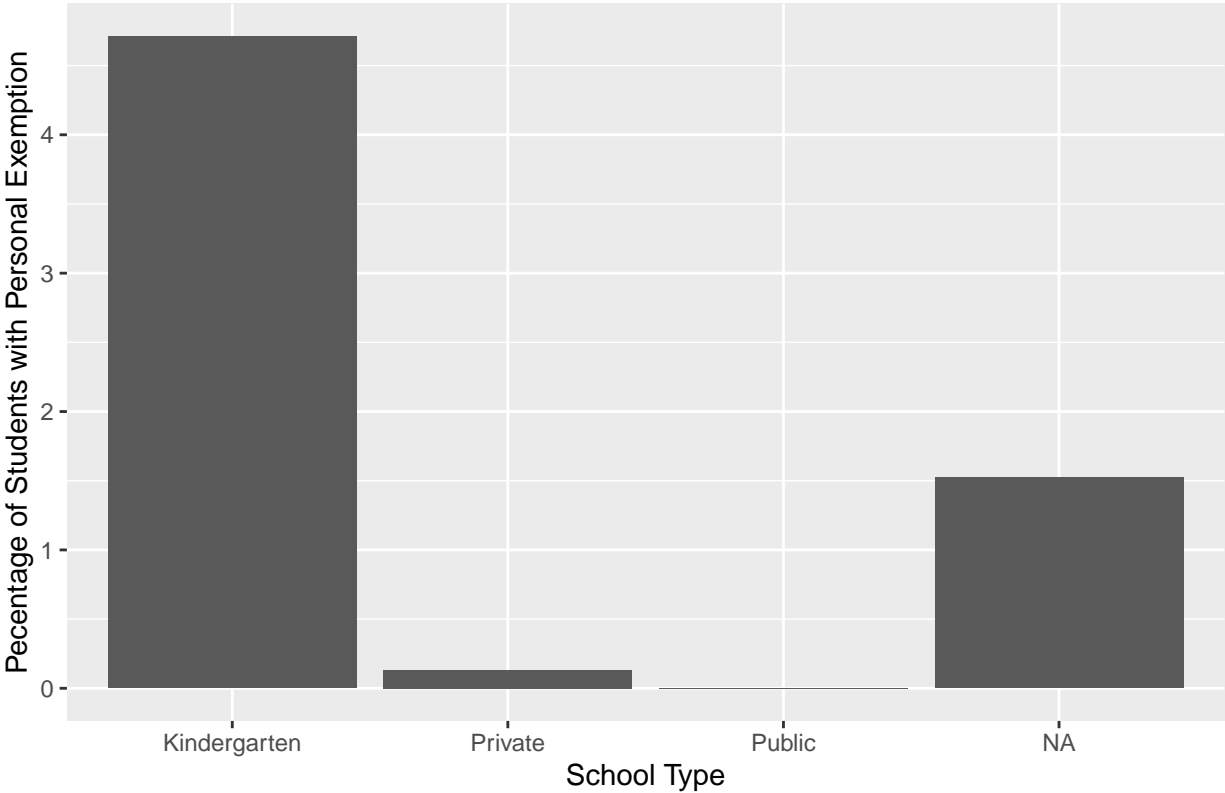
```
##
## Call:  glm(formula = cbind(numvaxx, unvaxx) ~ type + statefac, family = binomial,
##       data = measles)
##
## Coefficients:
##      (Intercept)      typePrivate      typePublic  statefacColorado
##           3.7220          -0.8424          -0.6406          -1.6471
##      statefacOhio
##          -0.8457
##
## Degrees of Freedom: 18645 Total (i.e. Null);  18641 Residual
## (20243 observations deleted due to missingness)
## Null Deviance:      114500
## Residual Deviance: 101300   AIC: 153400
```



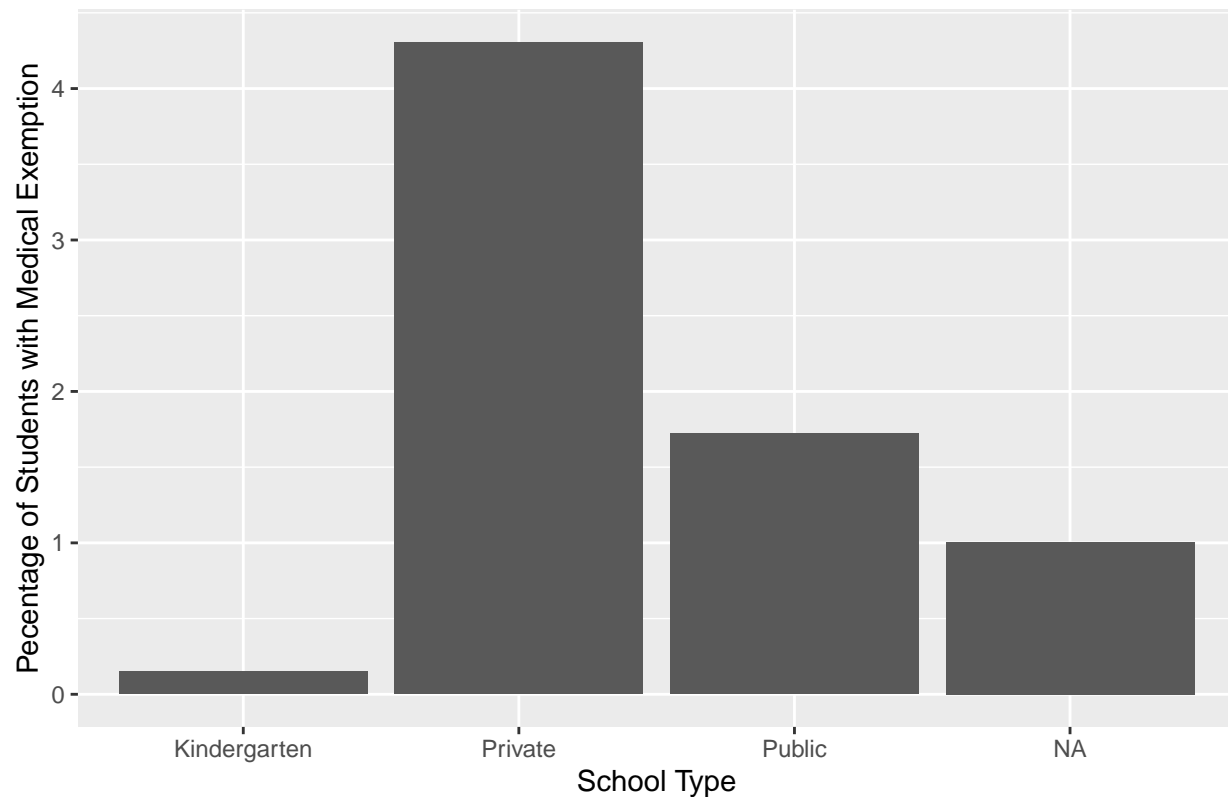
#Preliminary Bar Graphs



Personal Exemption Rates Across Different School Types



Medical Exemption Rates Across Different School Types



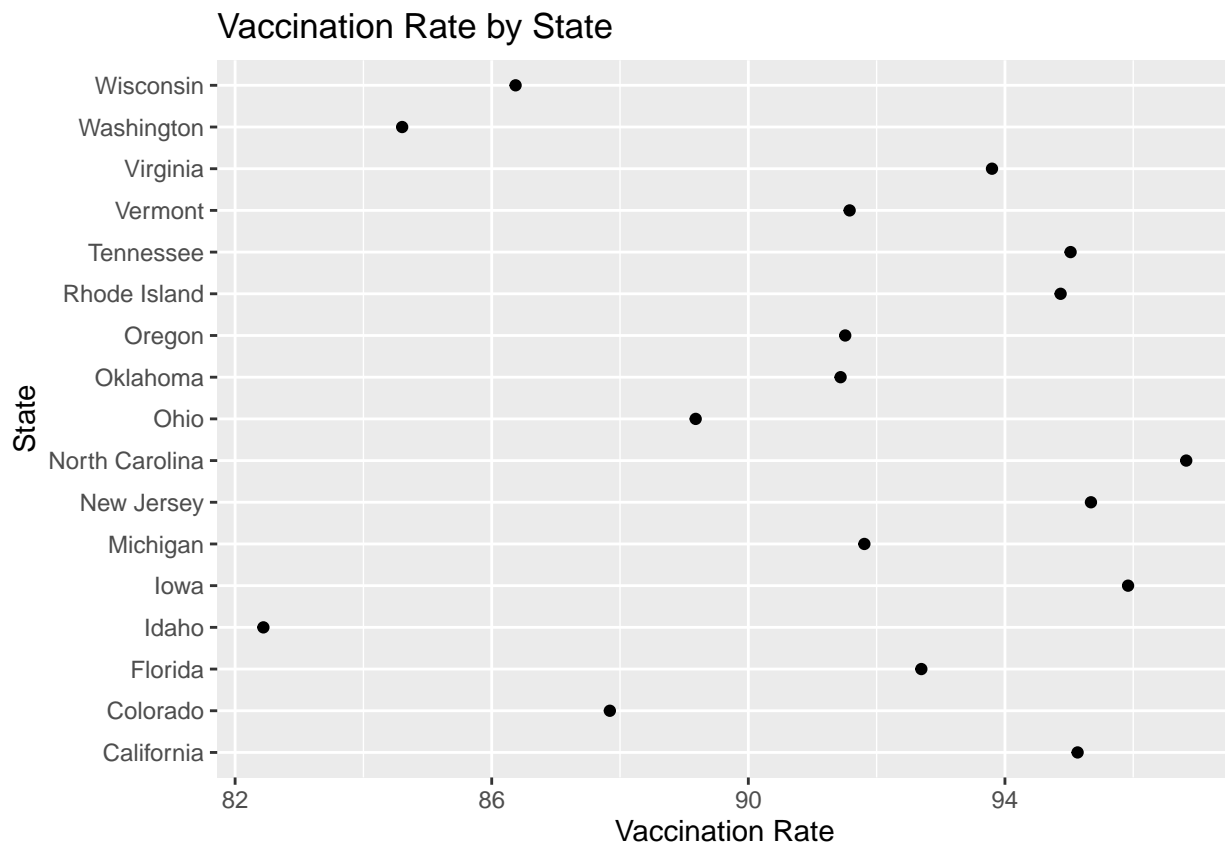
vaccination by state graph

```
measles %>%
  count(state) %>%
  group_by(state)
```

```
## # A tibble: 17 x 2
## # Groups:   state [17]
##   state      n
##   <chr>    <int>
## 1 California 14224
## 2 Colorado   1505
## 3 Florida    2672
## 4 Idaho       467
## 5 Iowa       1163
## 6 Michigan   2351
## 7 New Jersey 2044
## 8 North Carolina 2084
## 9 Ohio       2917
## 10 Oklahoma  1052
## 11 Oregon     806
## 12 Rhode Island 215
## 13 Tennessee 1152
## 14 Vermont    338
## 15 Virginia  1413
```

```
## 16 Washington      1978
## 17 Wisconsin       2508
```

```
measles %>%
  filter(overall != (-1)) %>%
  group_by(state) %>%
  summarise(statemean = mean(overall)) %>%
  ggplot(aes(x = statemean, y = state)) +
  geom_point() +
  labs(x = "Vaccination Rate", y = "State", title = "Vaccination Rate by State")
```



```
plotdata <- measles %>%
  filter(overall != (-1)) %>%
  group_by(state) %>%
  summarise(statemean = mean(overall))
plot_usmap(data=plotdata, values = "statemean") +
  labs(title = "Vaccination Rate by State", fill = "Vaccination Rate") +
  theme(panel.background = element_rect(color = "black", fill = "lightblue"))
```

Vaccination Rate

- 96
- 92
- 88
- 84