Final Report

due November 16, 2021 by 11:59 PM

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11/16/21

#Load Data

```
## 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"
```

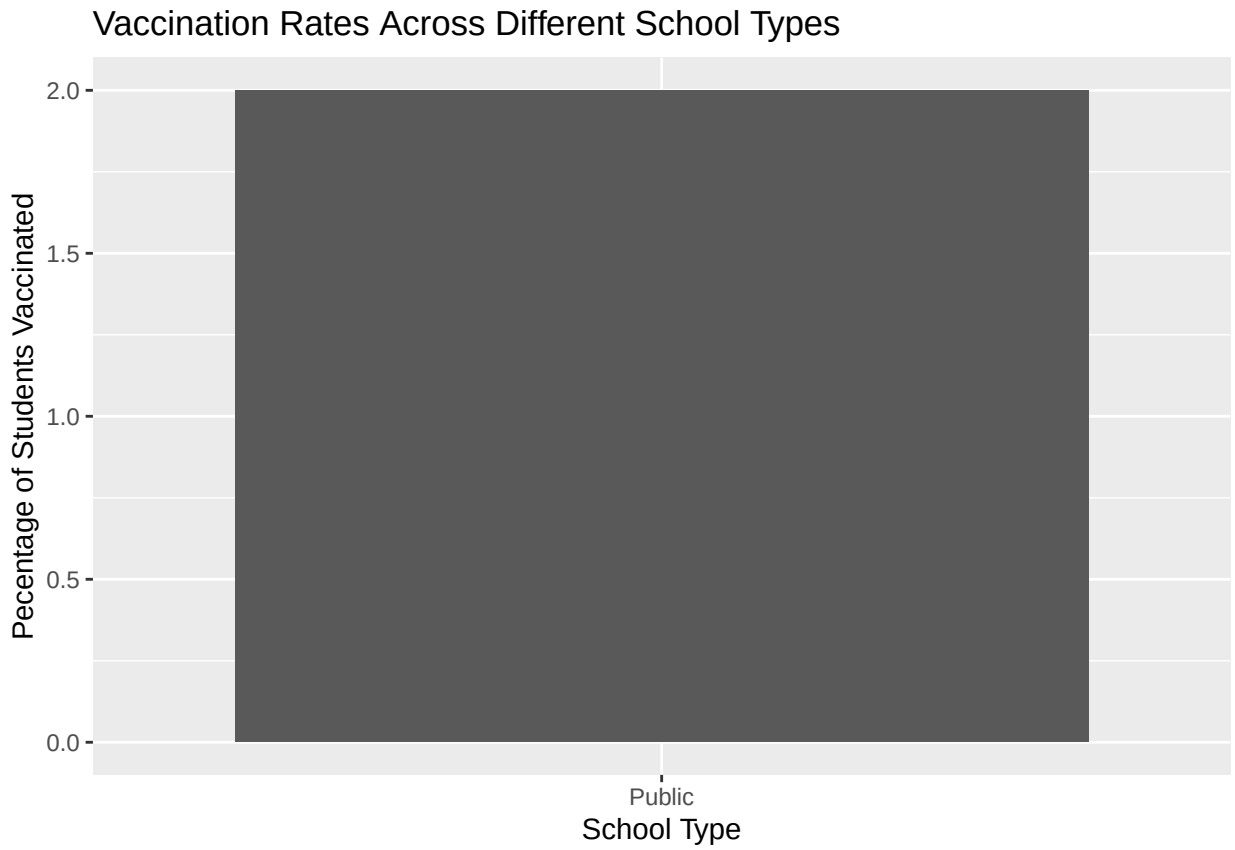
```
#v18 <- load_variables(2018, "acs5", cache = TRUE)

#View(v18)
```

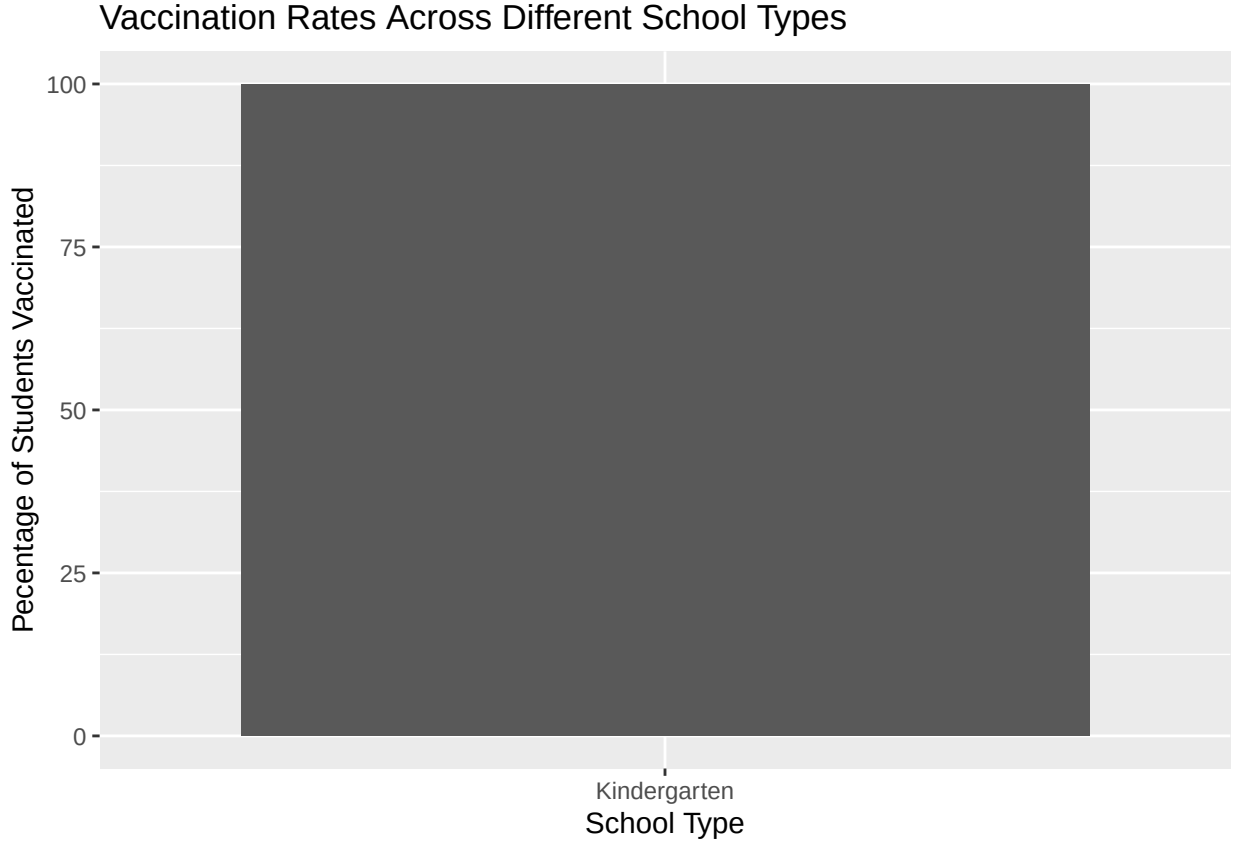
#Research Question

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

realrate vaccination status vs. state, realrate 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.

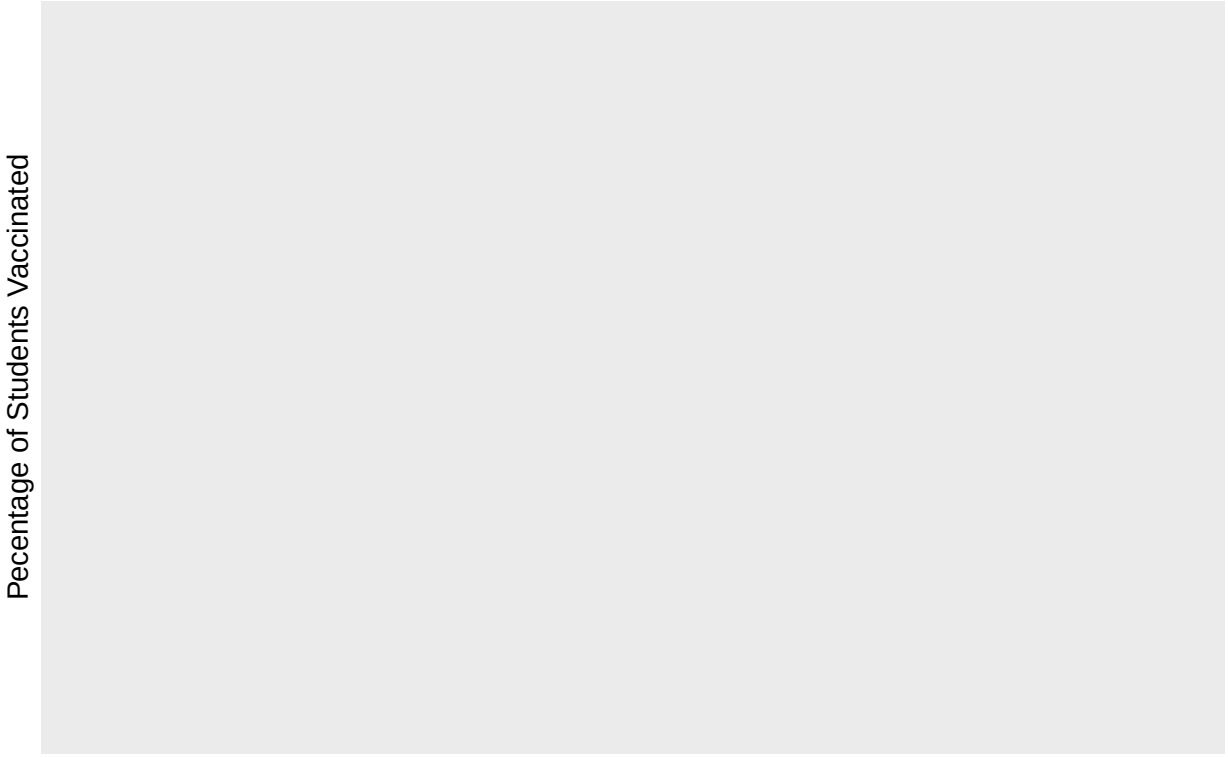
Data Wrangling






Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type

Vaccination Rates Across Different School Types




Vaccination Rates Across Different School Types
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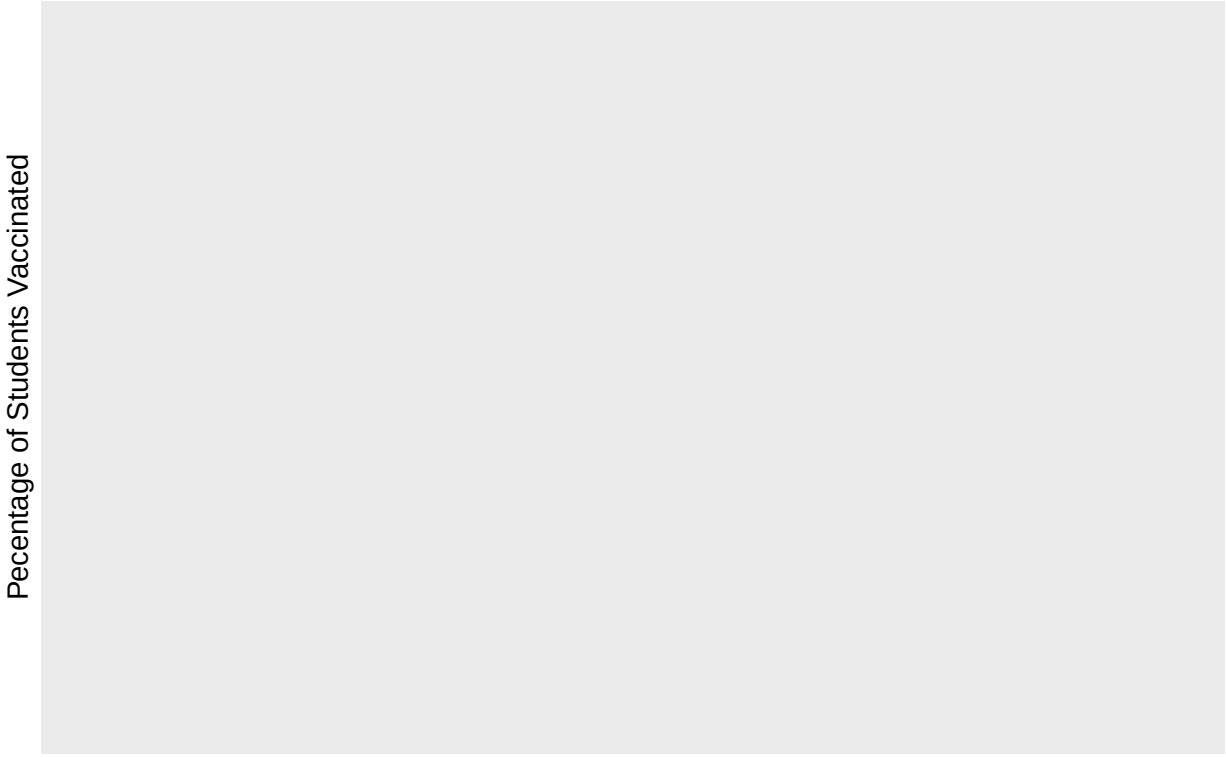
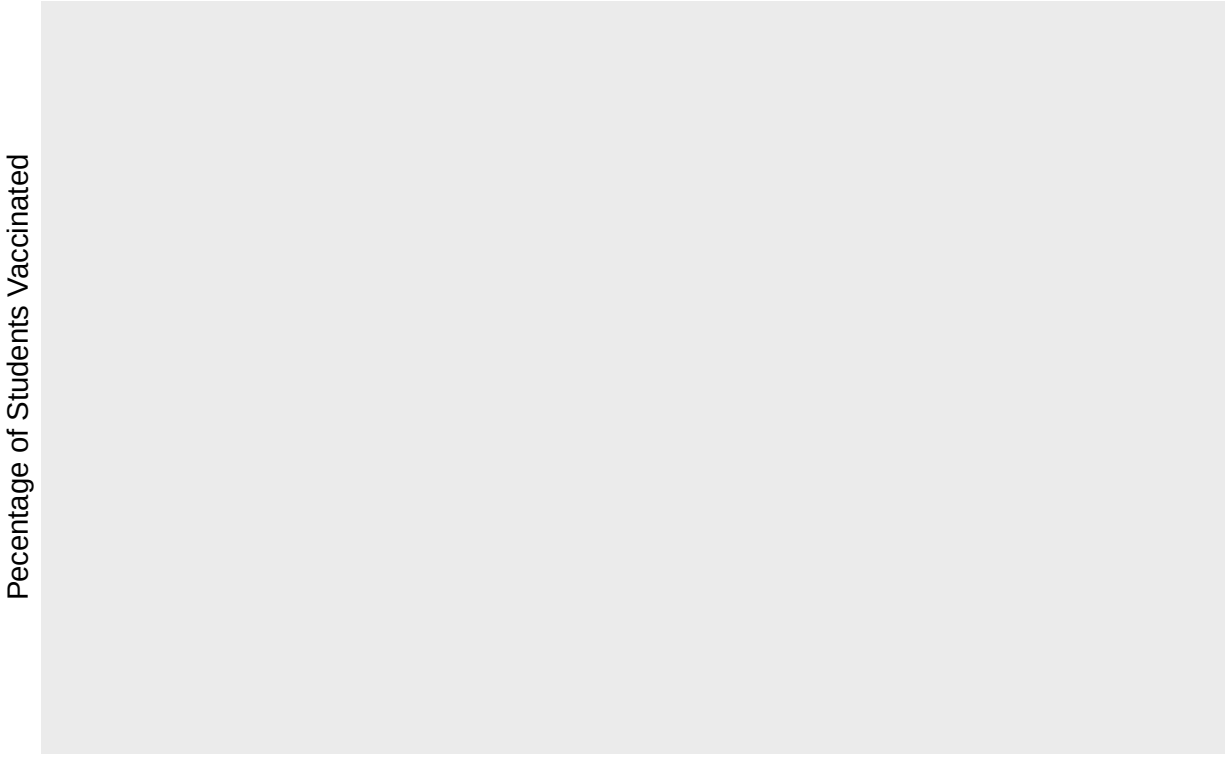
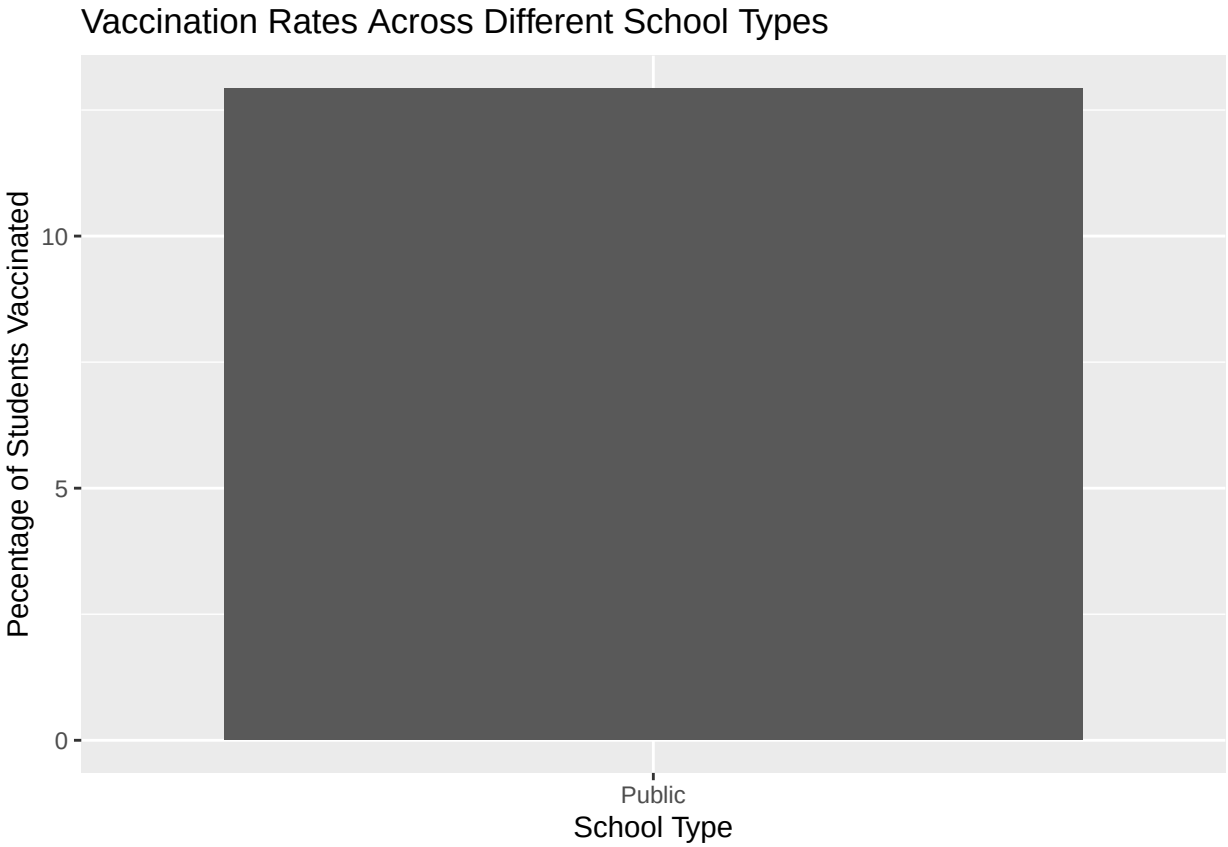



Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type

Vaccination Rates Across Different School Types



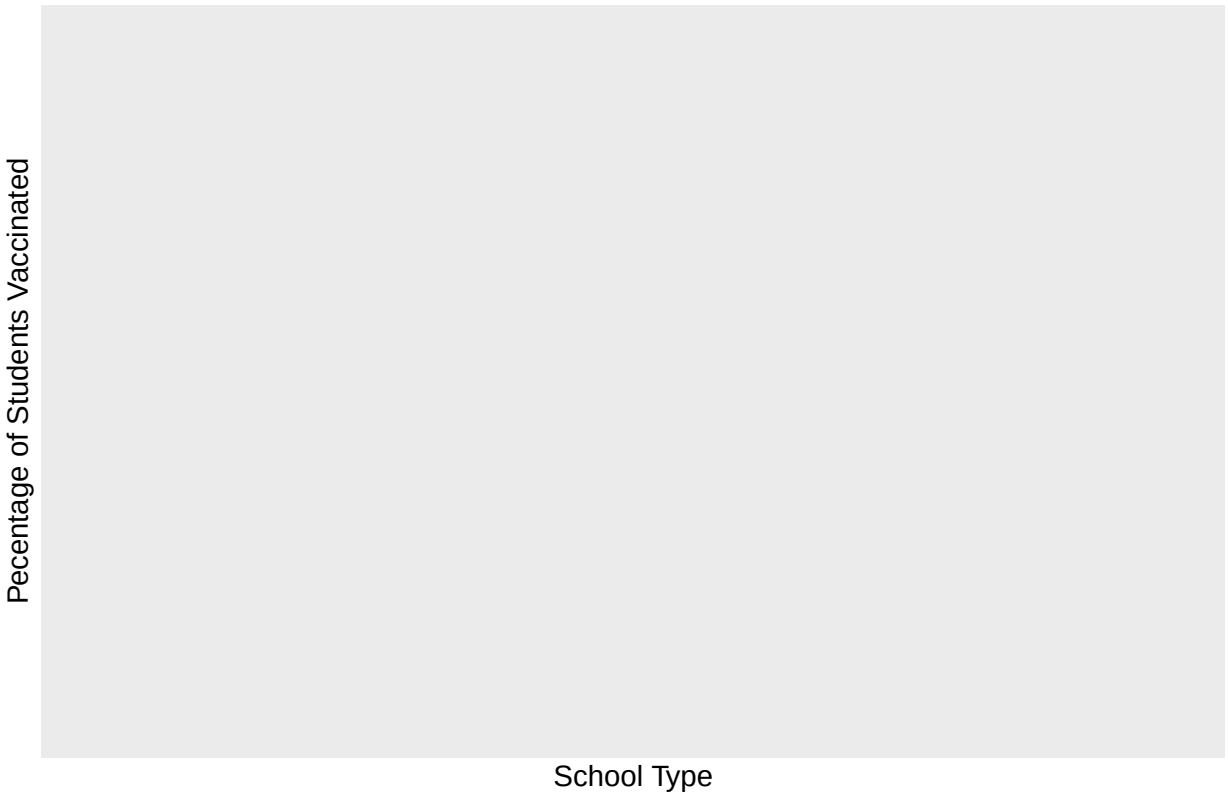

Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
10
5
0
Public
School Type


Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type


Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type

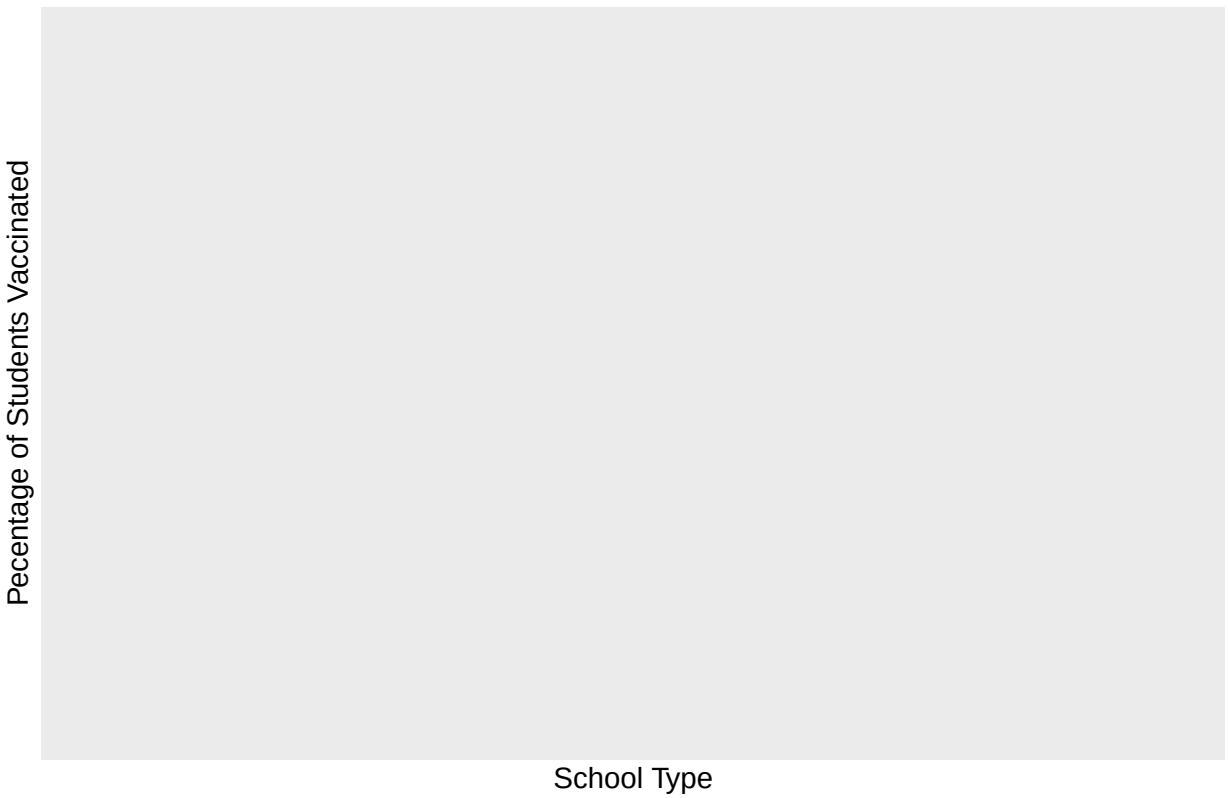

Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type


Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type


Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type


Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type


Vaccination Rates Across Different School Types
Pecentage of Students Vaccinated
School Type



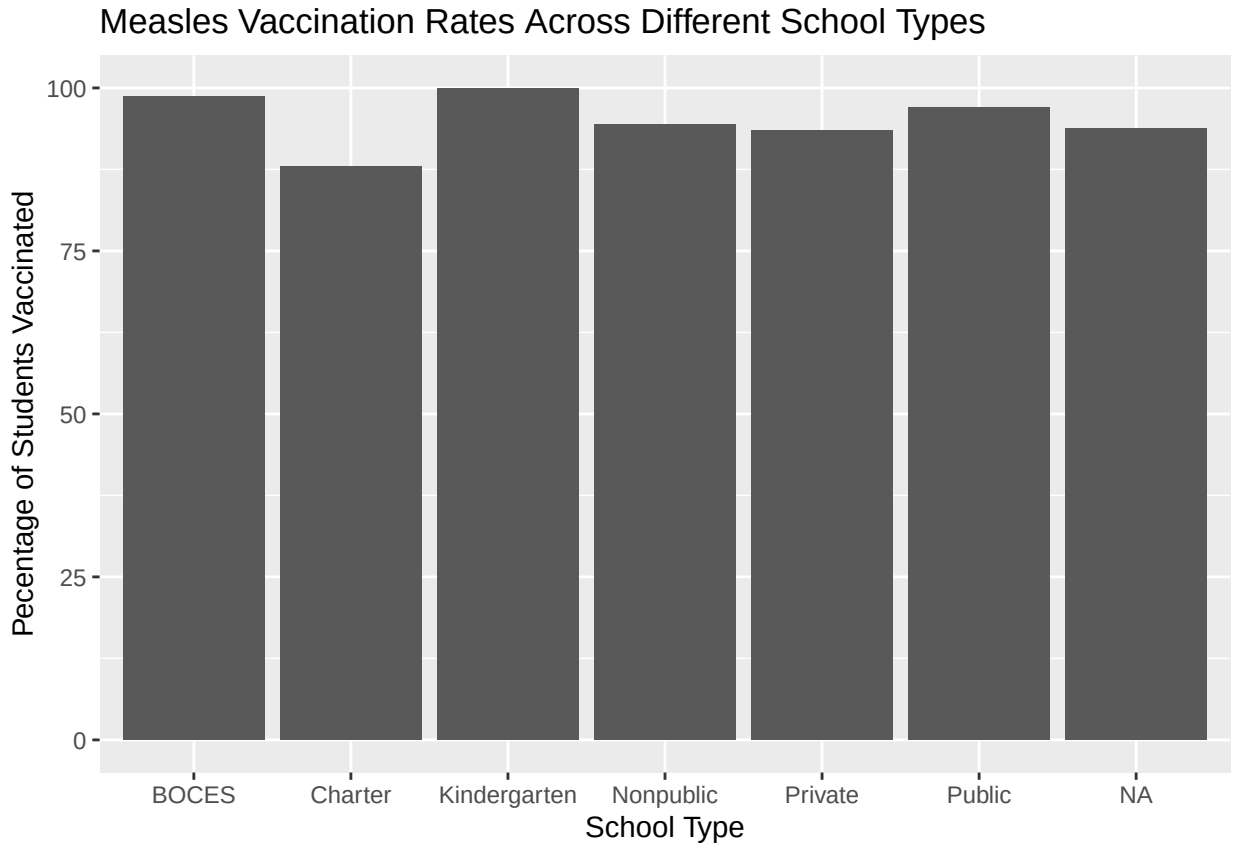
Exploratory Data Analysis

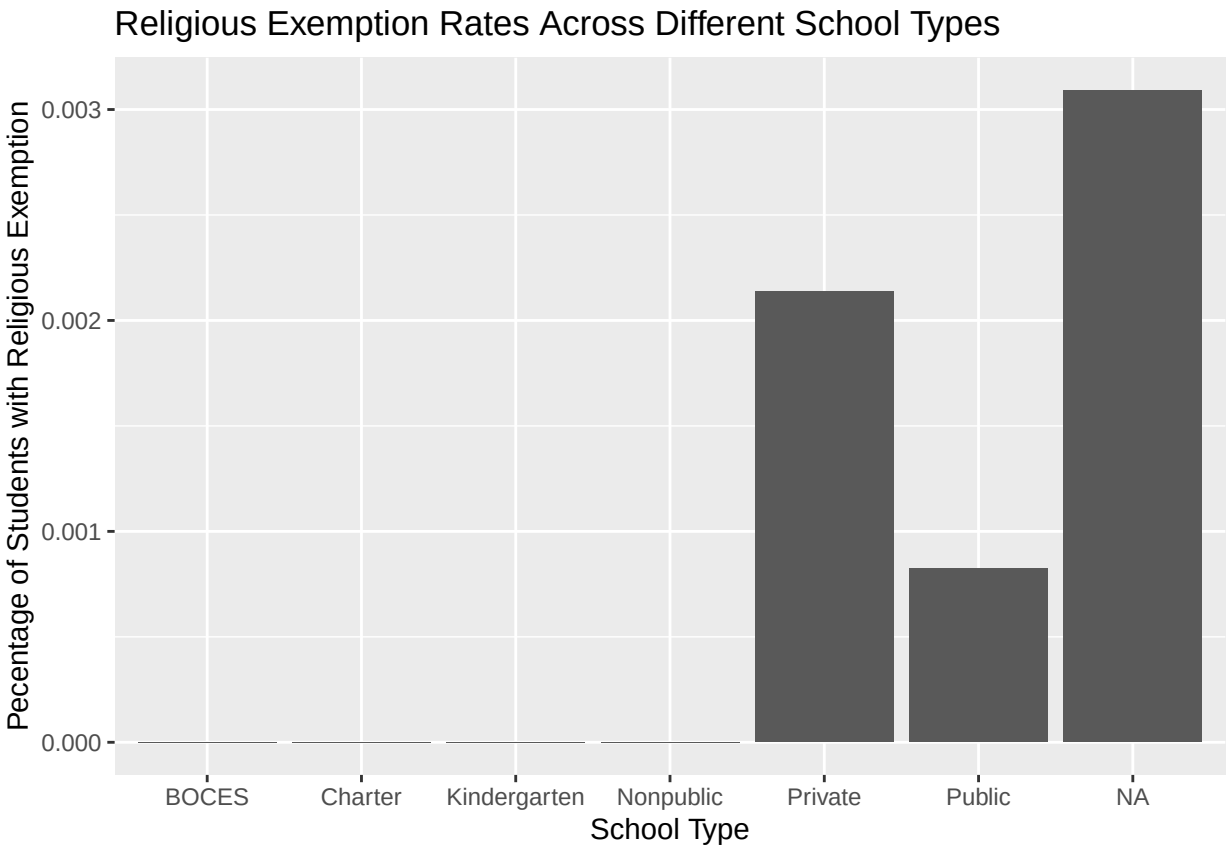
```
## # A tibble: 5,736 x 3
## # Groups:   mmr [3,901]
##    state     mmr     n
##    <chr>   <dbl> <int>
##  1 Arizona  15.4     3
##  2 Arizona  22.9     1
##  3 Arizona  37.9     1
##  4 Arizona  41.7     1
##  5 Arizona  42.9     1
##  6 Arizona  46.2     1
##  7 Arizona  47.4     1
##  8 Arizona  47.8     1
##  9 Arizona  48.0     1
## 10 Arizona  54.2     1
## # ... with 5,726 more rows
```

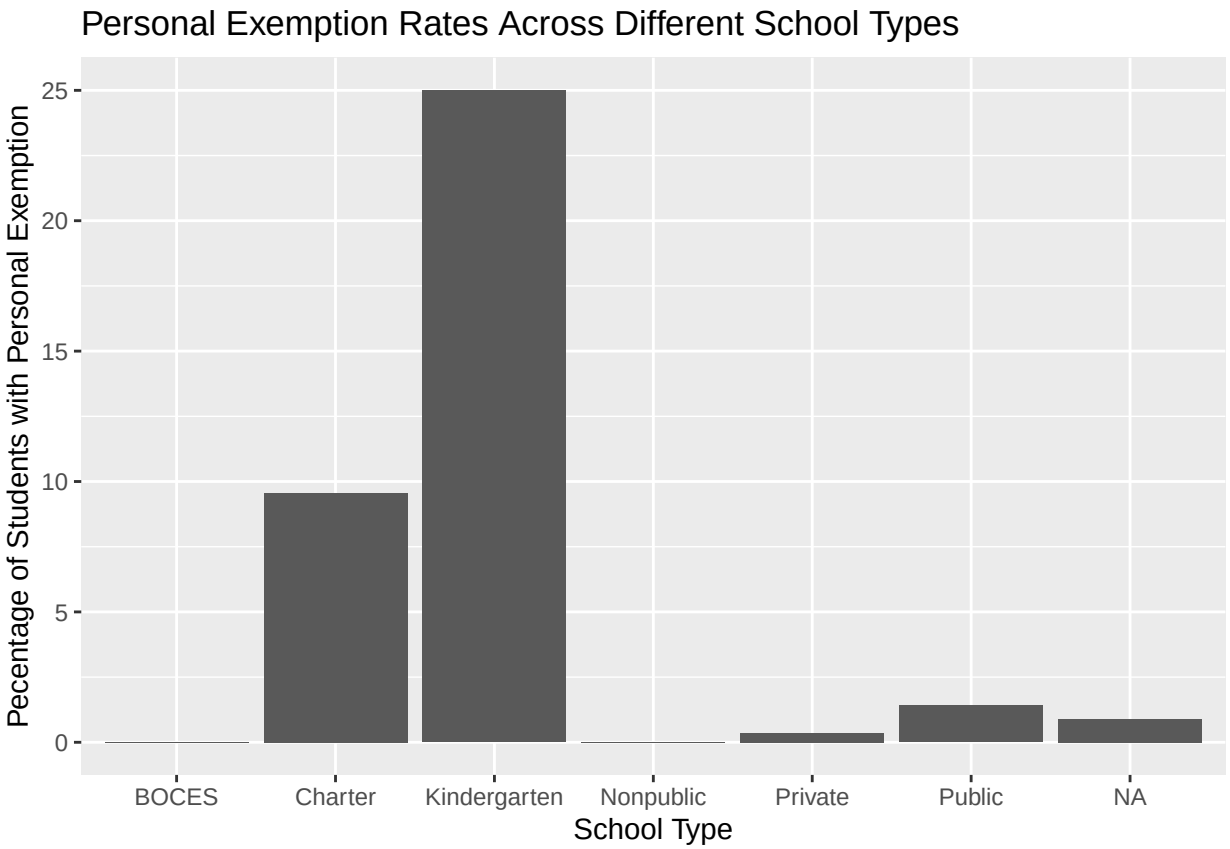
```
## # A tibble: 29 x 2
## # Groups:   state [29]
##    state           n
##    <chr>       <int>
##  1 Arizona      1171
##  2 Arkansas      567
##  3 California      1
##  4 Colorado        2
```

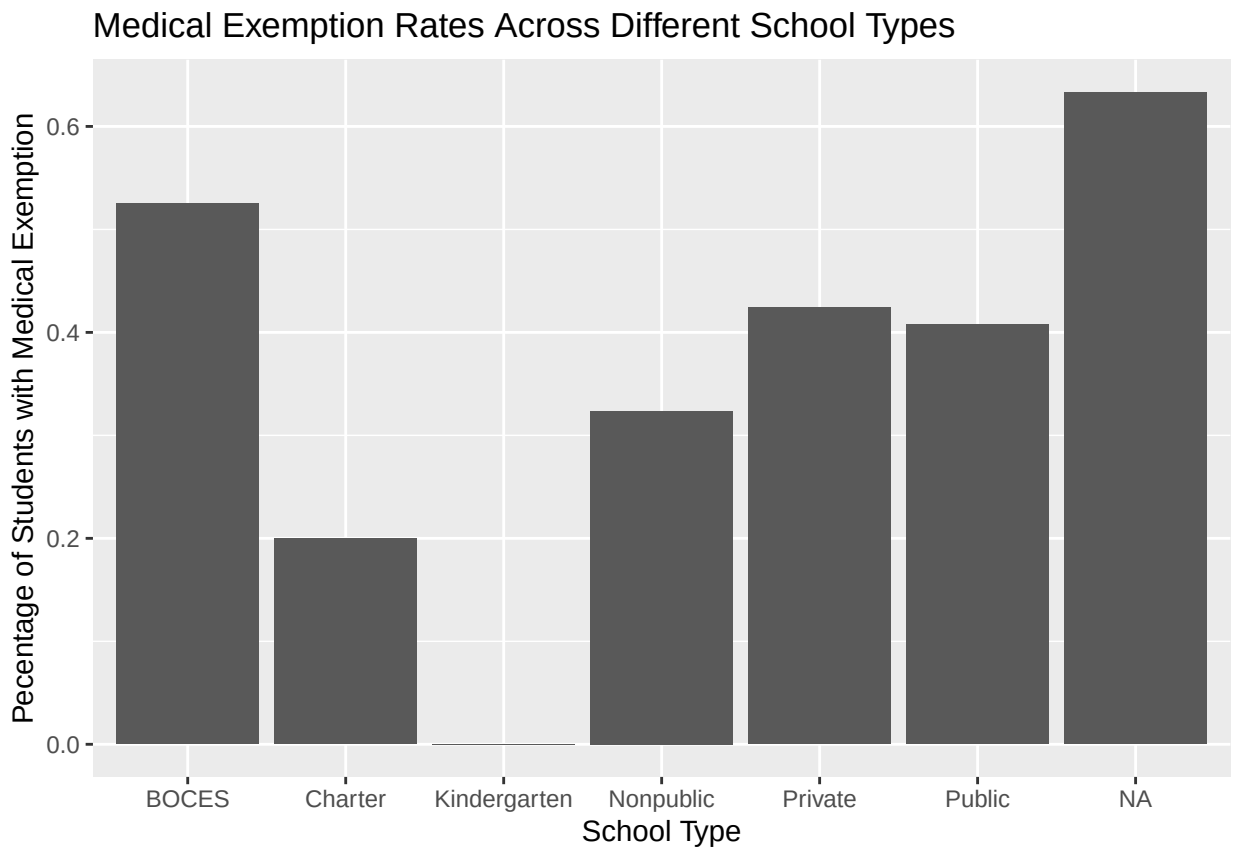
```
##  5 Connecticut   589
##  6 Florida      2672
##  7 Idaho         467
##  8 Illinois     7686
##  9 Iowa         1163
## 10 Maine         357
## # ... with 19 more rows
```

```
## # A tibble: 36 x 3
## # Groups:   type [7]
##    state       type            n
##    <chr>       <chr>       <int>
##  1 Arizona     Charter       217
##  2 Arizona     Private        74
##  3 Arizona     Public        880
##  4 Arkansas    <NA>          567
##  5 California  Public          1
##  6 Colorado    Kindergarten    2
##  7 Connecticut Nonpublic      18
##  8 Connecticut Public        571
##  9 Florida     <NA>         2672
## 10 Idaho       <NA>          467
## # ... with 26 more rows
```

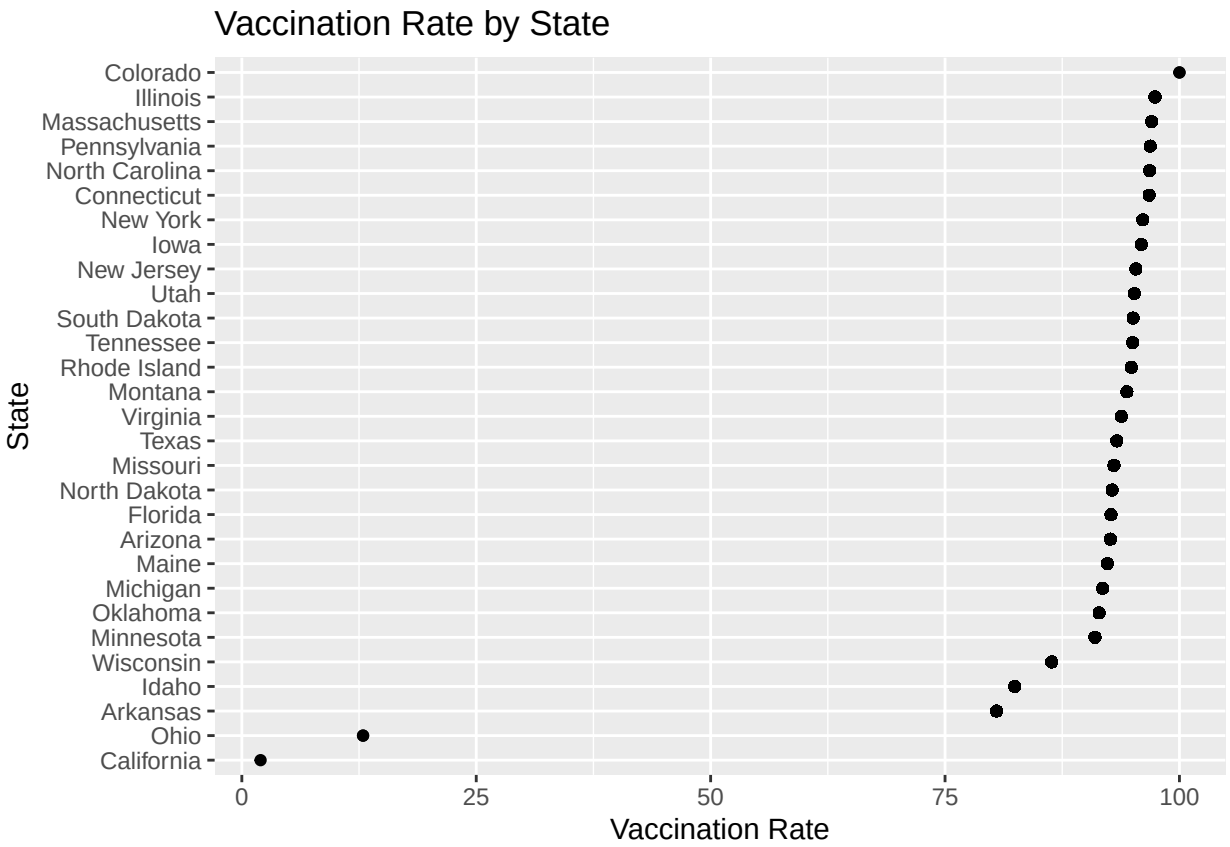



Religious Exemption Rates Across Different School Types
Pecentage of Students with Religious Exemption
0.003
0.002
0.001
0.000
BOCES
Charter
Kindergarten
Nonpublic
Private
Public
NA
School Type


Personal Exemption Rates Across Different School Types
Pecentage of Students with Personal Exemption
25
20
15
10
5
0
BOCES
Charter
Kindergarten
Nonpublic
Private
Public
NA
School Type

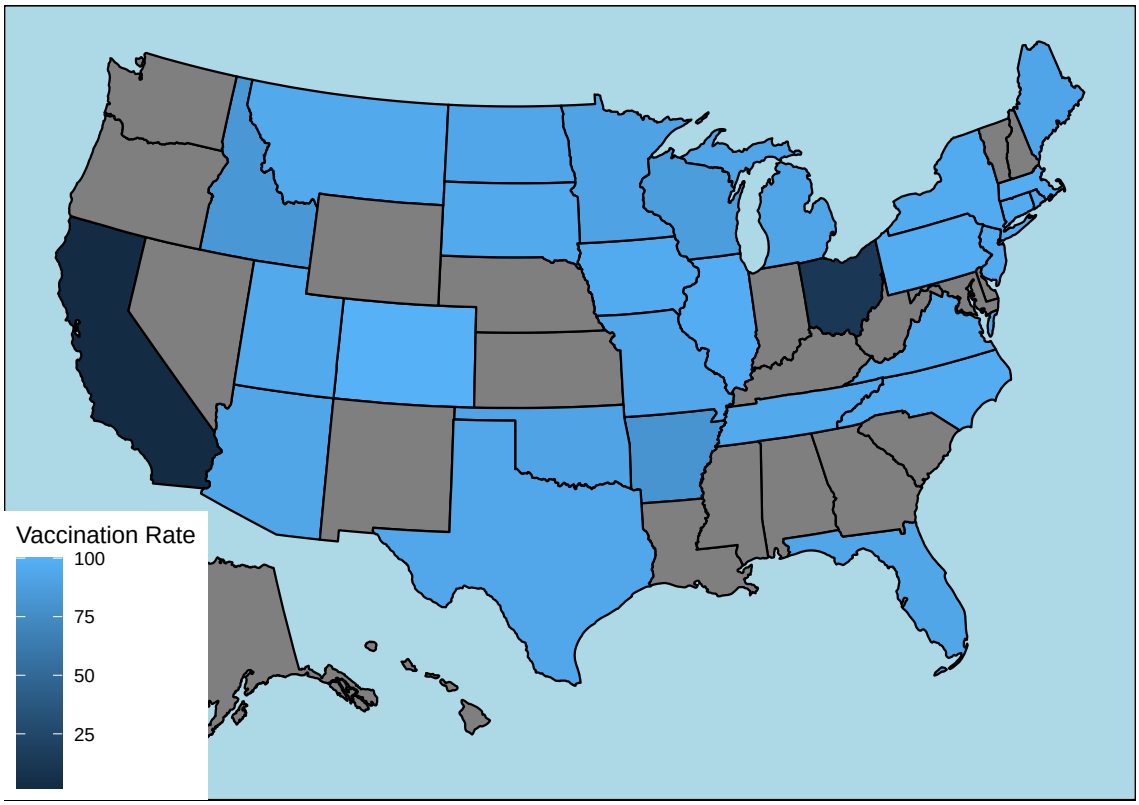



```
measles %>%
  ggplot(aes(x = statemean, y = reorder(state, statemean))) +
  geom_point() +
  labs(x = "Vaccination Rate", y = "State", title = "Vaccination Rate by State")
```



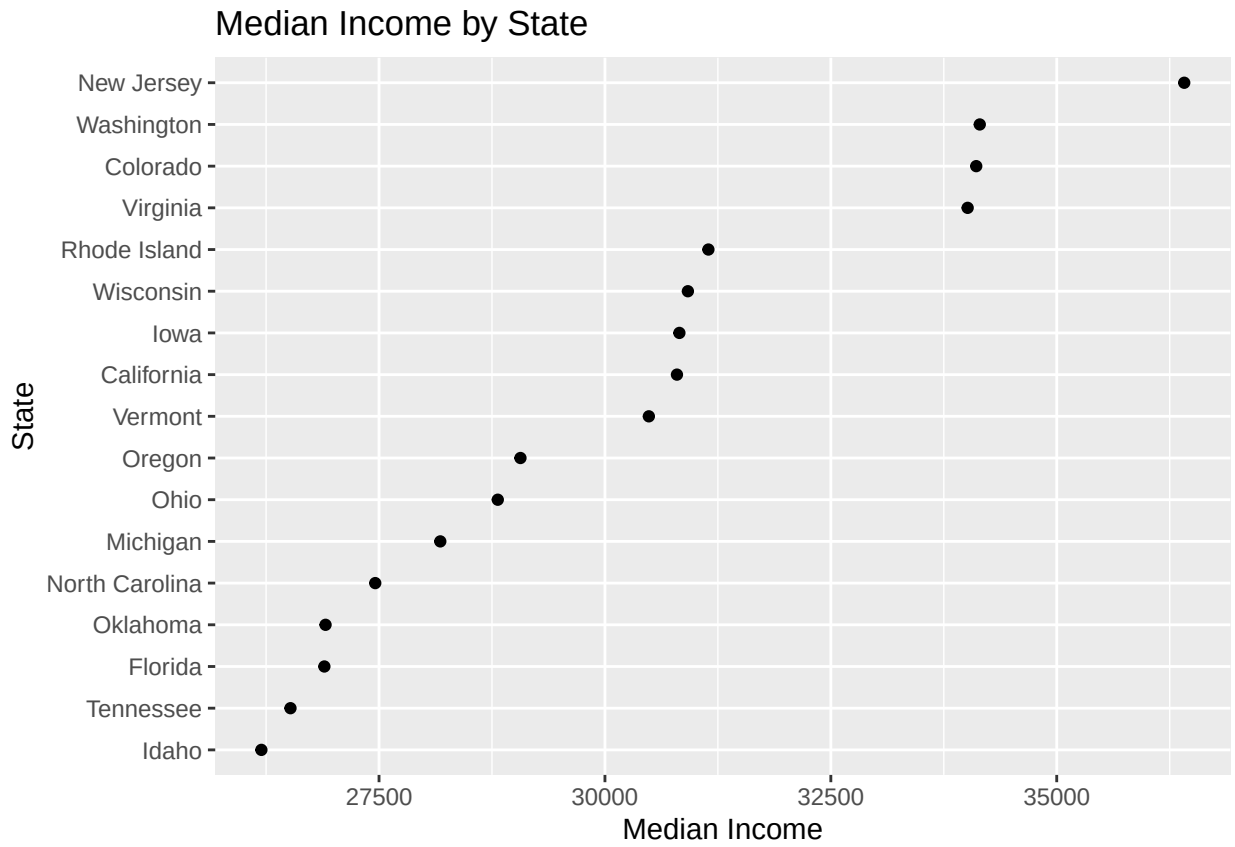

```
plotdata <- measles %>%
filter(realrate != (-1)) %>%
group_by(state) %>%
summarise(statemean = mean(realrate))
plot_usmap(data=plotdata, values = "statemean") +
  labs(title = "Vaccination Rate by State", fill = "Vaccination Rate") +
  theme(panel.background = element_rect(color = "black", fill =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

Vaccination Rate by State




```
## Getting data from the 2014-2018 5-year ACS
```

```
## # A tibble: 6 x 5
##   GEOID NAME       variable   estimate   moe
##   <chr> <chr>      <chr>         <dbl> <dbl>
## 1 01    Alabama    B07011_001    25375   132
## 2 02    Alaska     B07011_001    33413   428
## 3 04    Arizona    B07011_001    28815   147
## 4 05    Arkansas   B07011_001    24977   139
## 5 06    California B07011_001    30797    65
## 6 08    Colorado   B07011_001    34109   231
```




```
## Getting data from the 2014-2018 5-year ACS
```

```
## # A tibble: 6 x 5
##   GEOID NAME       variable   estimate   moe
##   <chr> <chr>      <chr>         <dbl> <dbl>
## 1 01    Alabama    B02001_002  3317453  3345
## 2 02    Alaska     B02001_002   478834  1368
## 3 04    Arizona    B02001_002  5364141  9871
## 4 05    Arkansas   B02001_002  2302874  2783
## 5 06    California B02001_002 23529068 26419
## 6 08    Colorado   B02001_002  4655584  5852
```

```
## Getting data from the 2014-2018 5-year ACS
```

```
## # A tibble: 6 x 5
##   GEOID NAME       variable   estimate   moe
##   <chr> <chr>      <chr>         <dbl> <dbl>
## 1 01    Alabama    B01003_001  4864680    NA
## 2 02    Alaska     B01003_001   738516    NA
## 3 04    Arizona    B01003_001  6946685    NA
## 4 05    Arkansas   B01003_001  2990671    NA
## 5 06    California B01003_001 39148760    NA
## 6 08    Colorado   B01003_001  5531141    NA
```

```
#racerates <- left_join(race, population, by="GEOID") %>%
#pivot_wider(names_from = "variable", values_from = "estimate")
```

```
#incomerates <- left_join(income, measles, by = "statemean")
```

```
 #summary(aov(state~statemean, data = measles))
```

```
measles3 <- measles %>%
 filter(type %in% c("Public", "Private")) %>%
 filter(realrate != (-1))
```

```
t.test(measles3$realrate~measles3$type)
```

```
##
##  Welch Two Sample t-test
##
## data:  measles3$realrate by measles3$type
## t = -11.461, df = 2665.4, p-value < 2.2e-16
## alternative hypothesis: true difference in means between group Private and group Public is not equal
## 95 percent confidence interval:
##  -4.075441 -2.884605
## sample estimates:
## mean in group Private  mean in group Public
##              93.47576              96.95578
```

Regression Analysis

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

```
##
## Call:  glm(formula = cbind(numvaxx, unvaxx) ~ statefac, family = binomial,
##     data = measles)
##
## Coefficients:
##            (Intercept)        statefacArkansas      statefacCalifornia
##               2.619172              -1.214998              -6.838680
##       statefacColorado         statefacFlorida        statefacIllinois
##               7.890725               0.002825               1.122926
##           statefacIowa          statefacMaine        statefacMichigan
##               0.587924               0.091579              -0.047001
##      statefacMinnesota         statefacMontana      statefacNew Jersey
##              -0.002653              -0.259731               0.670881
## statefacNorth Carolina    statefacNorth Dakota            statefacOhio
##               0.716962               0.062234              -4.680595
##   statefacPennsylvania    statefacRhode Island    statefacSouth Dakota
##               0.900324               0.511840               0.790630
##      statefacTennessee            statefacUtah        statefacVirginia
##               0.304427               0.476347               0.024633
##
## Degrees of Freedom: 28131 Total (i.e. Null);  28111 Residual
##   (11347 observations deleted due to missingness)
## Null Deviance:       316800
## Residual Deviance: 177000    AIC: 255100
```

```
summary(measlereg)
```

```
##
## Call:
## glm(formula = cbind(numvaxx, unvaxx) ~ statefac, family = binomial,
##     data = measles)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -154.356    -0.709     0.554     1.628    12.531
##
## Coefficients:
##                          Estimate Std. Error z value Pr(>|z|)
## (Intercept)              2.619172   0.013599 192.594  < 2e-16 ***
## statefacArkansas        -1.214998   0.014364 -84.584  < 2e-16 ***
## statefacCalifornia      -6.838680   1.007418  -6.788 1.13e-11 ***
## statefacColorado         7.890725  36.733652   0.215  0.82992
## statefacFlorida          0.002825   0.015823   0.179  0.85828
## statefacIllinois         1.122926   0.014195  79.107  < 2e-16 ***
## statefacIowa             0.587924   0.015962  36.833  < 2e-16 ***
## statefacMaine            0.091579   0.029166   3.140  0.00169 **
## statefacMichigan        -0.047001   0.017099  -2.749  0.00598 **
## statefacMinnesota       -0.002653   0.018816  -0.141  0.88786
## statefacMontana         -0.259731   0.016949 -15.324  < 2e-16 ***
## statefacNew Jersey       0.670881   0.021321  31.466  < 2e-16 ***
## statefacNorth Carolina   0.716962   0.020219  35.460  < 2e-16 ***
## statefacNorth Dakota     0.062234   0.036011   1.728  0.08395 .
## statefacOhio            -4.680595   0.401527 -11.657  < 2e-16 ***
## statefacPennsylvania     0.900324   0.021047  42.776  < 2e-16 ***
## statefacRhode Island     0.511840   0.049686  10.302  < 2e-16 ***
## statefacSouth Dakota     0.790630   0.052304  15.116  < 2e-16 ***
## statefacTennessee        0.304427   0.020575  14.796  < 2e-16 ***
## statefacUtah             0.476347   0.016331  29.169  < 2e-16 ***
## statefacVirginia         0.024633   0.018849   1.307  0.19125
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 316820  on 28131  degrees of freedom
## Residual deviance: 177046  on 28111  degrees of freedom
##   (11347 observations deleted due to missingness)
## AIC: 255119
##
## Number of Fisher Scoring iterations: 8
```

```
# linear_reg() %>%
# set_engine("lm") %>%
# fit(statemean ~ estimate, data = measleincome) %>%
# tidy()
```