COVID19 Vaccination Rate Mini Project

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Here we downloaded the data from file called “Statewide COVID-19 Vaccines Administered by ZIP Code” using website https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code

#First step is to import/read 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?

persons_fully_vaccinated

Q2. What column details the Zip code tabulation area?

zip_code_tabulation_area

Q3. What is the earliest date in this dataset?

2021-01-05

Q4. What is the latest date in this dataset?

2022-03-01

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

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

```
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?

9

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

18338

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

```
round((18338/107604)*100, 2)
```

```
## [1] 17.04
```

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

Not everyone gets them from the CDC, such as people who get them somewhere else such as the VA or elsewhere.

#Working with Dates

```
library(lubridate)
```

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

```
today()
```

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

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

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

```
## Time difference of 422 days
```

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

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

```
age <-today()-ymd("2000-01-20")
age
```

```
## Time difference of 8078 days
```

```
time_length(age, "year")
```

```
## [1] 22.11636
```

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

time difference of 2 days

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

```
## Time difference of 2 days
```

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

61 unique dates in the dataset

```
udates <- unique(vax$as_of_date)
length(udates)
```

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

#Working with Zipcodes

```r
library(zipcodeR)
```

```r
geocode_zip('92037')
```

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

```r
zip_distance('92037','92109')
```

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

```r
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>
```

```r
# Pull data for all ZIP codes in the dataset
zipdata <- reverse_zipcode(vax$zip_code_tabulation_area )
head(zipdata)
```

```
## # A tibble: 6 x 24
##   zipcode zipcode_type major_city post_office_city common_city_list county state
##   <chr>   <chr>        <chr>      <chr>                      <blob> <chr>  <chr>
## 1 90001   Standard     Los Angel~ Los Angeles, CA        <raw 44 B> Los A~ CA
## 2 90002   Standard     Los Angel~ Los Angeles, CA        <raw 47 B> Los A~ CA
## 3 90003   Standard     Los Angel~ Los Angeles, CA        <raw 23 B> Los A~ CA
## 4 90004   Standard     Los Angel~ Los Angeles, CA        <raw 34 B> Los A~ CA
## 5 90005   Standard     Los Angel~ Los Angeles, CA        <raw 34 B> Los A~ CA
## 6 90006   Standard     Los Angel~ Los Angeles, CA        <raw 23 B> Los A~ 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

Let’s now focus in on the San Diego County area by restricting ourselves first to vax$county == “San Diego” entries. We have two main choices on how to do this. The first using base R the second 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")
nrow(sd)
```

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

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

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

107 distinct zip codes listed for SD county

```
uzip <- unique(sd$zip_code_tabulation_area)
length(uzip)
```

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

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

92154

```
sdmax12 <- which.max(sd$age12_plus_population)
print(sdmax12)
```

```
## [1] 91
```

```
sd$zip_code_tabulation_area[sdmax12]
```

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

Using dplyr select all San Diego “county” entries on “as_of_date” “2022-02-22” and use this for the following questions.

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

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

Let's do this with the most recent date in the data-set (2022-03-01).

> Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2022-03-01"?

```
#filter to the day
sd.latest <- filter(sd, as_of_date == "2022-03-01")
round(mean(sd.latest$percent_of_population_fully_vaccinated, na.rm = TRUE),2)
```

```
## [1] 0.71
```

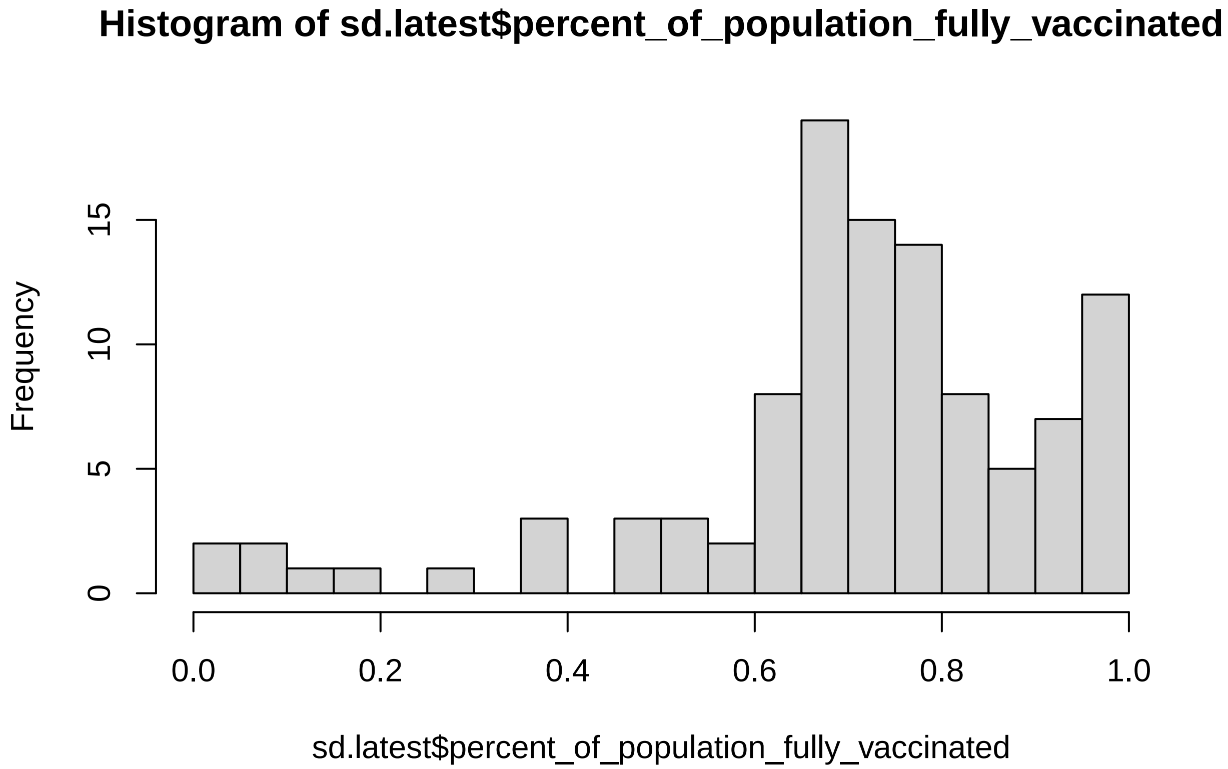
```
summary(sd.latest$percent_of_population_fully_vaccinated)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's 
## 0.01017 0.65132 0.72452 0.70529 0.82567 1.00000       1
```

71% overall average

> 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 "2022-03-01"?

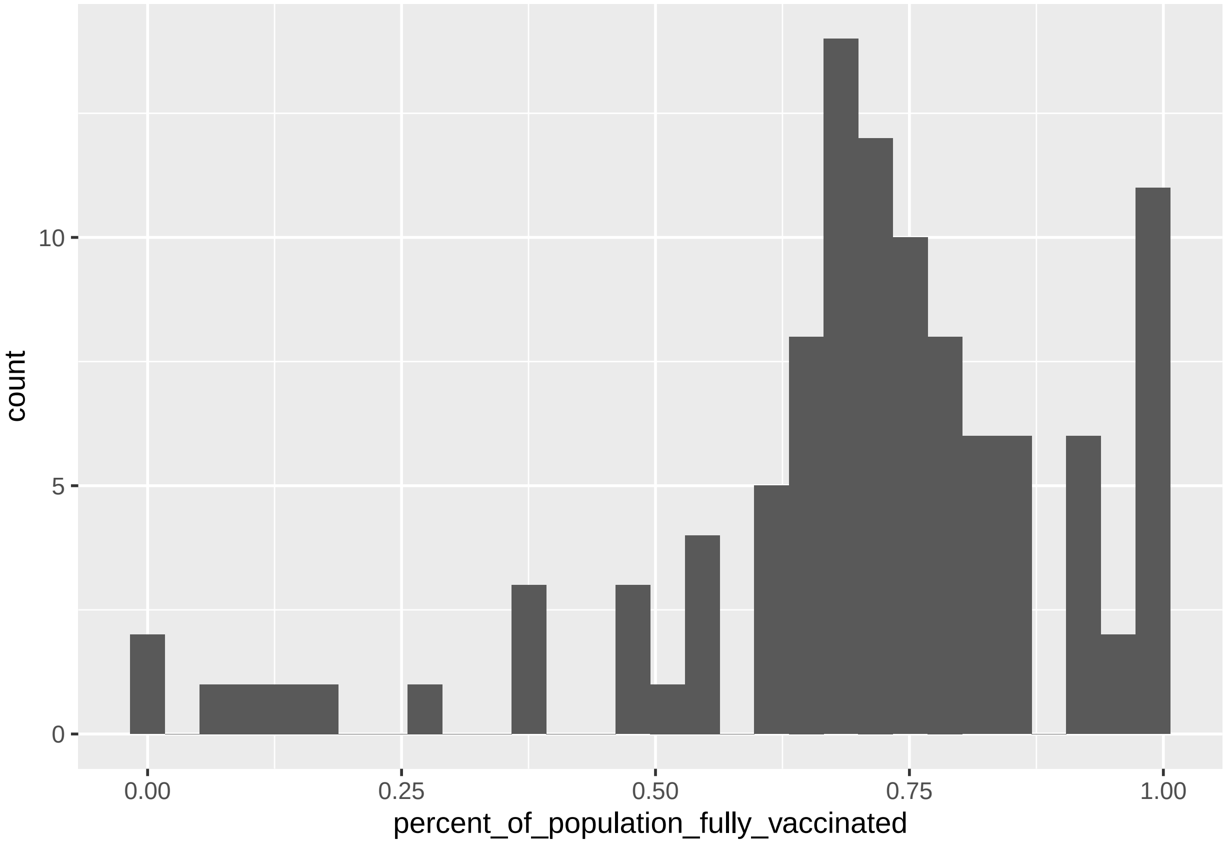
```
hist(sd.latest$percent_of_population_fully_vaccinated, breaks =30)
```



```
library(ggplot2)

ggplot(sd.latest) +aes(percent_of_population_fully_vaccinated)+ geom_histogram()
```

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

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



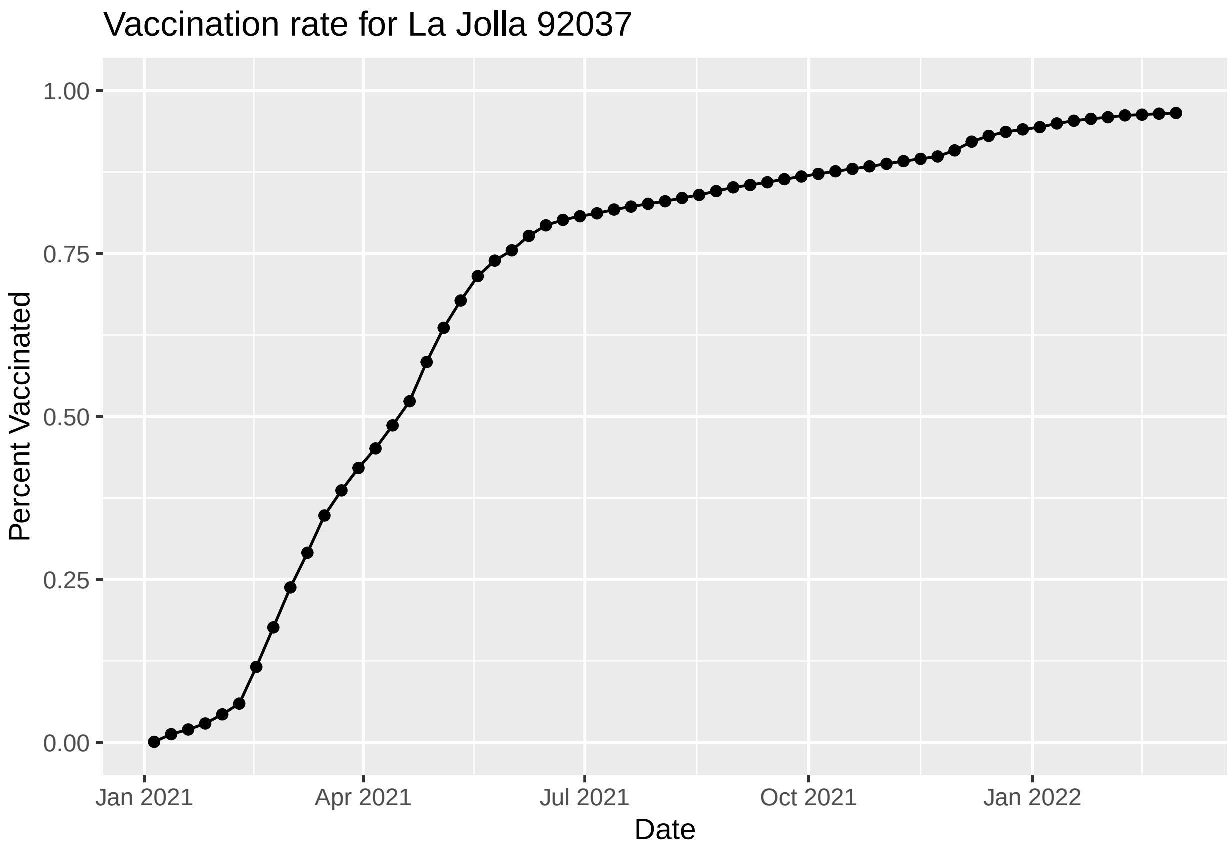
Focus on UCSD/La Jolla

```
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:

```
baseplot <- ggplot(ucsd) +
  aes(as_of_date,
      percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  ylim(c(0,1)) +
  labs(x= "Date", y="Percent Vaccinated", title= "Vaccination rate for La Jolla 92037" )
baseplot
```

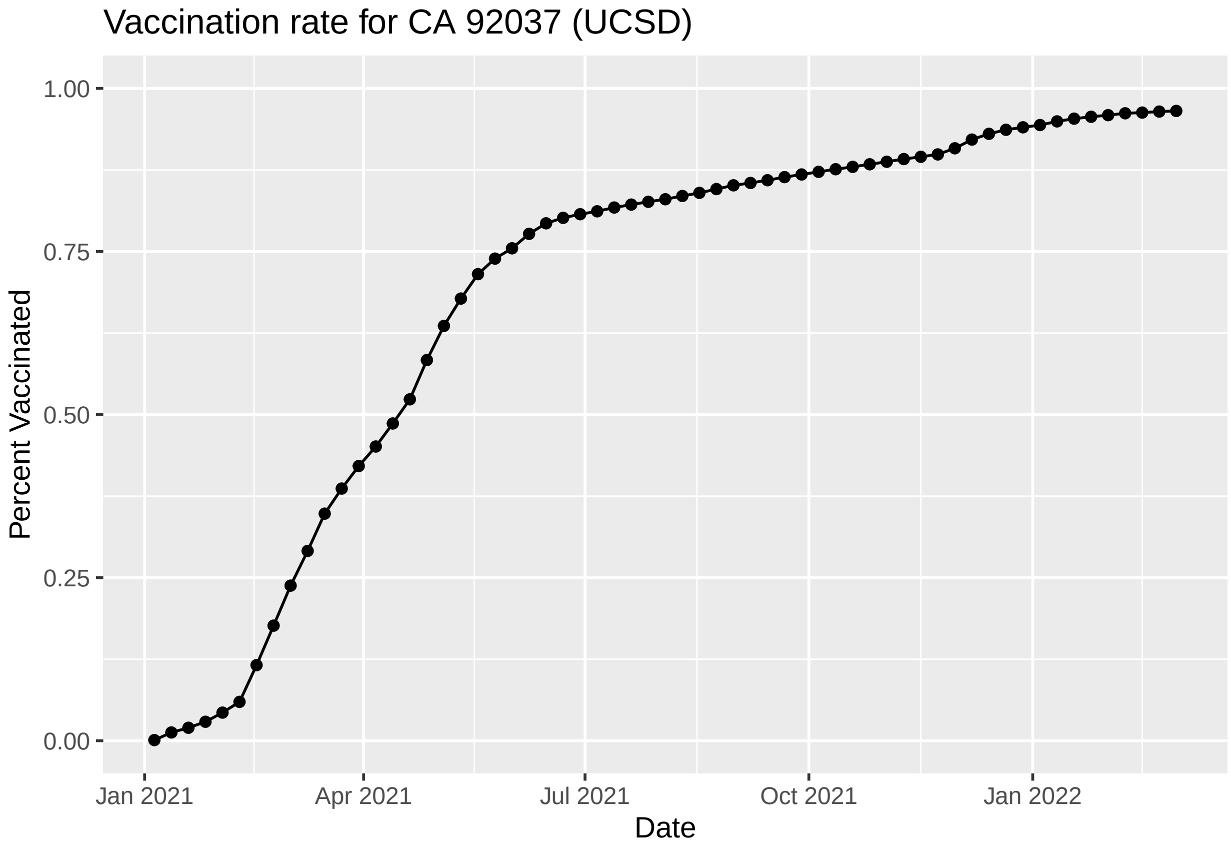


#Comparing to similar sized areas

> 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?

Add a line showing the average vaccination rate for all zip code areas with a population jyst as large as 92037

```
baseplot + labs(title= "Vaccination rate for CA 92037 (UCSD)")
```



Add a line showing the average vaccination rate for all zip code areas with a population jyst as large as 92037

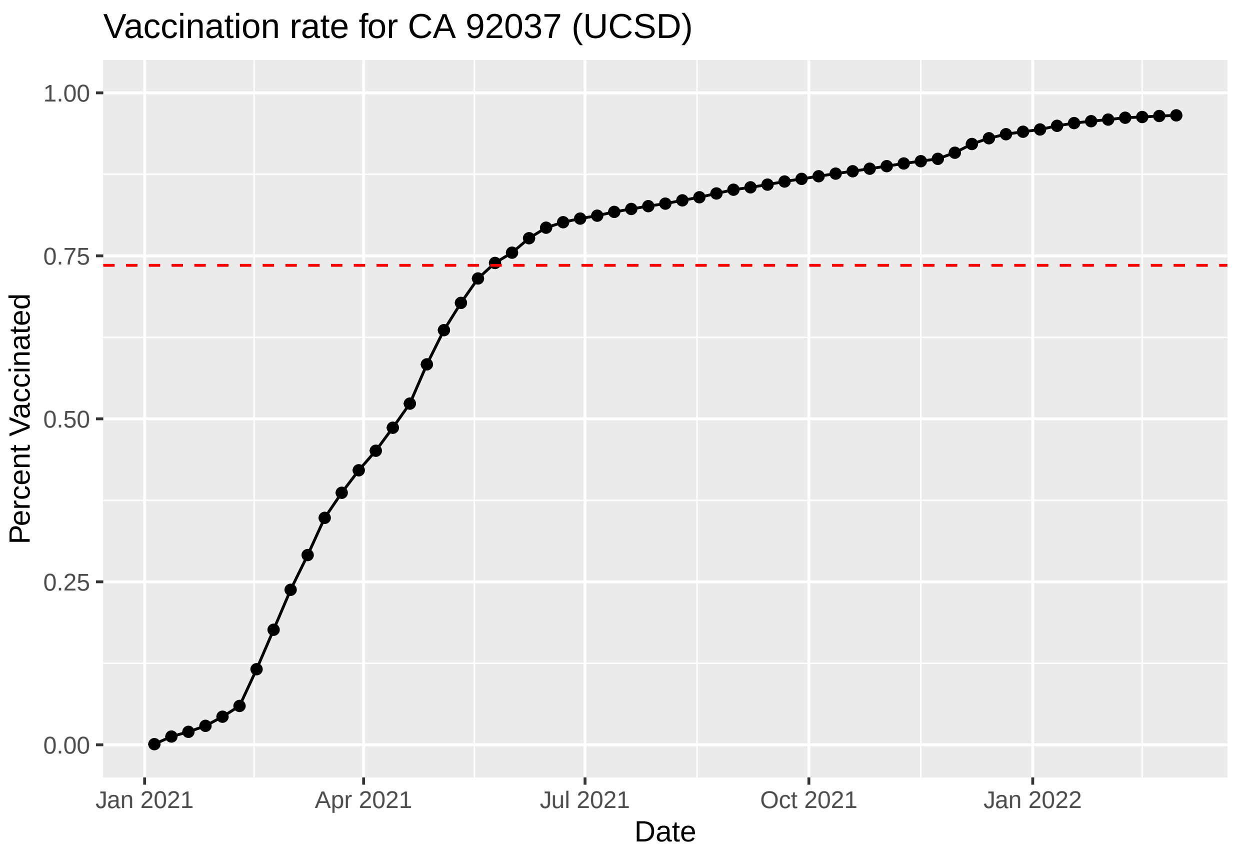
```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                as_of_date == "2022-03-01")

head(vax.36)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction      county
## 1 2022-03-01                    95628                Sacramento  Sacramento
## 2 2022-03-01                    90808                Long Beach Los Angeles
## 3 2022-03-01                    92507                 Riverside   Riverside
## 4 2022-03-01                    92626                    Orange      Orange
## 5 2022-03-01                    93257                    Tulare      Tulare
## 6 2022-03-01                    90011               Los Angeles Los Angeles
##   vaccine_equity_metric_quartile                 vem_source
## 1                              3 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                              1 Healthy Places Index Score
## 6                              1 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               35579.0                38694                    28842
## 2               33952.3                37179                    29383
## 3               51432.5                55253                    34455
## 4               44238.8                47883                    33767
## 5               61519.8                70784                    42919
## 6               87902.8               101902                    65342
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         1990                               0.745387
## 2                         2112                               0.790312
## 3                         3947                               0.623586
## 4                         2937                               0.705198
## 5                         5868                               0.606338
## 6                        15255                               0.641224
##   percent_of_population_partially_vaccinated
## 1                                   0.051429
## 2                                   0.056806
## 3                                   0.071435
## 4                                   0.061337
## 5                                   0.082900
## 6                                   0.149703
##   percent_of_population_with_1_plus_dose booster_recip_count redacted
## 1                               0.796816               16913       No
## 2                               0.847118               17253       No
## 3                               0.695021               15073       No
## 4                               0.766535               17595       No
## 5                               0.689238               17740       No
## 6                               0.790927               19928       No
```

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

```
## [1] 0.7353974
```

```
baseplot + labs(title= "Vaccination rate for CA 92037 (UCSD)") + geom_hline(yintercept=ave.36, linetype=
```



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)
```

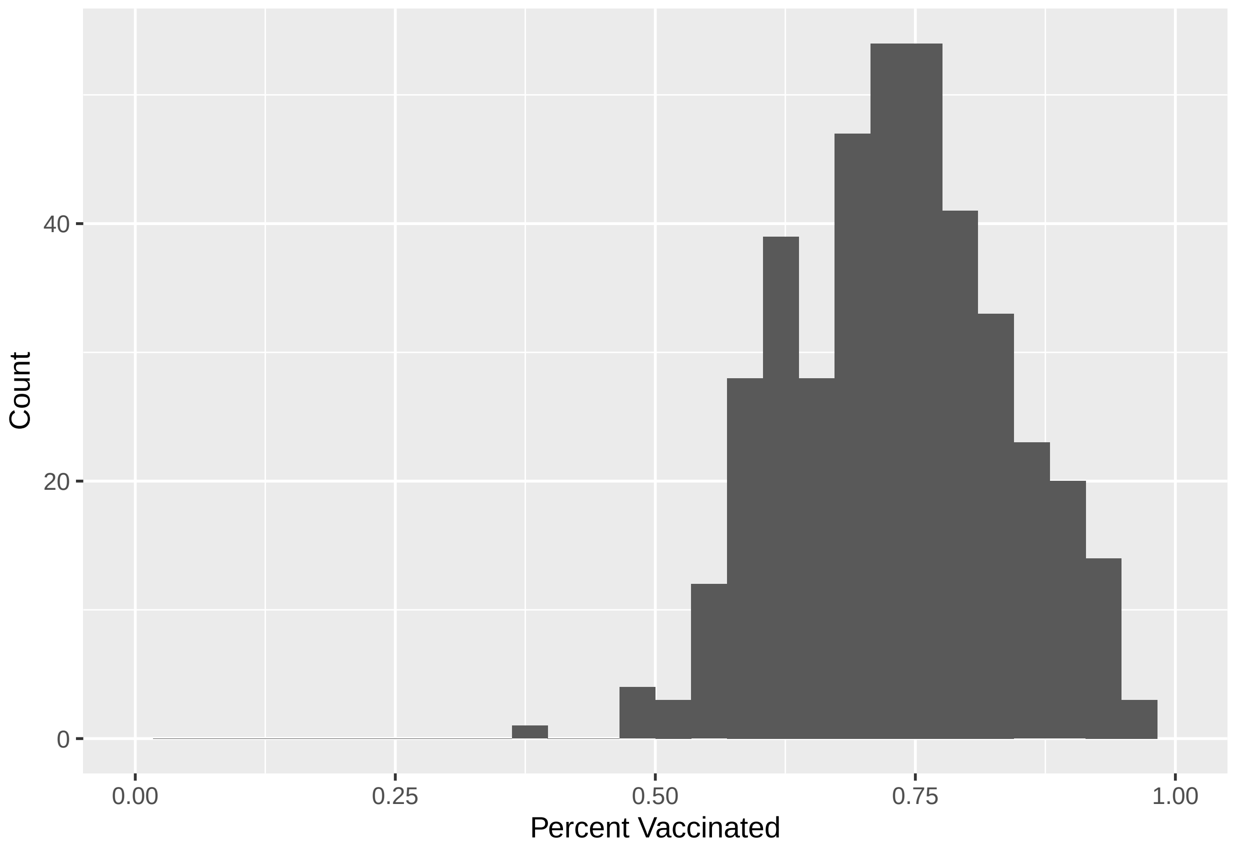
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.3890  0.6554  0.7350  0.7354  0.8044  1.0000
```

Q18. Using ggplot generate a histogram of this data.

```
library(ggplot2)
ggplot(vax.36)+ aes(percent_of_population_fully_vaccinated) + geom_histogram() +xlim(c(0,1)) + labs(x=
```

```
## `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?

```
vax %>% filter(as_of_date == "2022-03-01") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                               0.551981
```

```
vax %>% filter(as_of_date == "2022-03-01") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

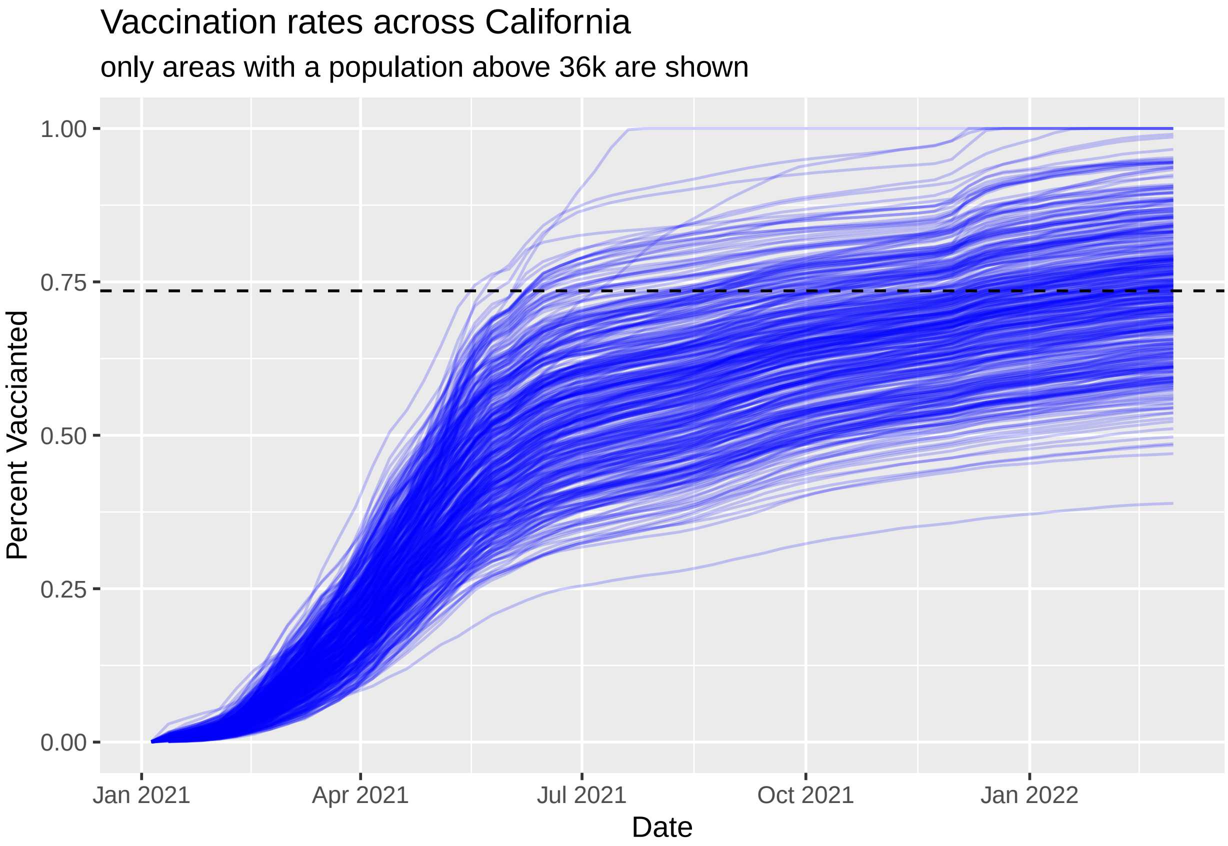
```
##   percent_of_population_fully_vaccinated
## 1                               0.723778
```

Both values are below the mean we found above. 0.754>0.724 0.754>0.552

> 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(c(0,1)) +
  labs(x="Date", y="Percent Vaccianted",
       title="Vaccination rates across California",
       subtitle="only areas with a population above 36k are shown") +
  geom_hline(yintercept = ave.36, linetype="dashed")
```

```
## 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 graduate this quarter so while I would be down to travel, I won't be a student anymore next quarter (sad)