Class17_MiniProject

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11/23/2021

Mini-Project COVID Vaccination Rates

As we approach a period of travel and larger gatherings lets have a look at vaccination rates across the State.

We will take data from the CA.gov site here: - "Statewide COVID-19 Vaccines Administered by ZIP Code" CSV file from: https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code"

```
vax <- read.csv("covid19vaccinesbyzipcode_test.csv")
head(vax)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   92804                    Orange    Orange
## 2 2021-01-05                   92626                    Orange    Orange
## 3 2021-01-05                   92250                  Imperial  Imperial
## 4 2021-01-05                   92637                    Orange    Orange
## 5 2021-01-05                   92155                 San Diego San Diego
## 6 2021-01-05                   92259                  Imperial  Imperial
##   vaccine_equity_metric_quartile                vem_source
## 1                              2 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                             NA            No VEM Assigned
## 6                              1    CDPH-Derived ZCTA Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               76455.9                84200                      19
## 2               44238.8                47883                      NA
## 3                7098.5                 8026                      NA
## 4               16027.4                16053                      NA
## 5                 456.0                  456                      NA
## 6                 119.0                  121                      NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         1282                                0.000226
## 2                           NA                                      NA
## 3                           NA                                      NA
## 4                           NA                                      NA
## 5                           NA                                      NA
## 6                           NA                                      NA
##   percent_of_population_partially_vaccinated
## 1                                   0.015226
## 2                                         NA
```

```
## 3                                          NA
## 4                                          NA
## 5                                          NA
## 6                                          NA
##   percent_of_population_with_1_plus_dose
## 1                               0.015452
## 2                                     NA
## 3                                     NA
## 4                                     NA
## 5                                     NA
## 6                                     NA
##                                                                    redacted
## 1                                                                        No
## 2 Information redacted in accordance with CA state privacy requirements
## 3 Information redacted in accordance with CA state privacy requirements
## 4 Information redacted in accordance with CA state privacy requirements
## 5 Information redacted in accordance with CA state privacy requirements
## 6 Information redacted in accordance with CA state privacy requirements
```

Ensure the date column is useful

We will use the **lubridate** package, which can make life allot easier when dealing with dates and times

Q1. What column details the total number of people fully vaccinated?

The column 'persons_fully_vaccinated'.

Q2. What column details the Zip code tabulation area?

The column 'zip_code_tabulation_area'.

Q3. What is the earliest date in this dataset?

```
vax$as_of_date[1]
```

```
## [1] "2021-01-05"
```

Q4. What is the latest date in this dataset?

```
vax$as_of_date[nrow(vax)]
```

```
## [1] "2021-11-16"
```

Quick look at the data structure

As before we can use the **skim()** function to quickly overview and summarize the various columns of the dataset.

```
skimr::skim(vax)
```

Table 1: Data summary

Name	vax
Number of rows	81144
Number of columns	14
Column type frequency:	
character	5
numeric	9
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
as_of_date	0	1	10	10	0	46	0
local_health_jurisdiction	0	1	0	15	230	62	0
county	0	1	0	15	230	59	0
vem_source	0	1	15	26	0	3	0
redacted	0	1	2	69	0	2	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
zip_code_tabulation_area	0	1.00	93665.11	817.39	90001	92257.75	93658.50	95380.50	97635.0	
vaccine_equity_metric_quartile	1002	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.94	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21106.05	0	1460.50	15364.00	34877.00	101902.0	
persons_fully_vaccinated	8256	0.90	9456.49	11498.25	11	506.00	4105.00	15859.00	71078.0	
persons_partially_vaccinated	8256	0.90	1900.61	2113.07	11	200.00	1271.00	2893.00	20185.0	
percent_of_population_fully_vaccinated	8256	0.90	0.42	0.27	0	0.19	0.44	0.62	1.0	
percent_of_population_partially_vaccinated	8256	0.90	0.10	0.10	0	0.06	0.07	0.11	1.0	
percent_of_population_with_1_plus_dose	8256	0.90	0.50	0.26	0	0.30	0.53	0.70	1.0	

Q5. How many numeric columns are in this dataset?

There are nine numeric columns in this data set.

Q6. Note that there are "missing values" in the dataset. How many NA values there in the persons_fully_vaccinated column?

```
sum(is.na(vax$persons_fully_vaccinated))
```

```
## [1] 8256
```

Q7. What percent of persons_fully_vaccinated values are missing (to 2 significant figures)?

There is 10.00% of the persons_fully_vaccinate values missing.

Q8. [Optional]: Why might this data be missing?

They might be missing because of the military bases (or other areas) may not be contributing data.

Working with dates

```
# install.packages("lubridate")

library(lubridate)
```

```
##
## Attaching package: 'lubridate'

## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
today()
```

```
## [1] "2021-11-23"
```

Here we make our data 'as_of_date' column lubridate format...

```
# Specify that we are using the Year-month-day format
vax$as_of_date <- ymd(vax$as_of_date)
```

Now I can do useful math with dates more easily:

Q. How many days since the first entry?

```
today() - vax$as_of_date[1]
```

```
## Time difference of 322 days
```

Q. How many days since the last entry?

```
today() - vax$as_of_date[nrow(vax)]
```

```
## Time difference of 7 days
```

Q9. How many days between the first and last entry in the data set?

```
vax$as_of_date[nrow(vax)] - vax$as_of_date[1]
```

```
## Time difference of 315 days
```

Q10. How many unique dates are in the dataset (i.e. how many different dates are detailed)?

```
length(unique(vax$as_of_date))
```

```
## [1] 46
```

This sounds good;

```
46*7
```

```
## [1] 322
```

Working with ZIP Codes

```
#install.packages("zipcodeR")
#install.packages("terra")
```

```
library(zipcodeR)

geocode_zip('92037')
```

```
## # A tibble: 1 x 3
##   zipcode   lat   lng
##   <chr>   <dbl> <dbl>
## 1 92037    32.8 -117.
```

More usefully, we can pull census data about ZIP code areas (including median household income etc.). For example:

```
reverse_zipcode(c('92037', "92109") )
```

```
## # A tibble: 2 x 24
##   zipcode zipcode_type major_city post_office_city common_city_list county state
##   <chr>   <chr>        <chr>      <chr>                     <blob> <chr>  <chr>
## 1 92037   Standard     La Jolla   La Jolla, CA           <raw 20 B> San D~ CA
## 2 92109   Standard     San Diego  San Diego, CA          <raw 21 B> San D~ CA
## # ... with 17 more variables: lat <dbl>, lng <dbl>, timezone <chr>,
## #   radius_in_miles <dbl>, area_code_list <blob>, population <int>,
## #   population_density <dbl>, land_area_in_sqmi <dbl>,
## #   water_area_in_sqmi <dbl>, housing_units <int>,
## #   occupied_housing_units <int>, median_home_value <int>,
## #   median_household_income <int>, bounds_west <dbl>, bounds_east <dbl>,
## #   bounds_north <dbl>, bounds_south <dbl>
```

Focus on San Diego County

Using base R;

```
# Subset to San Diego county only areas
inds <- vax$county == "San Diego"

head(vax[inds,])
```

```
##    as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 5  2021-01-05                   92155                San Diego San Diego
## 14 2021-01-05                   92147                San Diego San Diego
## 16 2021-01-05                   92124                San Diego San Diego
## 24 2021-01-05                   92145                San Diego San Diego
## 34 2021-01-05                   91935                San Diego San Diego
## 36 2021-01-05                   92102                San Diego San Diego
##    vaccine_equity_metric_quartile               vem_source
## 5                              NA           No VEM Assigned
## 14                             NA           No VEM Assigned
## 16                              3 Healthy Places Index Score
## 24                             NA           No VEM Assigned
## 34                              3 Healthy Places Index Score
## 36                              1 Healthy Places Index Score
##    age12_plus_population age5_plus_population persons_fully_vaccinated
## 5                  456.0                  456                       NA
## 14                 518.0                  518                       NA
## 16               25422.4                29040                       29
## 24                1603.5                 1821                       NA
## 34                7390.0                 8101                       NA
## 36               37042.3                41033                       29
##    persons_partially_vaccinated percent_of_population_fully_vaccinated
## 5                            NA                                     NA
## 14                           NA                                     NA
## 16                          573                                0.000999
## 24                           NA                                     NA
## 34                           NA                                     NA
## 36                         1495                                0.000707
##    percent_of_population_partially_vaccinated
## 5                                          NA
## 14                                         NA
## 16                                   0.019731
## 24                                         NA
## 34                                         NA
## 36                                   0.036434
##    percent_of_population_with_1_plus_dose
## 5                                      NA
## 14                                     NA
## 16                               0.020730
## 24                                     NA
## 34                                     NA
## 36                               0.037141
##                                                                redacted
## 5  Information redacted in accordance with CA state privacy requirements
```

```
## 14 Information redacted in accordance with CA state privacy requirements
## 16                                                                     No
## 24 Information redacted in accordance with CA state privacy requirements
## 34 Information redacted in accordance with CA state privacy requirements
## 36                                                                     No
```

Using the **dplyr** package;

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
sd <- filter(vax, county == "San Diego")

#How many entries are there in San Diego County?
nrow(sd)
```

```
## [1] 4922
```

```
sd.10 <- filter(vax, county == "San Diego" &
                age5_plus_population > 10000)
```

Q11. How many distinct zip codes are listed for San Diego County?

```
length(unique(sd$zip_code_tabulation_area))
```

```
## [1] 107
```

Q12. What San Diego County Zip code area has the largest 12 + Population in this dataset

```
ind <- which.max(sd$age12_plus_population)
sd[ind, ]
```

```
##    as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 23 2021-01-05                   92154                San Diego San Diego
##    vaccine_equity_metric_quartile                vem_source
## 23                              2 Healthy Places Index Score
##    age12_plus_population age5_plus_population persons_fully_vaccinated
## 23               76365.2                82971                        32
##    persons_partially_vaccinated percent_of_population_fully_vaccinated
```

```
## 23                          1336                                0.000386
##    percent_of_population_partially_vaccinated
## 23                                   0.016102
##    percent_of_population_with_1_plus_dose redacted
## 23                                0.016488       No
```

Q. What is the population in the 92037 ZIP Code area?

```
filter(sd, zip_code_tabulation_area == "92037")[1,]
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   92037                San Diego San Diego
##   vaccine_equity_metric_quartile                vem_source
## 1                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               33675.6                36144                        44
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         1265                                0.001217
##   percent_of_population_partially_vaccinated
## 1                                   0.034999
##   percent_of_population_with_1_plus_dose redacted
## 1                                0.036216       No
```

Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2021-11-09"?

```
sd.now <- filter(sd, as_of_date == "2021-11-09")

head(sd.now)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-11-09                   92075                San Diego San Diego
## 2 2021-11-09                   92130                San Diego San Diego
## 3 2021-11-09                   92060                San Diego San Diego
## 4 2021-11-09                   92091                San Diego San Diego
## 5 2021-11-09                   92020                San Diego San Diego
## 6 2021-11-09                   92004                San Diego San Diego
##   vaccine_equity_metric_quartile                vem_source
## 1                              4 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              3    CDPH-Derived ZCTA Score
## 4                              4    CDPH-Derived ZCTA Score
## 5                              2 Healthy Places Index Score
## 6                              2 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1              11136.3                12177                      9504
## 2              46300.3                53102                     45517
## 3                166.0                  166                       153
## 4               1238.3                 1303                      1159
## 5              49284.5                54991                     34904
## 6               2151.8                 2186                      2582
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
```

```
## 1                          1623                                0.780488
## 2                          6642                                0.857162
## 3                            34                                0.921687
## 4                           221                                0.889486
## 5                          4688                                0.634722
## 6                           514                                1.000000
##   percent_of_population_partially_vaccinated
## 1                                   0.133284
## 2                                   0.125080
## 3                                   0.204819
## 4                                   0.169609
## 5                                   0.085250
## 6                                   0.235133
##   percent_of_population_with_1_plus_dose redacted
## 1                               0.913772       No
## 2                               0.982242       No
## 3                               1.000000       No
## 4                               1.000000       No
## 5                               0.719972       No
## 6                               1.000000       No
```

```
mean(sd.now$percent_of_population_fully_vaccinated, na.rm = TRUE)
```

```
## [1] 0.6727567
```

To get the 6-number summary;

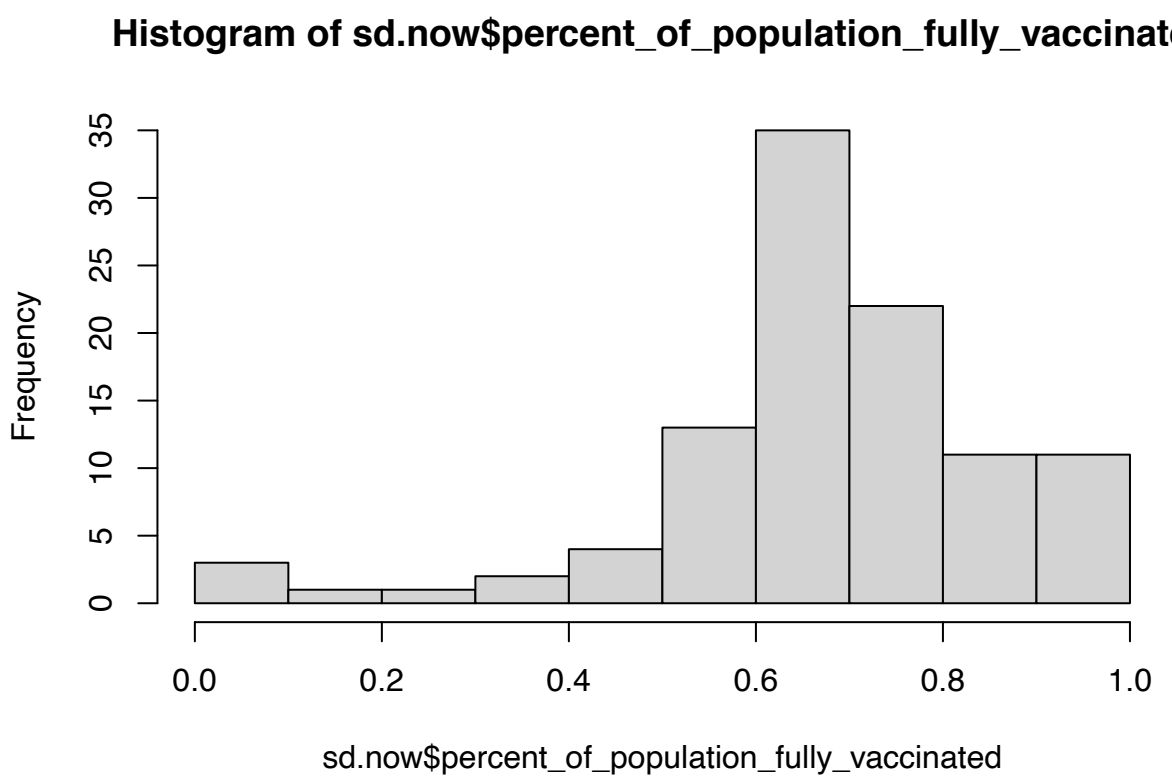
```
summary(sd.now$percent_of_population_fully_vaccinated)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
## 0.01017 0.60776 0.67700 0.67276 0.76164 1.00000       4
```

Q14. Using either ggplot or base R graphics make a summary figure that shows the distribution of Percent of Population Fully Vaccinated values as of "2021-11-09"?

Using base R;

```
hist(sd.now$percent_of_population_fully_vaccinated)
```

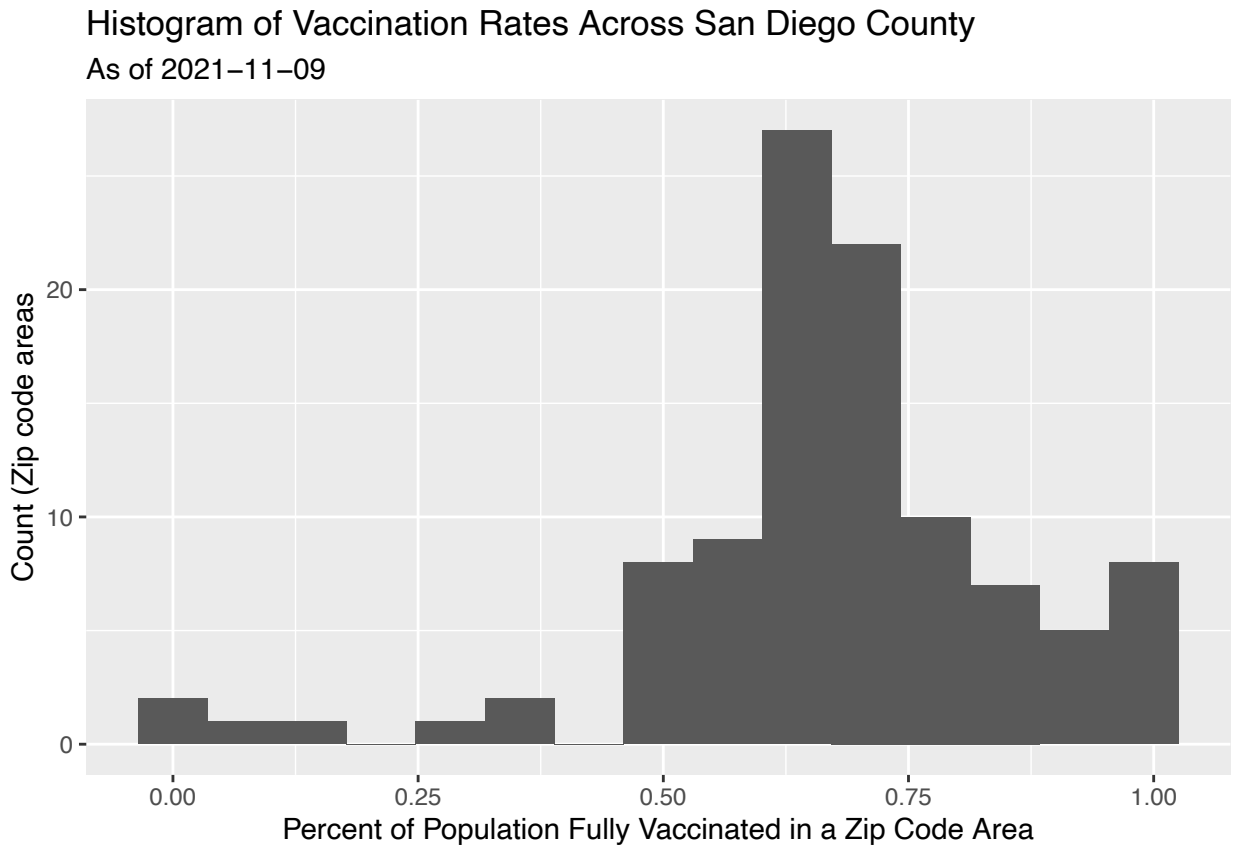


Using ggplot;

```
library(ggplot2)

ggplot(sd.now) +
  aes(percent_of_population_fully_vaccinated) + geom_histogram(bins = 15) + labs(title = "Histogram of
```

```
## Warning: Removed 4 rows containing non-finite values (stat_bin).
```



Focus on UCSD/La Jolla

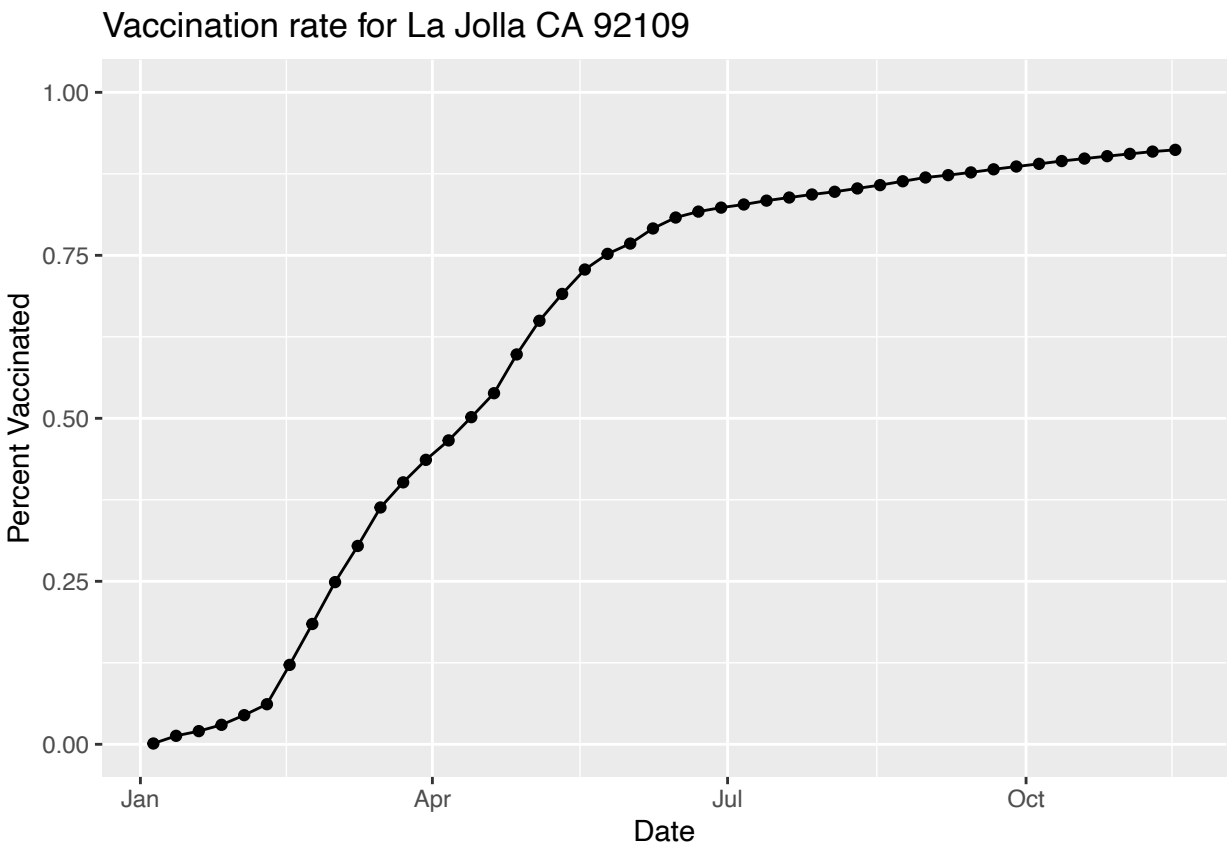
```
ucsd <- filter(sd, zip_code_tabulation_area=="92037")

ucsd[1,]$age5_plus_population
```

```
## [1] 36144
```

Q15. Using ggplot make a graph of the vaccination rate time course for the 92037 ZIP code area:

```
ggplot(ucsd) +
  aes(as_of_date,
  percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  ylim(c(0,1)) +
  labs(title = "Vaccination rate for La Jolla CA 92109", x = "Date", y="Percent Vaccinated")
```



We have about ~90% fully vaccinated.

Comparing 92037 to other similar sized areas

Let's return to the full dataset and look across every zip code area with a population at least as large as that of 92037 on as_of_date "2021-11-16".

```
# Subset to all CA areas with a population as large as 92037
vax.36.all <- filter(vax, age5_plus_population > 36144)

nrow(vax.36.all)
```

```
## [1] 18906
```

How many unique zip codes have a population as large as 92037?

```
length(unique(vax.36.all$zip_code_tabulation_area))
```

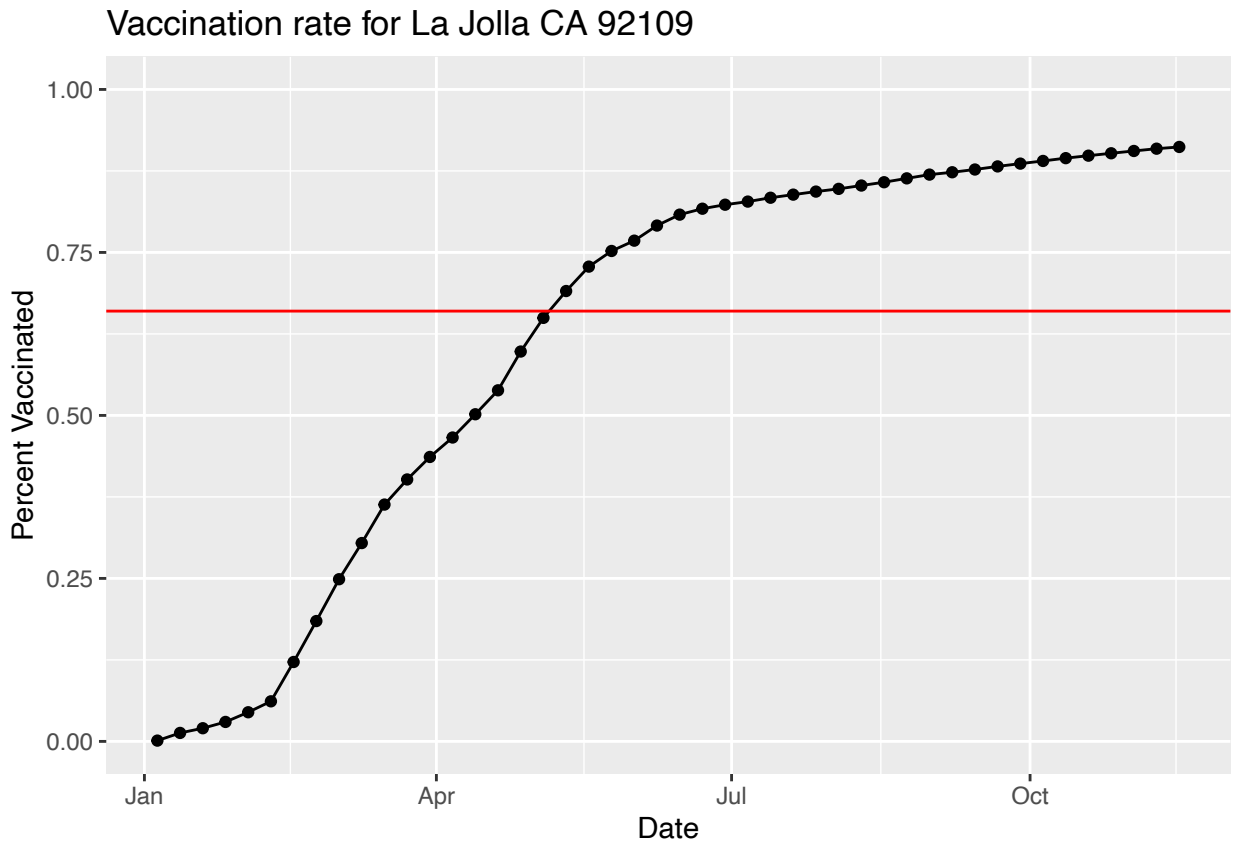
```
## [1] 411
```

Q16. Calculate the mean "Percent of Population Fully Vaccinated" for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

```
#mean(vax.36$percent_of_population_fully_vaccinated)
```

Add H-line

```
ggplot(ucsd) +
  aes(as_of_date,
  percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  geom_hline(yintercept = 0.66, col = "red") +
  ylim(c(0,1)) +
  labs(title = "Vaccination rate for La Jolla CA 92109", x = "Date", y="Percent Vaccinated")
```



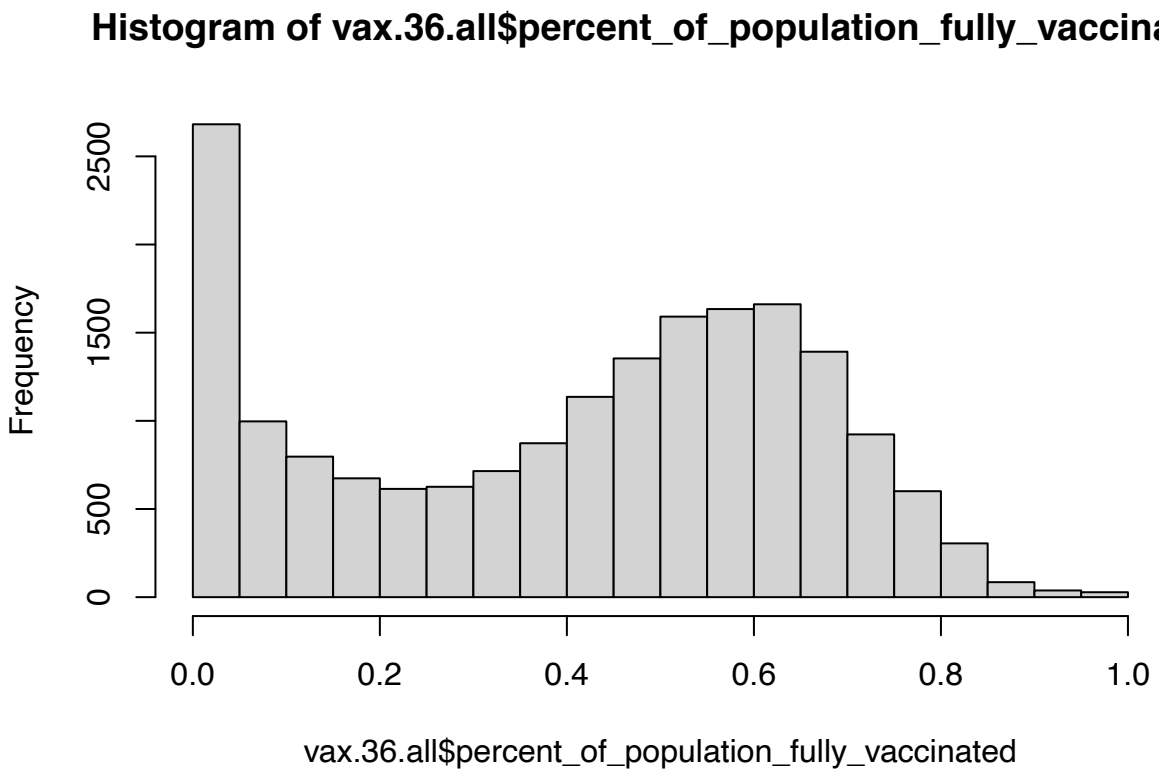
Q17. What is the 6 number summary (Min, 1st Qu., Median, Mean, 3rd Qu., and Max) of the "Percent of Population Fully Vaccinated" values for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16"?

```
summary(vax.36.all$percent_of_population_fully_vaccinated)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
## 0.00012 0.16384 0.46031 0.40615 0.61044 1.00000     180
```

Q18. Using ggplot generate a histogram of this data.

```
hist(vax.36.all$percent_of_population_fully_vaccinated)
```



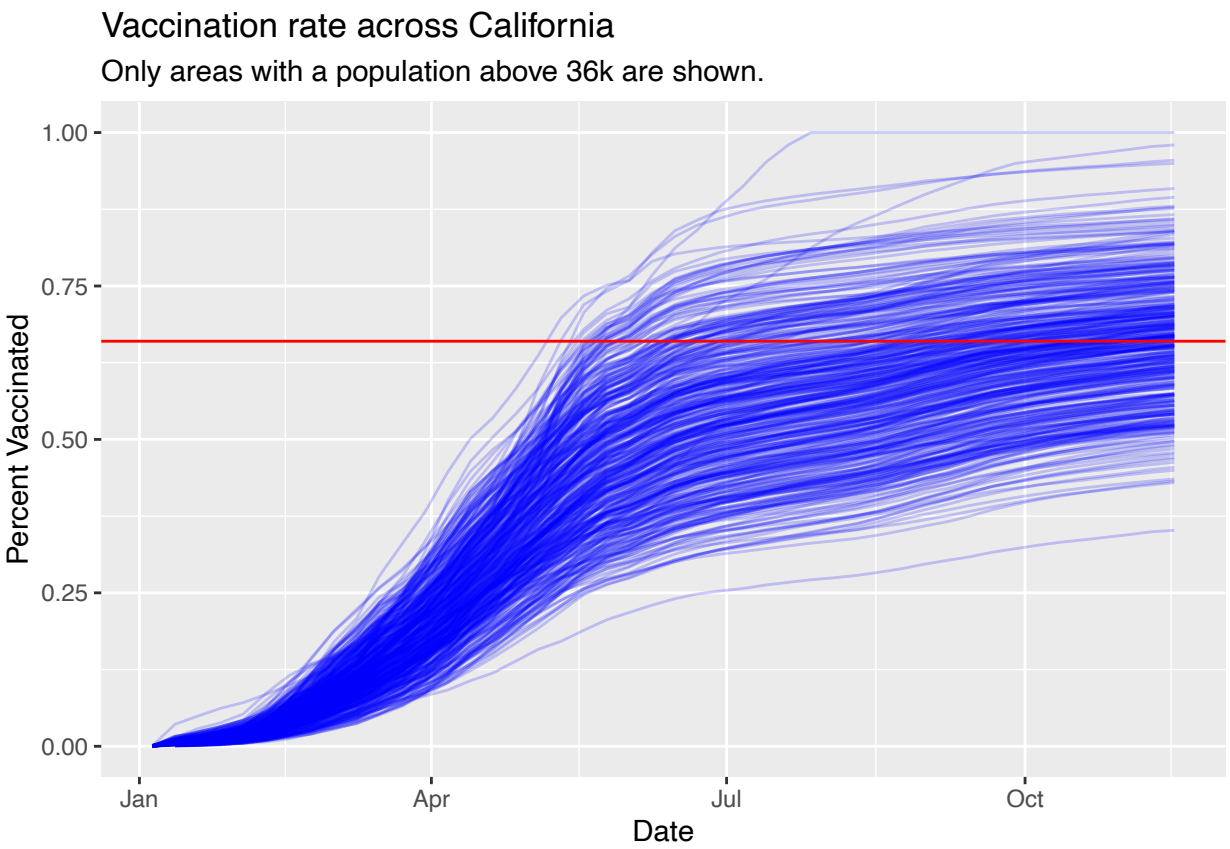
Q19. Is the 92109 and 92040 ZIP code areas above or below the average value you calculated for all these above?

They are below the average value I calculated.

Q20. Finally make a time course plot of vaccination progress for all areas in the full dataset with a age5_plus_population > 36144.

```
ggplot(vax.36.all) +
  aes(as_of_date,
      percent_of_population_fully_vaccinated,
      group = zip_code_tabulation_area) +
      geom_line(alpha = 0.2, col = "blue") +
      geom_hline(yintercept = 0.66, col = "red") + labs(title = "Vaccination rate across California", su
```

```
## Warning: Removed 180 row(s) containing missing values (geom_path).
```



Q21. How do you feel about traveling for Thanksgiving and meeting for in-person class next Week?

I would rather not meet in person. I feel like we're going to see high rates of exposure, even if everyone is fully vaccinated. I would be happy to log online during next week's classes; or at least maybe we could have a hybrid week? Maybe Tuesday online and Thursday in person (after hopefully everyone gets tested); I do like the help in person provides, I'm just a little scared about potential exposure.