Covid-19 Vaccination Rate

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Covid-19 Vaccination Rates

Download the Statewide COVID-19 Vaccines csv file.

Limitations of the data:

Data don't include doses administered by the following federal agencies who received vaccine allocated directly from CDC: Indian Health Service, Veterans Health Administration, Department of Defense, and the Federal Bureau of Prisons. Zip code areas that include military bases will likely show artificially low vaccination rates

Reading the file

```
vax <- read.csv("Statewide COVID-19 Vaccines.csv")
head(vax)
```

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction          county
1 2021-01-05                   93562            San Bernardino  San Bernardino
2 2021-01-05                   93437             Santa Barbara   Santa Barbara
3 2021-01-05                   93445          San Luis Obispo San Luis Obispo
4 2021-01-05                   93442          San Luis Obispo San Luis Obispo
5 2021-01-05                   93444          San Luis Obispo San Luis Obispo
6 2021-01-05                   93453          San Luis Obispo San Luis Obispo
  vaccine_equity_metric_quartile                vem_source
1                              1 Healthy Places Index Score
2                             NA            No VEM Assigned
3                              2 Healthy Places Index Score
4                              3 Healthy Places Index Score
5                              3 Healthy Places Index Score
6                              3 Healthy Places Index Score
```

```
  age12_plus_population age5_plus_population tot_population
1                1469.5                 1668           1771
2                2494.5                 2871           3387
3                6116.7                 6762           7106
4               10005.2                10615          10917
5               18951.8                20522          21331
6                2373.6                 2499           2578
  persons_fully_vaccinated persons_partially_vaccinated
1                       NA                           NA
2                       NA                           NA
3                       NA                           NA
4                       NA                           NA
5                       NA                           NA
6                       NA                           NA
  percent_of_population_fully_vaccinated
1                                     NA
2                                     NA
3                                     NA
4                                     NA
5                                     NA
6                                     NA
  percent_of_population_partially_vaccinated
1                                         NA
2                                         NA
3                                         NA
4                                         NA
5                                         NA
6                                         NA
  percent_of_population_with_1_plus_dose booster_recip_count
1                                     NA                  NA
2                                     NA                  NA
3                                     NA                  NA
4                                     NA                  NA
5                                     NA                  NA
6                                     NA                  NA
  bivalent_dose_recip_count eligible_recipient_count
1                        NA                        0
2                        NA                        1
3                        NA                        0
4                        NA                        1
5                        NA                        0
6                        NA                        0
                                                      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?

Column 'tot_population' shows the total number of people fully vaccinated in each area.

Q2. What column details the Zip code tabulation area?

Column 'zip_code_tabulation_area' contains zip code of each area.

Q3. What is the earliest date in this dataset?

```
min(vax$as_of_date)
```

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

The earliest date in the dataset is Jan 05, 2021.

Q4. What is the latest date in this dataset?

```
max(vax$as_of_date)
```

```
[1] "2022-11-15"
```

The latest data in the dataset is Nov 15, 2022.

Let's use 'skim()' function from the skimr package to get a quick overview

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

Table 1: Data summary

Name	vax
Number of rows	172872
Number of columns	18
Column type frequency:	

Table 1: Data summary

character	5
numeric	13
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	98	0
local_health_jurisdiction	0	1	0	15	490	62	0
county	0	1	0	15	490	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	8526	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.01	18993.88	0	1346.95	13685.13	31756.12	85556.7	
age5_plus_population	0	1.00	20875.22	21105.98	0	1460.50	15364.00	34877.00	101902.0	
tot_population	8428	0.95	23372.72	22628.51	12	2126.00	18714.00	38168.00	111165.0	
persons_fully_vaccinated	15440	0.91	13309.15	14740.07	11	859.00	7687.00	22253.00	87305.0	
persons_partially_vaccinated	15440	0.91	1679.13	1993.86	11	157.00	1158.00	2483.00	39201.0	
percent_of_population_fully_vaccinated	18986	0.89	0.54	0.26	0	0.36	0.58	0.73	1.0	
percent_of_population_partially_vaccinated	18986	0.89	0.08	0.09	0	0.05	0.06	0.08	1.0	
percent_of_population_with_1_plus_dose	19822	0.89	0.60	0.26	0	0.42	0.64	0.79	1.0	
booster_recip_count	70642	0.59	5701.06	6972.68	11	276.00	2546.00	9513.00	58301.0	
bivalent_dose_recip_count	156937	0.09	1512.94	1994.71	11	101.00	662.00	2236.00	16790.0	
eligible_recipient_count	0	1.00	12114.81	14551.97	0	438.00	5520.00	20714.00	86817.0	

Q5. How many numeric columns are in this dataset?

There are 13 numeric columns in the dataset.

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

‘persons_fully_vaccinated’ column contains 15440 NA values

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

89% of 'persons_fully_vaccinated' are missing

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

This data might be missing due to lack of vaccination record performed by federal agency.

Working with Dates

'as_of_date' column contains dates in the Year-Month-Day format.

'lubridate' package can make life allot easier when dealing with date format.

```
library(lubridate)
```

```
Loading required package: timechange
```

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

```
The following objects are masked from 'package:base':

    date, intersect, setdiff, union
```

```
today()
```

```
[1] "2022-11-30"
```

This is cool!

By using 'lubridate' we can turn 'as_of_date' column into the usable form. We need to provide argument first to allow us to do math with date.

```
vax$as_of_date <- ymd(vax$as_of_date)
```

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

```
Time difference of 694 days
```

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

```
today()-max(vax$as_of_date)
```

```
Time difference of 15 days
```

It has been 7 days since the last update of the dataset.

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

```
nrow(table(vax$as_of_date))
```

```
[1] 98
```

There are 98 different dates in the dataset.

Working with Zipcode

We can use the 'zipcodeR' package to make working with these codes easier.

Focus on San Diego Area

We can focus by restricting ourselves first to vax$county == "San Diego"

```
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] 10486
```

Using dplyr also allow us to subset across multiple criteria

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

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

```
nrow(table(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?

```
which.max(sd$age12_plus_population)
```

```
[1] 90
```

```
sd[90,2]
```

```
[1] 92154
```

Zip code with the largest 12+ population value is 92154.

Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2022-11-15"?

```
library(dplyr)
sd1115 <- filter(vax, county == "San Diego" & as_of_date == "2022-11-15")
```

```
nrow(sd1115)
```

```
[1] 107
```

```
sd1115_mean <- mean(sd1115$percent_of_population_fully_vaccinated, na.rm = TRUE)
sd1115_mean
```

```
[1] 0.7381765
```

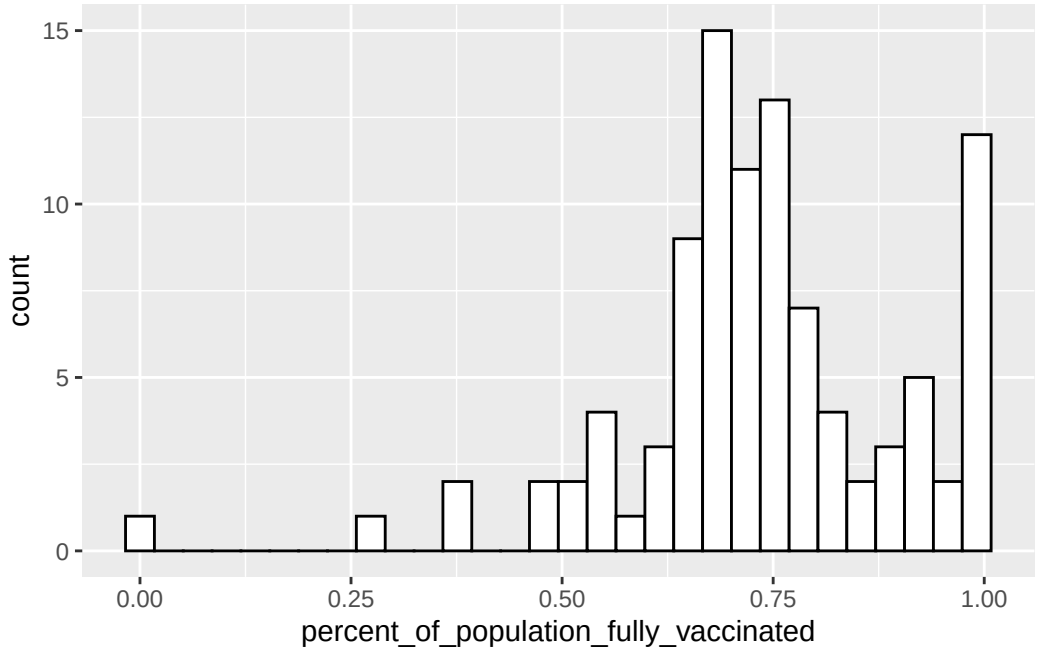
Average of fully vaccinated population percentage is 0.738

> 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 "2022-11-15"?

```
library(ggplot2)
df <- sd1115
p <- ggplot(df, aes(x = percent_of_population_fully_vaccinated)) + geom_histogram(color =
p
```

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

```
Warning: Removed 8 rows containing non-finite values (stat_bin).
```



Focus on UCSD/La Jolla

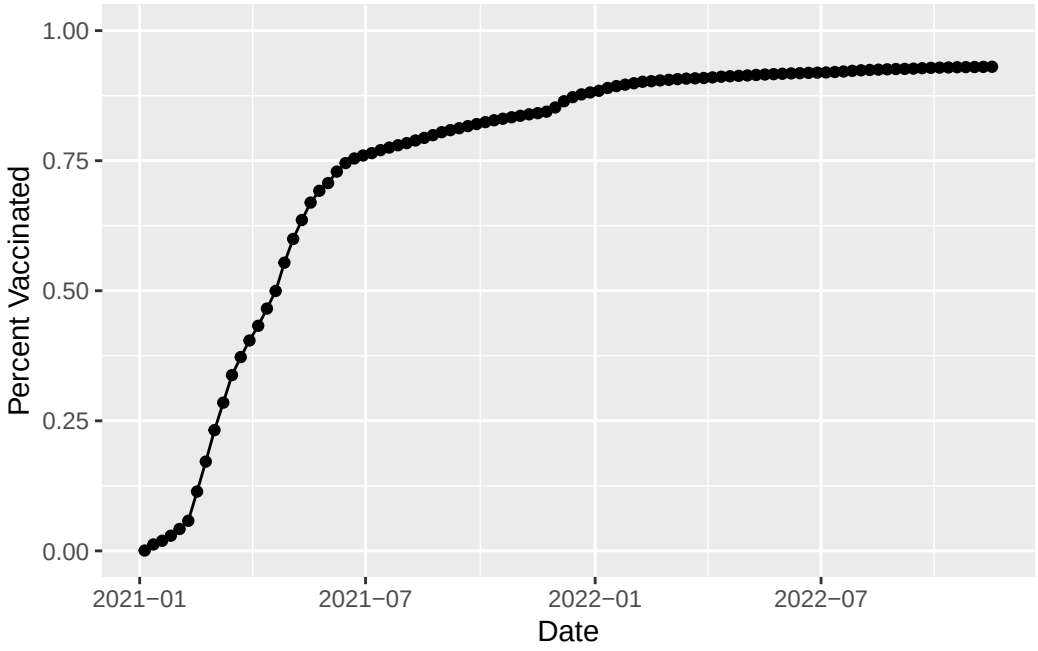
UC San Diego resides in the 92037 ZIP code area and is listed with an age 5+ population size of 36,144.

```
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:

```
p <- ggplot(ucsd) +
  aes(x = as_of_date,y = percent_of_population_fully_vaccinated) + geom_point() + geom_lin
  labs(x = "Date", y = "Percent Vaccinated")
p
```



Comparing to 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 "2022-02-22".

```
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2022-11-15")

head(vax.36)
```

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction       county
1 2022-11-15                   92127                 San Diego    San Diego
2 2022-11-15                   92201                 Riverside    Riverside
3 2022-11-15                   92111                 San Diego    San Diego
4 2022-11-15                   92122                 San Diego    San Diego
5 2022-11-15                   92129                 San Diego    San Diego
6 2022-11-15                   94561              Contra Costa Contra Costa
  vaccine_equity_metric_quartile                vem_source
1                              4 Healthy Places Index Score
2                              1 Healthy Places Index Score
3                              3 Healthy Places Index Score
```

```
4                           4 Healthy Places Index Score
5                           4 Healthy Places Index Score
6                           3 Healthy Places Index Score
  age12_plus_population age5_plus_population tot_population
1               38942.3                46080          49935
2               55960.9                61733          65726
3               44075.0                48160          50693
4               44091.1                45951          48071
5               46449.1                51493          54762
6               34548.9                39272          42473
  persons_fully_vaccinated persons_partially_vaccinated
1                    41150                         3362
2                    44078                         7311
3                    34968                         3524
4                    37846                         5167
5                    43573                         3337
6                    32347                         1804
  percent_of_population_fully_vaccinated
1                               0.824071
2                               0.670633
3                               0.689799
4                               0.787294
5                               0.795679
6                               0.761590
  percent_of_population_partially_vaccinated
1                                   0.067328
2                                   0.111235
3                                   0.069517
4                                   0.107487
5                                   0.060936
6                                   0.042474
  percent_of_population_with_1_plus_dose booster_recip_count
1                               0.891399               27742
2                               0.781868               21043
3                               0.759316               21623
4                               0.894781               26519
5                               0.856615               29989
6                               0.804064               18909
  bivalent_dose_recip_count eligible_recipient_count redacted
1                      7809                    40694       No
2                      3965                    43955       No
3                      5715                    34693       No
4                      8646                    37523       No
```

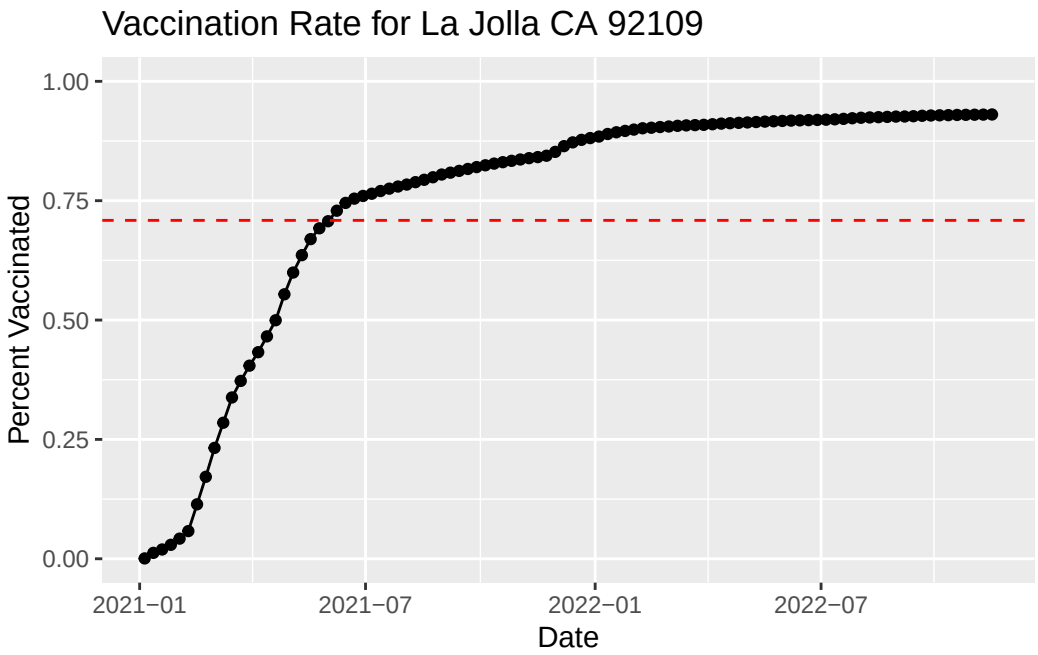
```
5                      8783                    43106       No
6                      4323                    32167       No
```

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 "2022-11-15". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

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

```
[1] 0.7088141
```

```
p2 <- ggplot(ucsd) +
  aes(x = as_of_date,y = percent_of_population_fully_vaccinated) + geom_point() + geom_lin
  labs(x = "Date", y = "Percent Vaccinated")
p2
```



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 "2022-11-15"?

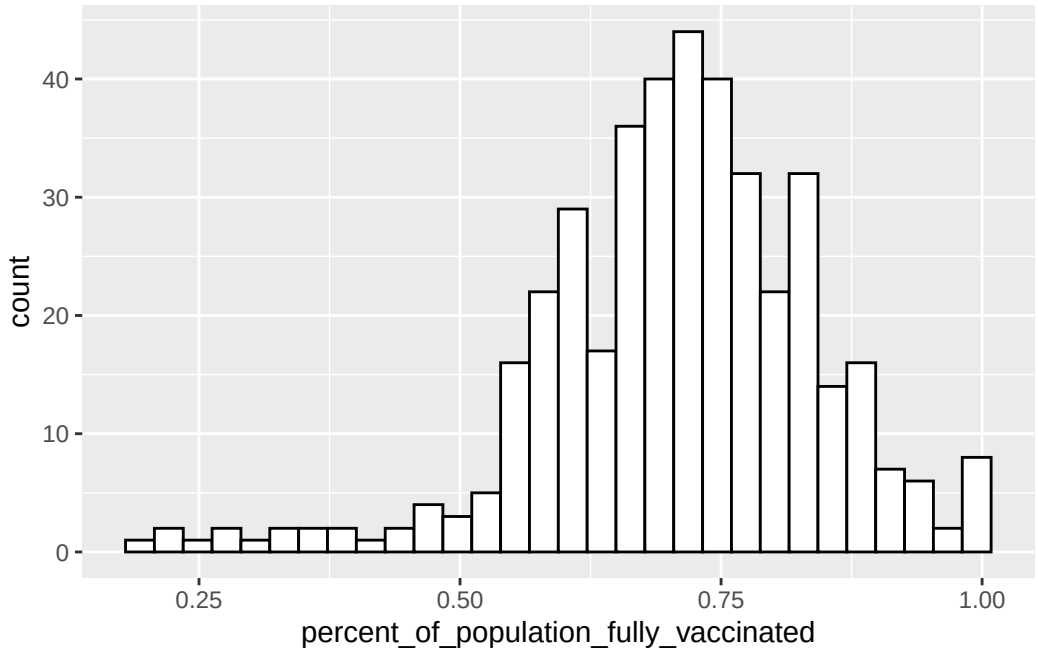
```
summary(vax.36$percent_of_population_fully_vaccinated)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
 0.1986  0.6338  0.7162  0.7088  0.7893  1.0000 
```

Q18. Using ggplot generate a histogram of this data.

```
df <- vax.36
p3 <- ggplot(df, aes(x = percent_of_population_fully_vaccinated)) + geom_histogram(color =
p3
```

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



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 == "2022-11-15") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
  percent_of_population_fully_vaccinated
1                               0.547251
```

```
vax %>% filter(as_of_date == "2022-11-15") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

```
  percent_of_population_fully_vaccinated
1                               0.695676
```

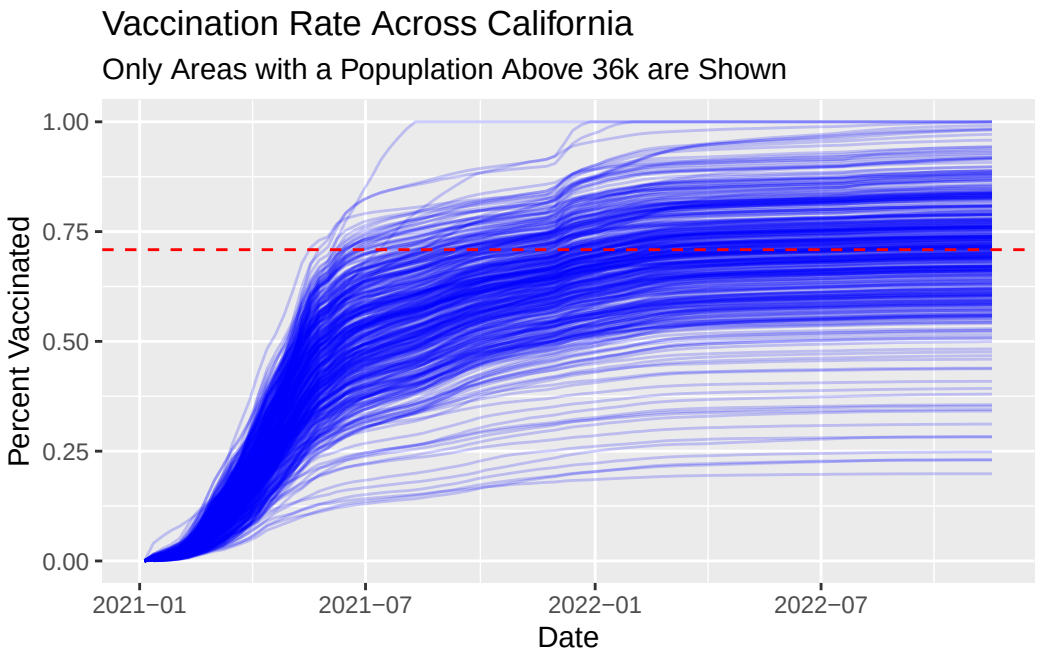
Both area 92040 and 92109 are below the average for fully vaccinated population percentages for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2022-11-15".

> 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 Vaccinated",
       title="Vaccination Rate Across California",
       subtitle="Only Areas with a Popuplation Above 36k are Shown") +
  geom_hline(yintercept = vax_mean, linetype="dashed", color = "red")
```

```
Warning: Removed 183 row(s) containing missing values (geom_path).
```



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

Pretty safe, as about more than half of the areas seem to be vaccinated above the average.