Covid_vaccination_rates

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Import Vaccination Data

Import CA data on COVID vaccines administered by zipcode from: https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code/resource/15702a90-aa5d-49bc-8621-a8129630725a

NOTE: answers in this lab report may differ from answer key on lab walk through b/c data has been updated since last week as of 11/30/21.

```
# Import CSV
vax <- read.csv("./covid19vaccinesbyzipcode_test.csv", header = TRUE)
head(vax)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction       county
## 1 2021-01-05                   92091                San Diego    San Diego
## 2 2021-01-05                   92116                San Diego    San Diego
## 3 2021-01-05                   95360               Stanislaus   Stanislaus
## 4 2021-01-05                   94564             Contra Costa Contra Costa
## 5 2021-01-05                   95501                 Humboldt     Humboldt
## 6 2021-01-05                   95492                   Sonoma       Sonoma
##   vaccine_equity_metric_quartile               vem_source
## 1                              4   CDPH-Derived ZCTA Score
## 2                              3 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              4 Healthy Places Index Score
## 5                              2 Healthy Places Index Score
## 6                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1                1238.3                 1303                       NA
## 2               30255.7                31673                       45
## 3               10478.5                12301                       NA
## 4               17033.0                18381                       NA
## 5               20566.6                22061                       NA
## 6               25076.9                28024                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                          898                                0.001421
## 3                           NA                                     NA
## 4                           NA                                     NA
## 5                           NA                                     NA
## 6                           NA                                     NA
##   percent_of_population_partially_vaccinated
```

```
## 1                                       NA
## 2                                 0.028352
## 3                                       NA
## 4                                       NA
## 5                                       NA
## 6                                       NA
##   percent_of_population_with_1_plus_dose
## 1                                     NA
## 2                                0.029773
## 3                                     NA
## 4                                     NA
## 5                                     NA
## 6                                     NA
##                                                                  redacted
## 1 Information redacted in accordance with CA state privacy requirements
## 2                                                                      No
## 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
```

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

```
head(vax$persons_fully_vaccinated)
```

```
## [1] NA 45 NA NA NA NA
```

Q2. What column details the Zip code tabulation area?

```
head(vax$zip_code_tabulation_area)
```

```
## [1] 92091 92116 95360 94564 95501 95492
```

Q3. What is the earliest date in this dataset? "2021-01-05"

```
head(vax$as_of_date)
```

```
## [1] "2021-01-05" "2021-01-05" "2021-01-05" "2021-01-05" "2021-01-05"
## [6] "2021-01-05"
```

Q4. What is the latest date in this dataset? "2021-11-30". Note, this differs from lab report solutions because the dataset has been updated since 11/24 when class was held.

```
dim(vax)
```

```
## [1] 84672    14
```

```
vax$as_of_date[84672]
```

```
## [1] "2021-11-30"
```

Look at overview of df

```
# Install and load Skimr package
#install.packages("skimr")
library(skimr)

#skimr::skim(vax)
```

Q5. How many numeric columns are in this dataset? 9

Q6. Note that there are "missing values" in the dataset. How many NA values there in the persons_fully_vaccinated column? 8472. This numer was taken from the skimr report, from the "n_missing" column. Note, this differs from lab report solutions because the dataset has been updated since 11/24 when class was held.

Q7. What percent of persons_fully_vaccinated values are missing (to 2 significant figures)? 10.01 %

```
# Find dimension of data frame
dim(vax)
```

```
## [1] 84672    14
```

```
# Divide # of missing values for persons_fully_vaccinated by number of columns
round(((8472/84672)*100), 2)
```

```
## [1] 10.01
```

Working with Dates

We need to change dates in our vax$as_of_date column to useful format using the lubridate package so that we can work with our data in R

```
library(lubridate)
```

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

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

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

How many days have passed since the first vaccination reported in this dataset?

```
# Now that dates have been reformatted, we can now do math with our as_of_date column

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

```
## Time difference of 332 days
```

how many days does the the dataset span?

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

```
## Time difference of 329 days
```

Q9. How many days have passed since the last update of the dataset? 3 days

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

```
## Time difference of 3 days
```

Q10. How many unique dates are in the dataset (i.e. how many different dates are detailed)? 48

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

```
## [1] 48
```

Working with Zip Codes

Will be using zipcodeR package to make working with zip codes easier

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

Note: reverse_zipcode function, which gathers census data, can be used to investigate if various soceioeconomic factors correlate with vaccination rates

```
# Calculate the distance between the centroids of two zip codes. E.g.:
zip_distance('92037','92109')
```

```
##   zipcode_a zipcode_b distance
## 1     92037     92109     2.33
```

```
# Pull census data for the following zip codes
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 the San Diego Area

```
# Subset to San Diego county only areas using base R
sd <- vax[ vax$county == "San Diego", ]

# Alternatively, we could have subset to San Diego using dplyr:
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")

nrow(sd)
```

```
## [1] 5136
```

Q11. How many distinct zip codes are listed for San Diego County? 107

```
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? 92154

```
sd$zip_code_tabulation_area[which.max(sd$age12_plus_population)]
```

```
## [1] 92154
```

Using dplyr select all San Diego "county" entries on "as_of_date" "2021-11-09" and use this for the following questions.

```
# Data on as of date nov 9th
sd_nov_9 <- filter(sd, as_of_date == "2021-11-09")
```

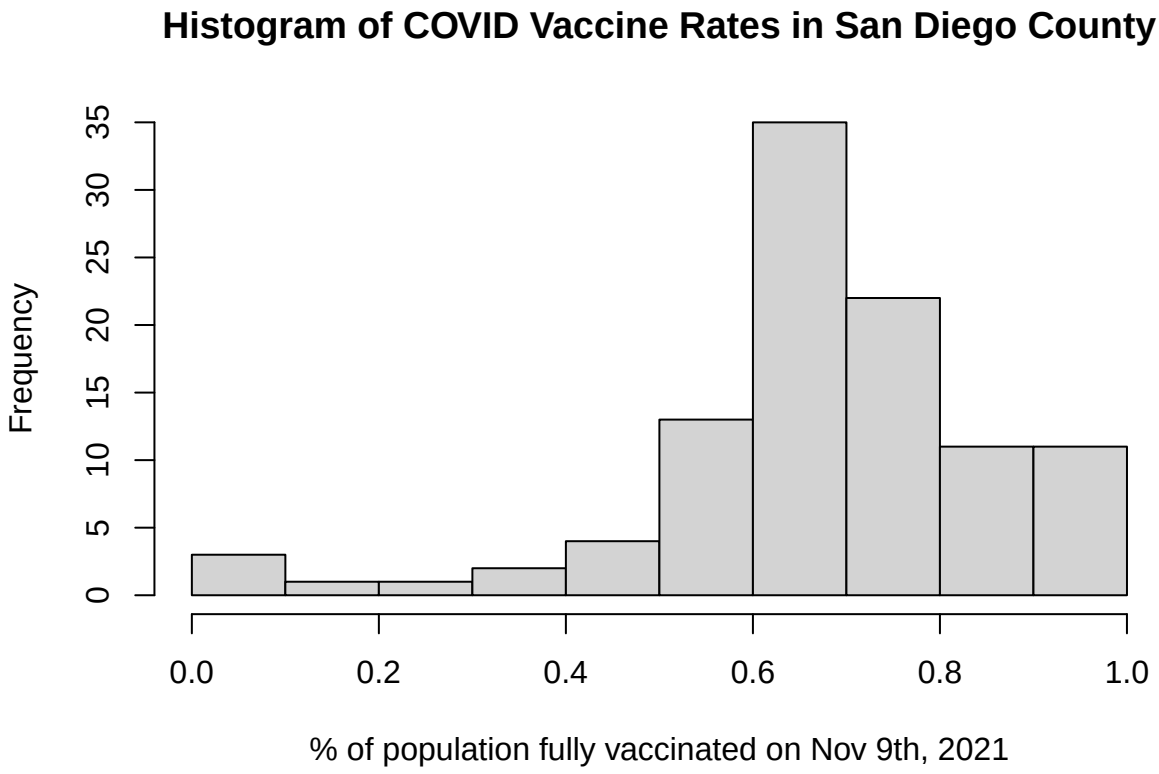
Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2021-11-09"? 67.41%

```
round((mean(sd_nov_9$percent_of_population_fully_vaccinated, na.rm=TRUE)*100), 2)
```

```
## [1] 67.41
```

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"?

```
hist(sd_nov_9$percent_of_population_fully_vaccinated,
     main="Histogram of COVID Vaccine Rates in San Diego County",
        xlab="% of population fully vaccinated on Nov 9th, 2021")
```



Focus on UCSD/La Jolla

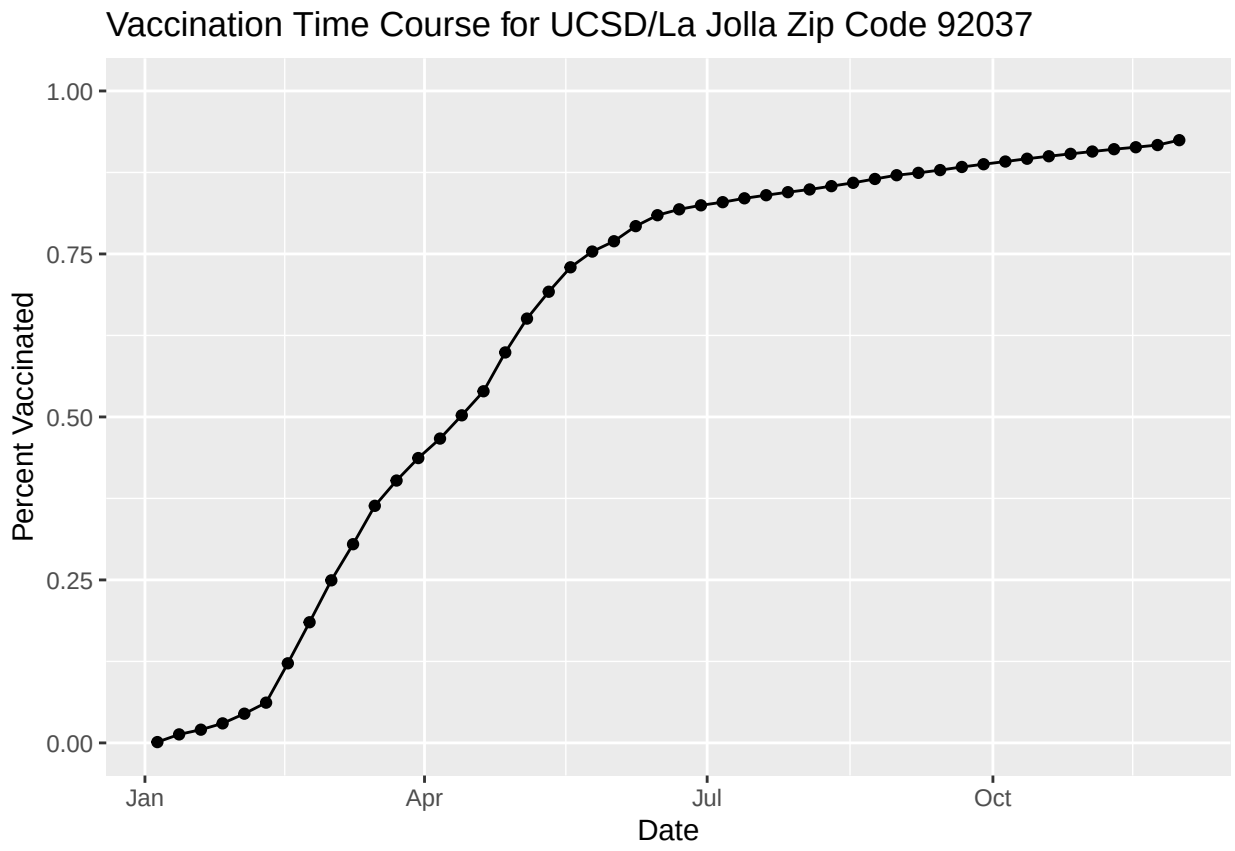
UCSD area code is 92037

```
# Filter to UCSD data
ucsd <- filter(sd, zip_code_tabulation_area=="92037")
```

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

```
library(ggplot2)

# Graph time course of vaccination rate for UCSD
ggplot(ucsd) +
  aes(x= as_of_date, y= percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  ylim(c(0,1)) +
  labs(x="Date", y="Percent Vaccinated",
       title= "Vaccination Time Course for UCSD/La Jolla Zip Code 92037")
```



Comparing La Jolla/UCSD to similar sized areas

Compare to area codes with similarly sized population.

Go back to the original dataset and compare to area codes that have a population at least as large as La Jolla

```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2021-11-16")

head(vax.36)
```

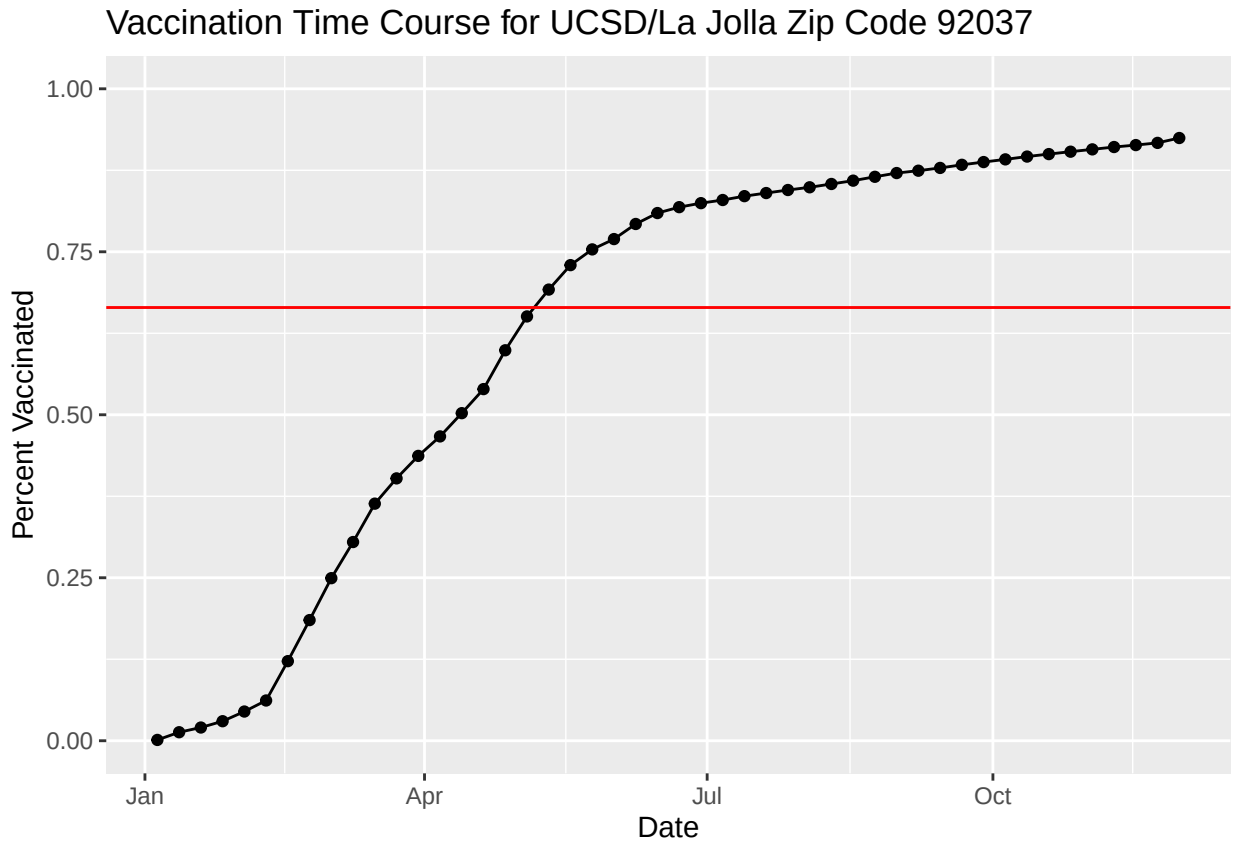
```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         county
## 1 2021-11-16                   92345           San Bernardino San Bernardino
## 2 2021-11-16                   92553                Riverside      Riverside
## 3 2021-11-16                   92058                San Diego      San Diego
## 4 2021-11-16                   91786           San Bernardino San Bernardino
## 5 2021-11-16                   92507                Riverside      Riverside
## 6 2021-11-16                   93021                  Ventura        Ventura
##   vaccine_equity_metric_quartile                vem_source
## 1                              1 Healthy Places Index Score
## 2                              1 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              2 Healthy Places Index Score
## 5                              1 Healthy Places Index Score
## 6                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               66047.5                75539                    35432
## 2               61770.8                70472                    37411
## 3               34956.0                39695                    14023
## 4               45602.3                50410                    30834
## 5               51432.5                55253                    31939
## 6               32753.7                36197                    24918
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         4389                                0.469056
## 2                         4846                                0.530863
## 3                         2589                                0.353269
## 4                         3132                                0.611664
## 5                         3427                                0.578050
## 6                         2012                                0.688400
##   percent_of_population_partially_vaccinated
## 1                                   0.058102
## 2                                   0.068765
## 3                                   0.065222
## 4                                   0.062131
## 5                                   0.062024
## 6                                   0.055585
##   percent_of_population_with_1_plus_dose redacted
## 1                               0.527158       No
## 2                               0.599628       No
## 3                               0.418491       No
## 4                               0.673795       No
## 5                               0.640074       No
## 6                               0.743985       No
```

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_pop <- mean(vax.36$percent_of_population_fully_vaccinated)

# Add mean_pop to ggplot graph of vaccination timecourse for UCSD/LA Jolla county

ggplot(ucsd) +
  aes(x= as_of_date, y= percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  geom_hline(yintercept = mean_pop, color="red")+
  ylim(c(0,1)) +
  labs(x="Date", y="Percent Vaccinated",
       title= "Vaccination Time Course for UCSD/La Jolla Zip Code 92037")
```



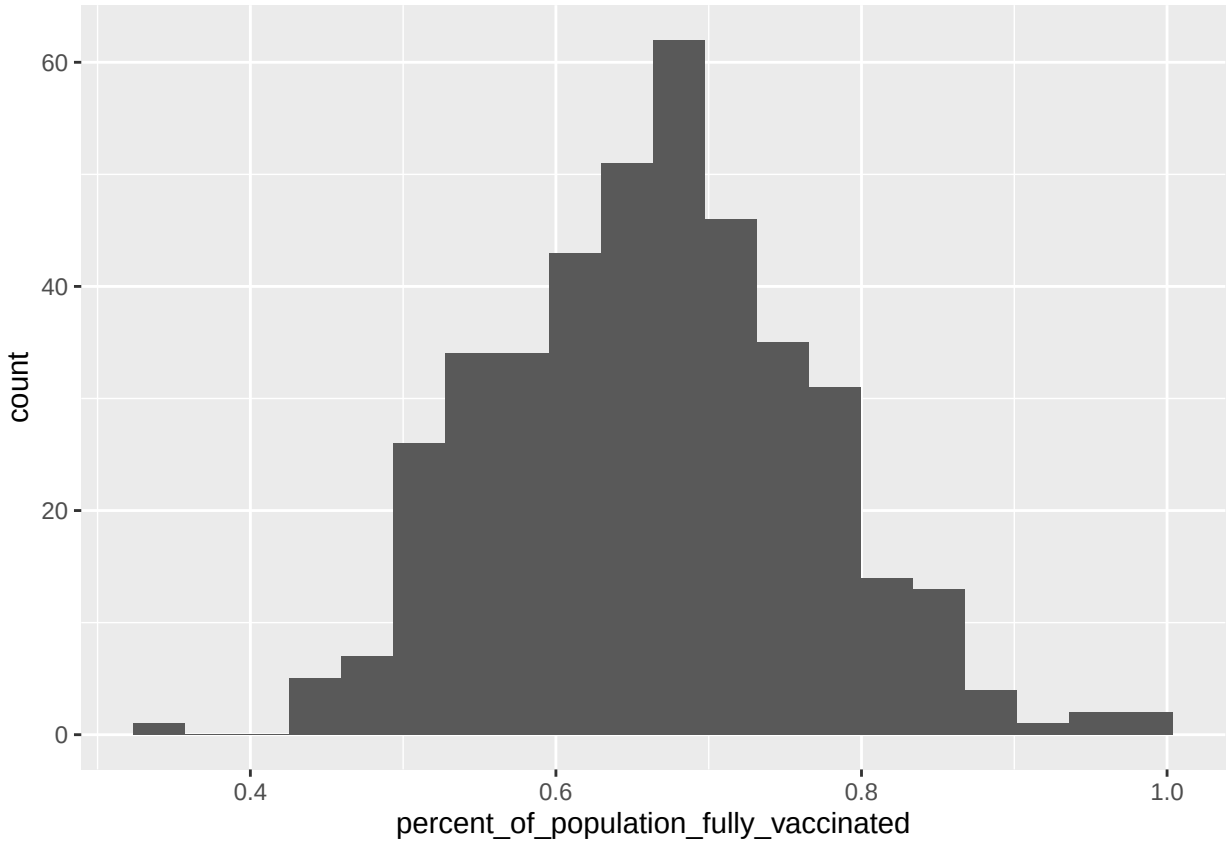
> Q17. What is the 6 number summary (Min, 1st Qu., Median, Mean, 3rd Qu., and Max) of the "Percent of Population Fully Vaccinated" values for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16"?

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.3533  0.5910  0.6669  0.6645  0.7311  1.0000
```

Q18. Using ggplot generate a histogram of this data.

```
ggplot(vax.36,
       aes(percent_of_population_fully_vaccinated))+
  geom_histogram(bins=20)
```



> Q19. Is the 92109 and 92040 ZIP code areas above or below the average value you calculated for all these above? The average % of population fully vaccinated for area codes w/ a population at least as large as san diego on 11/16/21 is 66.45%. Based on this, 92040 area code has a lower than average vaccination rate (~52%), and 92109 has an above average vaccination rate (~69%).

```
# % fully vaccinated for 92040 on 11/16/21
vax %>% filter(as_of_date == "2021-11-16") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                                0.52142
```

```
# % fully vaccinated for 92109 on 11/16/21
vax %>% filter(as_of_date == "2021-11-16") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

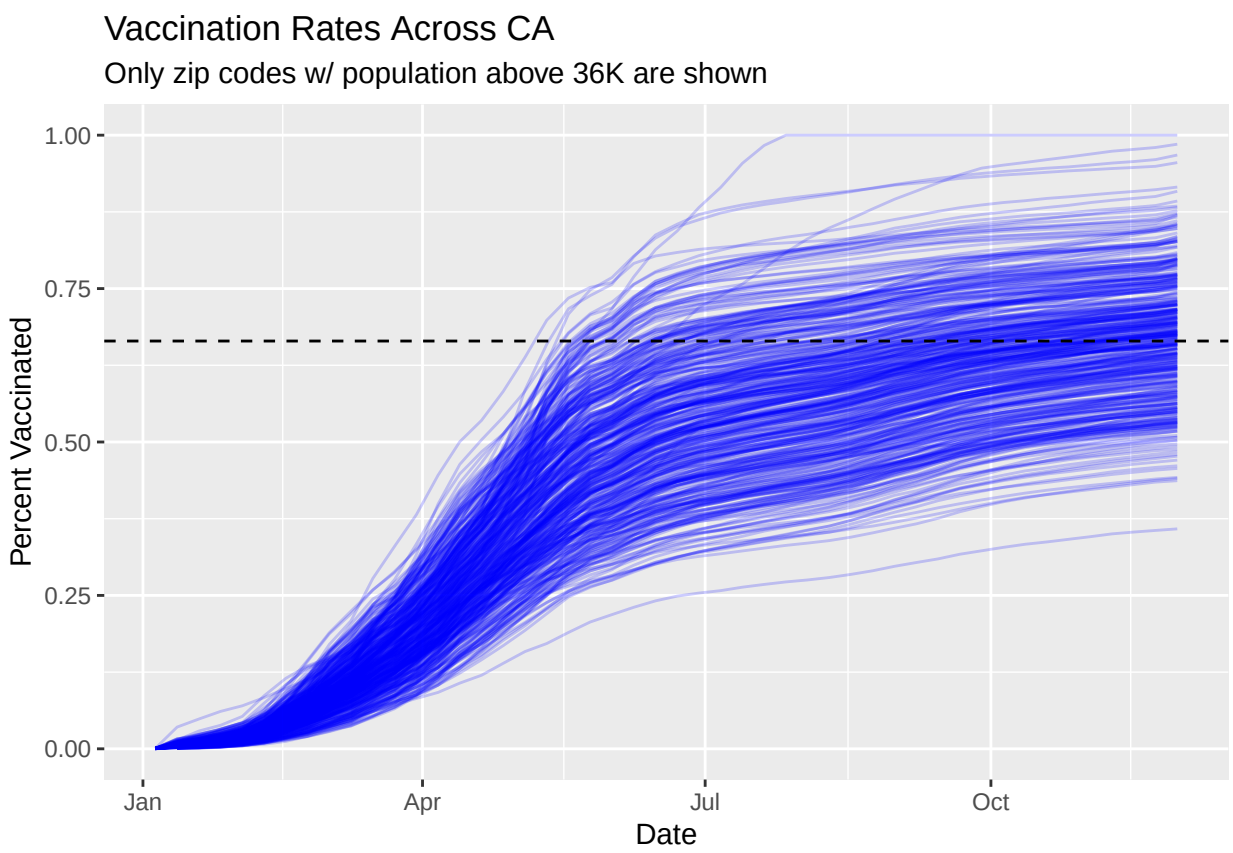
```
##   percent_of_population_fully_vaccinated
## 1                                0.68912
```

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

```
# Subset data to populations larger than 36K
vax.36.all <- filter(vax, age5_plus_population > 36144)

# Plot vaccine timecourse for all area codes.
ggplot(vax.36.all) +
  aes(x=as_of_date,
      y=percent_of_population_fully_vaccinated,
      group=zip_code_tabulation_area) +
  geom_line(alpha=0.2, color="blue") +
  ylim(0,1) +
  labs(x="Date", y="Percent Vaccinated",
       title="Vaccination Rates Across CA",
       subtitle="Only zip codes w/ population above 36K are shown") +
  geom_hline(yintercept = mean_pop, linetype=2)
```

```
## Warning: Removed 177 row(s) containing missing values (geom_path).
```



> Q21. How do you feel about traveling for Thanksgiving and meeting for in-person class next Week? About as good as I can given the circumstances... :D