Vaccination Mini Project

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Getting Started

Download our CSV file to the project directory and read and import it.

```
# Import vaccination data
vax <- read.csv("covid19vaccinesbyzipcode_test.csv" )
head(vax)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         county
## 1 2021-01-05                    92549                 Riverside      Riverside
## 2 2021-01-05                    92130                 San Diego      San Diego
## 3 2021-01-05                    92397            San Bernardino San Bernardino
## 4 2021-01-05                    94563              Contra Costa   Contra Costa
## 5 2021-01-05                    94519              Contra Costa   Contra Costa
## 6 2021-01-05                    91042               Los Angeles    Los Angeles
##   vaccine_equity_metric_quartile                 vem_source
## 1                              3 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              4 Healthy Places Index Score
## 5                              3 Healthy Places Index Score
## 6                              2 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1                2348.4                 2461                       NA
## 2               46300.3                53102                       61
## 3                3695.6                 4225                       NA
## 4               17216.1                18896                       NA
## 5               16861.2                18678                       NA
## 6               23962.2                25741                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                           27                               0.001149
## 3                           NA                                     NA
## 4                           NA                                     NA
## 5                           NA                                     NA
## 6                           NA                                     NA
##   percent_of_population_partially_vaccinated
## 1                                         NA
## 2                                   0.000508
## 3                                         NA
## 4                                         NA
## 5                                         NA
## 6                                         NA
##   percent_of_population_with_1_plus_dose booster_recip_count
## 1                                     NA                  NA
## 2                               0.001657                  NA
## 3                                     NA                  NA
## 4                                     NA                  NA
## 5                                     NA                  NA
## 6                                     NA                  NA
##                                                                 redacted
## 1 Information redacted in accordance with CA state privacy requirements
## 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
```

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

The persons_fully_vaccinated column details the total number of people fully vaccinated.

Q2. What column details the Zip code tabulation area?

The zip_code_tabulation_area column details zip code tabulation area.

Q3. What is the earliest date in this dataset?

```
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
```

```
library(lubridate)
```

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

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

```r
#Sort values by date column in ascending order.
earliest_first <- vax[order(as.Date(vax$as_of_date, format = "%Y-%m-%d")),]
#Grab first date to know earliest date in the dataset
earliest_first[1, 'as_of_date']
```

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

The earliest date in this dataset is January 5th, 2021 (2021-01-05).

Q4. What is the latest date in this dataset?

```r
#Sort values by date column in descending order
latest_first <- vax[rev(order(as.Date(vax$as_of_date , format = "%Y-%M-%D"))),]
#Grab first date to know latest date in the dataset
latest_first[1, 'as_of_date']
```

```
## [1] "2022-03-01"
```

The latest date in this dataset is March 1st 2022 (2022-03-01).

Calling the skim() function to get a quick overview of this dataset.

```r
library(skimr)
skimr::skim(vax)
```

Table 1: Data summary

Name	vax
Number of rows	107604
Number of columns	15
Column type frequency:	
character	5
numeric	10
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	61	0
local_health_jurisdiction	0	1	0	15	305	62	0
county	0	1	0	15	305	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	1817.39	90001	92257.75	93658.50	95380.50	97635.0	
vaccine_equity_metric_quartile	5307	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.91	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21106.02	0	1460.50	15364.00	34877.00	101902.0	
persons_fully_vaccinated	18338	0.83	12155.61	13063.88	11	1066.25	7374.50	20005.00	77744.0	
persons_partially_vaccinated	18338	0.83	831.74	1348.68	11	76.00	372.00	1076.00	34219.0	
percent_of_population_fully_vaccinated	18338	0.83	0.51	0.26	0	0.33	0.54	0.70	1.0	
percent_of_population_partially_vaccinated	18338	0.83	0.05	0.09	0	0.01	0.03	0.05	1.0	
percent_of_population_with_1_plus_dose	18338	0.83	0.54	0.28	0	0.36	0.58	0.75	1.0	
booster_recip_count	64317	0.40	4100.55	5900.21	11	176.00	1136.00	6154.50	50602.0	

Q5. How many numeric columns are in this dataset?

There are 10 numeric columns in this datset. ## Q6. Note that there are "missing values" in the dataset. How many NA values there in the persons_fully_vaccinated column?

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

```
## [1] 18338
```

There are 18,338 NA values. ## Q7. What percent of persons_fully_vaccinated values are missing (to 2 significant figures)?

```
#Dividing the number of NA values by the total number of entries to get the % missing
(na/nrow(vax))*100
```

```
## [1] 17.04212
```

17% of the data entries are missing for persons_fully_vaccinated.

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

It is possible that no one received full vaccinations on these dates. When looking at the table it is clear that when sorted from earliest to latest there are many more NA values around the earliest dates which would make sense at that time point as fewer people were receiving or ready to receive second doses so early in the statewide vaccination process.

Working with Dates

```
 library(lubridate)
```

```
today()
```

```
## [1] "2022-03-08"
```

```r
# This will give an Error!
#today() - vax$as_of_date[1]
```

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

Now we can do math with the dates.

```r
#How many days have passed since the first vaccination in the dataset?
today() - vax$as_of_date[1]
```

```
## Time difference of 427 days
```

```r
#How many days does the dataset span?
vax$as_of_date[nrow(vax)] - vax$as_of_date[1]
```

```
## Time difference of 420 days
```

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

```r
#Using the same equation as above but with my df that sorted the dates with most recent first
latest_first$as_of_date <- ymd(latest_first$as_of_date)
today() - latest_first$as_of_date[1]
```

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

Six days have passed since the last update of the data set. ## Q10. How many unique dates are in the dataset (i.e. how many different dates are detailed)?

```r
#Using the dplyr function n_distinct to count the number of unique dates in the dataset.
n_distinct(vax$as_of_date)
```

```
## [1] 61
```

There are 61 unique dates in the dataset.

Working with ZIP Codes

```r
library(zipcodeR)
```

```r
geocode_zip("92037")
```

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

Calculate the distance between centroids of any two zipcodes in miles.

```
#example of calculating the distance
zip_distance("92037", "92109")
```

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

Pulling census data about ZIP code areas.

```
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>
```

We can pull census data for all of the zip codes in the dataset.

```
zipdata <- reverse_zipcode( vax$zip_code_tabulation_area )
```

Focus on the San Diego Area

There are two main ways to select the San Diego entries in the dataset. The first shown below uses base R.

```
sd <- vax[vax$county == "San Diego",]
```

The second method shown below is using the dplyr pakcage.

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

```
## [1] 6527
```

Using dplyr to subset all San Diego county areas with a population greater than 10000.

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

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

```
#using the n_distinct function on our previously made subset of the data to count the number of unique 
n_distinct(sd$zip_code_tabulation_area)
```

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

There are 107 distinct zip codes listed for San Diego County.

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

```
#Sort the sd dataframe by 12+ population in decreasing order
largest_pop <- sd[order(sd$age12_plus_population, decreasing = TRUE),]
```

```
# Selecting for the zipcode with the largest 12+ population
largest_pop[1, "zip_code_tabulation_area"]
```

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

The San Diego County Zip code are with the 12+ population in this data set is 92154.

Now,using dplyr select all San Deigo “county” entries on “as_of_date”“2022-02-22”

```
date_filter <- filter(sd, as_of_date == "2022-02-22")
```

Q13. What is the overall average “Percent of Population Fully Vaccinated” value for all San Diego “County” as of “2022-02-22”?

```
#take the mean of the Percent of Pop Fully Vaccinated
mean(date_filter$percent_of_population_fully_vaccinated, na.rm = TRUE )
```

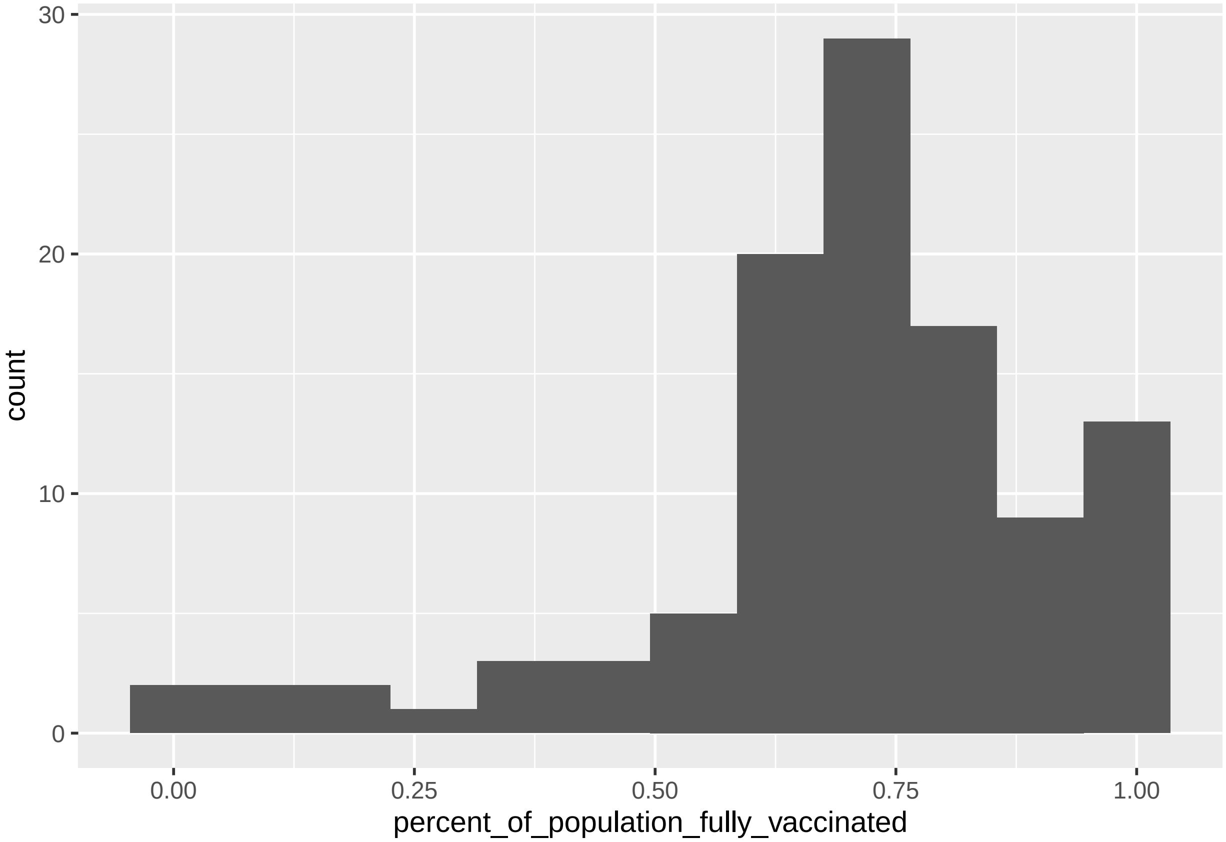
```
## [1] 0.7041551
```

The overall average value for “Percent of Population Fully Vaccinated” in SD county is 0.7042 or 70.42%

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 “2022-02-22”?

```
library(ggplot2)
ggplot(date_filter, aes(x=percent_of_population_fully_vaccinated)) + geom_histogram(binwidth = 0.09)
```

```
## Warning: Removed 1 rows containing non-finite values (stat_bin).
```



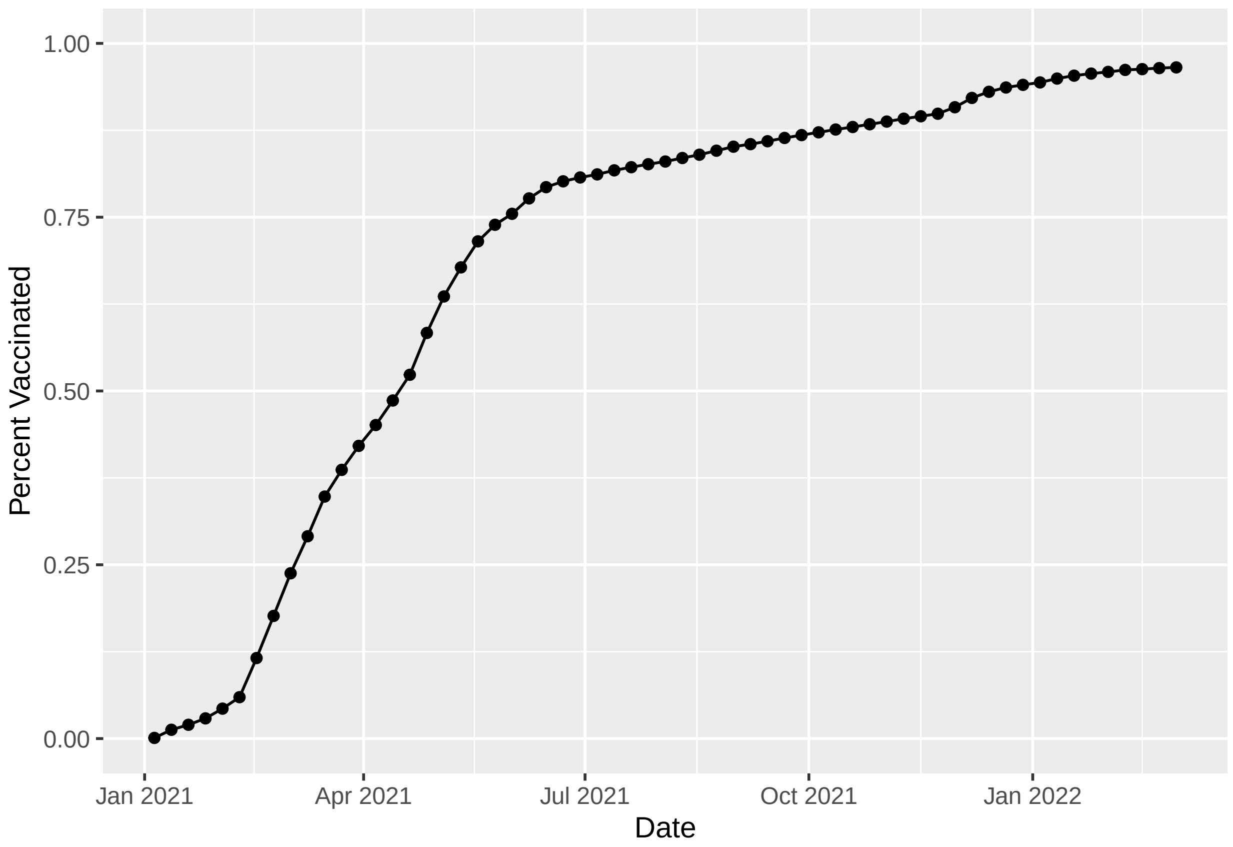
# Focus on UCSD/La Jolla

```
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(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")
```



Comparing to Similar Sized Areas

```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                as_of_date == "2022-02-22")

head(vax.36)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction      county
## 1 2022-02-22                    92840                    Orange      Orange
## 2 2022-02-22                    92064                 San Diego   San Diego
## 3 2022-02-22                    92508                 Riverside   Riverside
## 4 2022-02-22                    95403                    Sonoma      Sonoma
## 5 2022-02-22                    90001               Los Angeles Los Angeles
## 6 2022-02-22                    92802                    Orange      Orange
##   vaccine_equity_metric_quartile                 vem_source
## 1                              2 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                              1 Healthy Places Index Score
## 6                              2 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               47302.5                 51902                    40725
## 2               42177.1                 46855                    34266
## 3               32415.3                 36303                    21925
## 4               38545.9                 42294                    33158
## 5               47175.7                 54805                    43075
## 6               35113.6                 39393                    29268
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         4324                               0.784652
## 2                         6861                               0.731320
## 3                         1714                               0.603945
## 4                         2833                               0.783988
## 5                        13917                               0.785968
## 6                         6138                               0.742975
##   percent_of_population_partially_vaccinated
## 1                                   0.083311
## 2                                   0.146430
## 3                                   0.047214
## 4                                   0.066983
## 5                                   0.253937
## 6                                   0.155814
##   percent_of_population_with_1_plus_dose booster_recip_count redacted
## 1                               0.867963               20654       No
## 2                               0.877750               15499       No
## 3                               0.651159               10753       No
## 4                               0.850971               18659       No
## 5                               1.000000               13408       No
## 6                               0.898789               12816       No
```

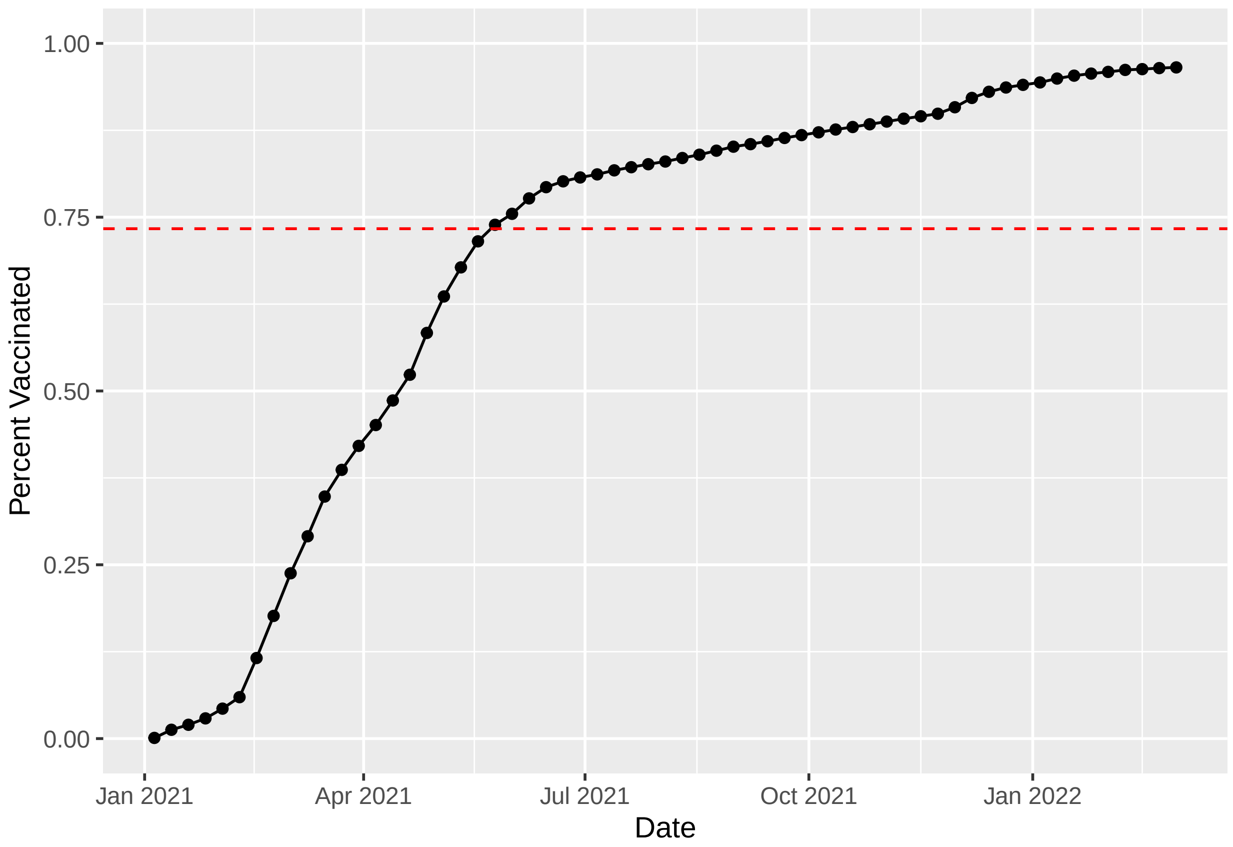
Q16. Calculate the mean "Percent of Population Fully Vaccinated" for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2022-02-22". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

```
mean_vax <- mean(vax.36$percent_of_population_fully_vaccinated, na.rm=TRUE)
mean_vax
```

```
## [1] 0.733385
```

The mean of "Percent of Population Fully vaccinated for zip code areas with a populaiton as large as 92037 is 0.733385.

```
#Replotting the above histogram with a horizontal line at the mean.
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") +
  geom_hline(yintercept = mean_vax, linetype = "dashed", color = "red")
```



## 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 "2022-02-22"?

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

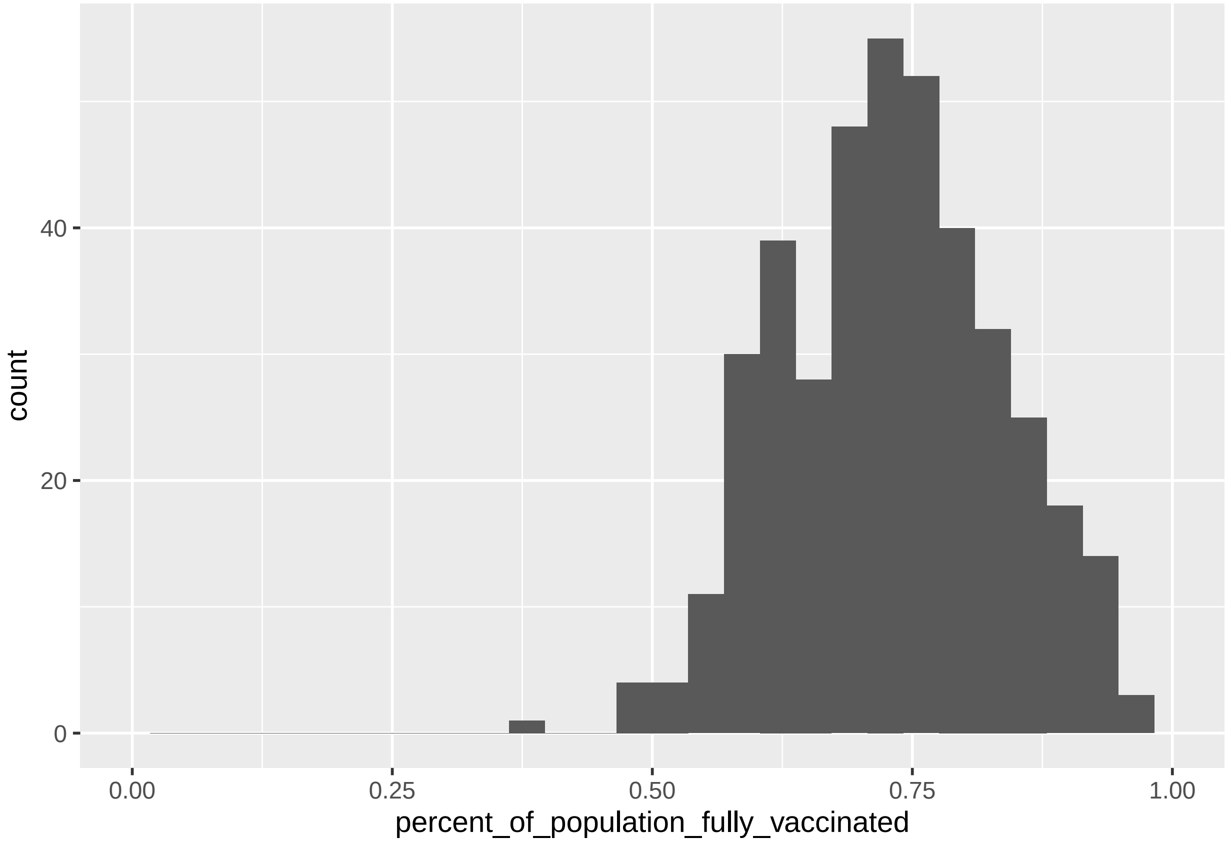
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
##  0.3881  0.6539  0.7333  0.7334  0.8027  1.0000
```

Q18. Using ggplot generate a histogram of this data.

```
ggplot(vax.36, aes(x=percent_of_population_fully_vaccinated)) +
  geom_histogram() +
  xlim(0,1)
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 2 rows containing missing values (geom_bar).
```



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

```
#finding the % fully vaxxed for 92040
vax %>% filter(as_of_date == "2022-02-22") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                               0.551304
```

```
#finding the % fully vaxxed for 92109
vax %>% filter(as_of_date == "2022-02-22") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                               0.723044
```

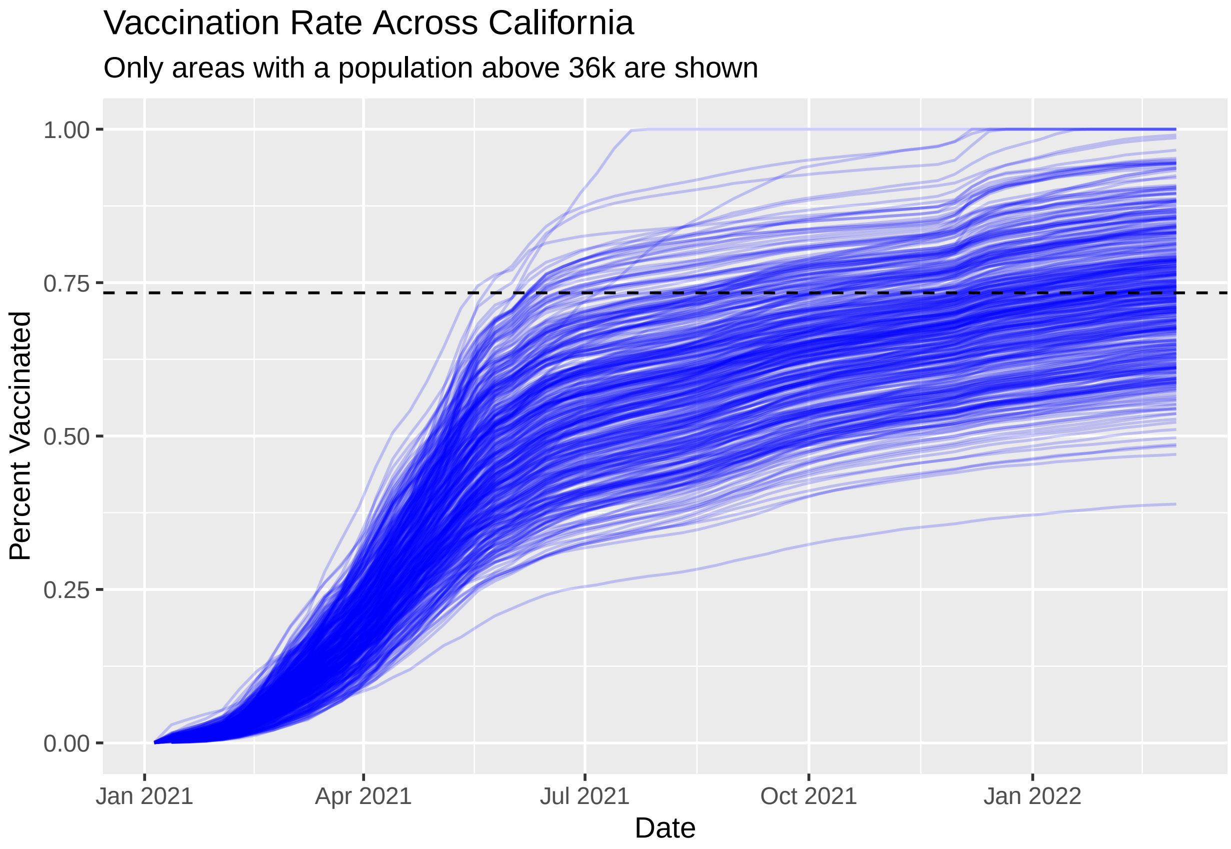
Answer: The average that I calculated above was 0.733385. Both the 92040 zip code at a proportion of 0.551304 and the 92109 zip code at a proportion of 0.723044 fall below the average value.

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

```
vax.36.all <- filter(vax, 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, color="blue") +
  ylim(0,1) +
  labs(x="Date", y="Percent Vaccinated",
       title="Vaccination Rate Across California",
       subtitle= "Only areas with a population above 36k are shown") +
  geom_hline(yintercept = mean(vax.36$percent_of_population_fully_vaccinated, na.rm =TRUE), linetype="da
```

```
## Warning: Removed 311 row(s) containing missing values (geom_path).
```



Q21. How do you feel about traveling for Spring Break and meeting for in-person class afterwards?

I feel indifferent about it. It is clearly not an ideal situation, but thankfully numbers are trending downwards.