COVID_Vax_Analysis

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Import vax data

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

```
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"
```

```r
tail(vax$as_of_date)
```

```
[1] "2022-11-15" "2022-11-15" "2022-11-15" "2022-11-15" "2022-11-15"
[6] "2022-11-15"
```

Q1. What column details the total number of people fully vaccinated? # persons_partially_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? # 2022-11-15

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

Table 1: Data summary

Name	vax
Number of rows	172872
Number of columns	18
Column type frequency:	
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	18895.04	18993.88	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21105.98	0	1460.50	15364.00	34877.00	101902.0	
tot_population	8428	0.95	23372.77	22628.51	12	2126.00	18714.00	38168.00	111165.0	
persons_fully_vaccinated	15440	0.91	13309.14	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	1	101.00	662.00	2236.00	16790.0	
eligible_recipient_count	0	1.00	12114.80	10551.97	0	438.00	5520.00	20714.00	86817.0	

Q5. How many numeric columns are in this dataset? # 13 numeric columns

Q6. Note that there are "missing values" in the dataset. How many NA values there in the persons_fully_vaccinated column? # There are 15440 missing values in the in the fully vaccinated column.

Q7. What percent of persons_fully_vaccinated values are missing (to 2 significant figures)? # 8.9% of the persons fully vaccinated values are missing

```
(15440/172872)*100
```

```
[1] 8.931464
```

Q8. [Optional]: Why might this data be missing? # These data may be missing according to the reporting conditions/limitations from the CDC as stated at the beginning of the document. "These data do NOT 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."

Working with dates

```
library(lubridate)
```

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

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

    date, intersect, setdiff, union
```

```
today()
```

```
[1] "2022-11-22"
```

```
#specify ymd format
vax$as_of_date <- ymd(vax$as_of_date)

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

```
Time difference of 686 days
```

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

```
Time difference of 679 days
```

Q9. How many days have passed since the last update of the dataset? # 6 days have passed since the last update to the dataset, 2022-11-15.

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

```
Time difference of 7 days
```

Q10. How many unique dates are in the dataset (i.e. how many different dates are detailed)? # There are 98 unique dates in the dataset.

```
library(dplyr)
```

```
Warning: package 'dplyr' was built under R version 4.1.3


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
```

```
n_distinct(vax$as_of_date)
```

```
[1] 98
```

Working with zip codes

```
library(zipcodeR)

geocode_zip('92037')
```

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

```
# distance between 2 centroids
zip_distance('92037','92109')
```

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

```
# census data
reverse_zipcode(c('92037','92109'))
```

```
# A tibble: 2 x 24
  zipcode zipcode_~1 major~2 post_~3 common_c~4 county state   lat   lng timez~5
  <chr>   <chr>      <chr>   <chr>       <blob> <chr>  <chr> <dbl> <dbl> <chr>
1 92037   Standard   La Jol~ La Jol~ <raw 20 B> San D~ CA     32.8 -117. Pacific
```

```
2 92109    Standard   San Di~ San Di~ <raw 21 B> San D~ CA     32.8 -117. Pacific
# ... with 14 more variables: 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>, and abbreviated variable names
#   1: zipcode_type, 2: major_city, 3: post_office_city, ...
```

Focus on SD area

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

```
[1] 10486
```

Q11. How many distinct zip codes are listed for San Diego County? # There are 107 distinct zip codes in SD county.

```
n_distinct(sd$zip_code_tabulation_area)
```

```
[1] 107
```

Q12. What San Diego County Zip code area has the largest 12 + Population in this dataset? # Zip code 92154 has the largest 12+ population in SD.

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

```
[1] 92154
```

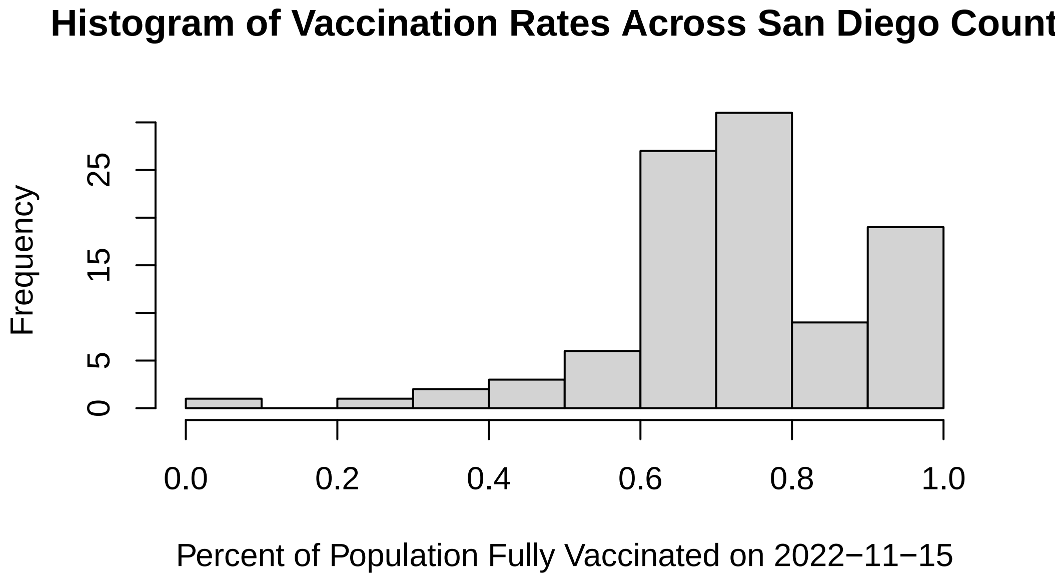
Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2022-11-15"? # On average, 73.8% percent of the SD population is fully vaccinated as of 2022-11-25.

```
date_20221115 <- filter(sd, as_of_date == '2022-11-15')
mean(date_20221115$percent_of_population_fully_vaccinated, na.rm = TRUE)
```

```
[1] 0.7381765
```

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"? #

```
hist(date_20221115$percent_of_population_fully_vaccinated, main = "Histogram of Vaccinatio
```



Focus on UCSD/La Jolla

```
ucsd <- filter(sd, zip_code_tabulation_area == "92037")
ucsd[1,]$age5_plus_population
```

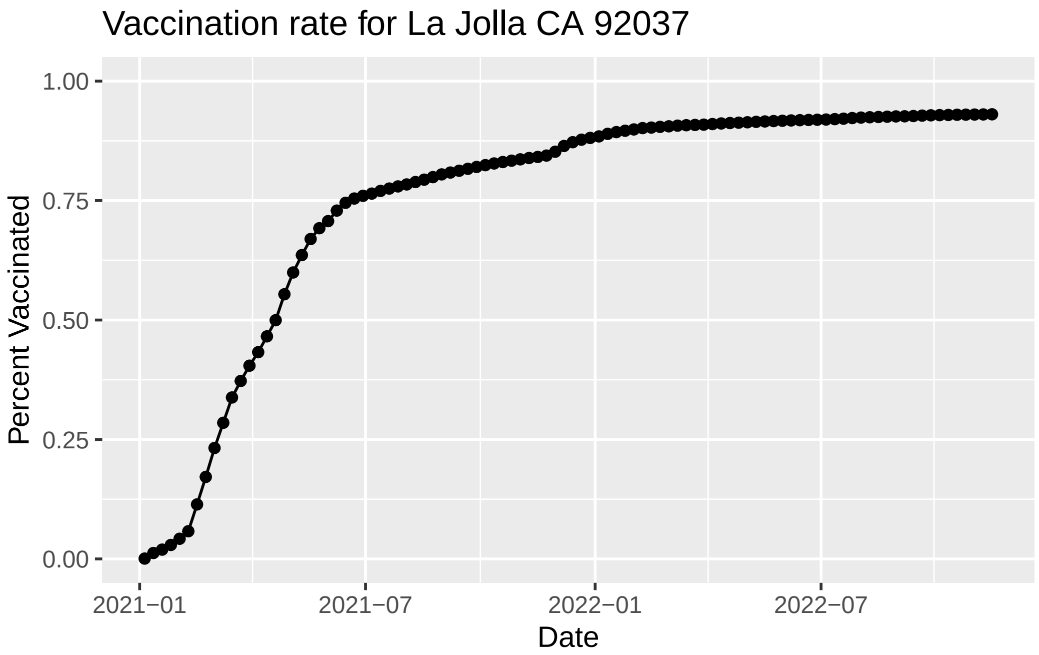
```
[1] 36144
```

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

```
library(ggplot2)
```

```
Warning: package 'ggplot2' was built under R version 4.1.3
```

```
p <- 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 CA 92037")
p
```



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 == "2022-11-15")
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
```

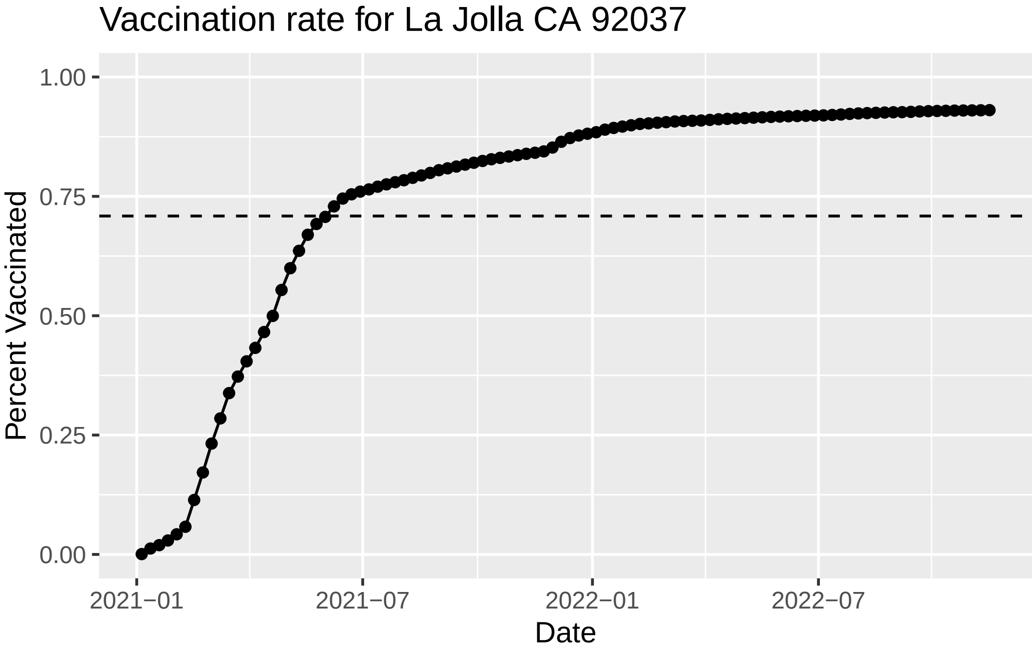
```
5 2022-11-15                    92129                 San Diego    San Diego
6 2022-11-15                    94561              Contra Costa Contra Costa
  vaccine_equity_metric_quartile                 vem_source
1                              4 Healthy Places Index Score
2                              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?

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

p + geom_hline(yintercept = h_line, linetype = 2)
```



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"?

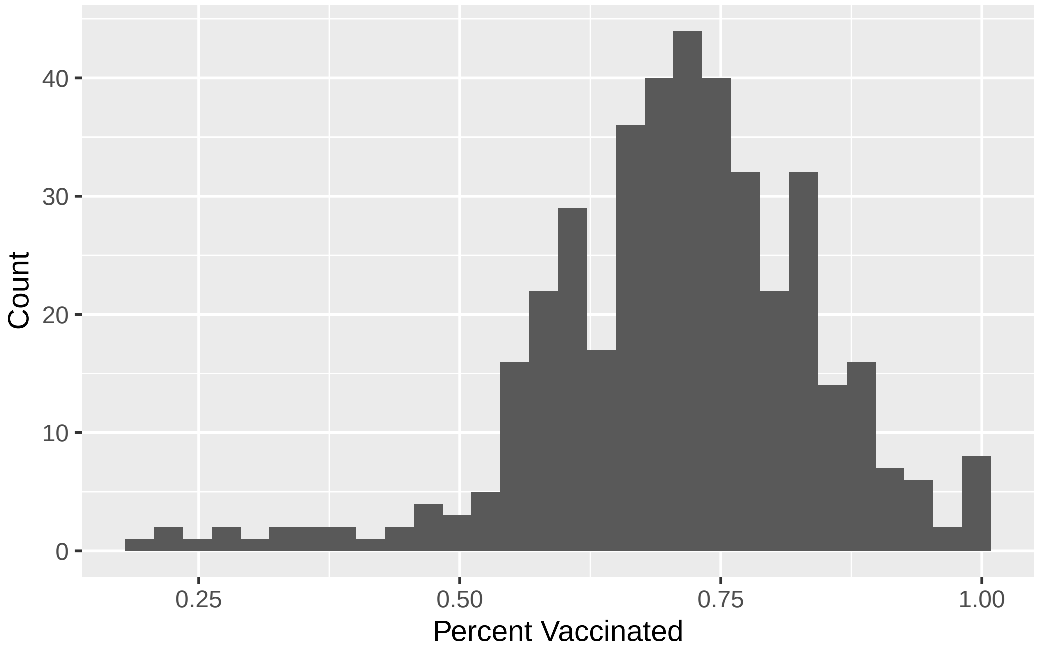
```
sum_stats <- summary(vax.36$percent_of_population_fully_vaccinated)
sum_stats
```

```
   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.

```
ggplot(vax.36) +
  aes(percent_of_population_fully_vaccinated) +
  geom_histogram() +
  labs(x="Percent Vaccinated", y="Count")
```

```
`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? # Both zipcodes 92109 and 92040 are below the calculated average 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”.

```r
vax_92040 <- vax %>% filter(as_of_date == "2022-11-15") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
vax_92040
```

```
  percent_of_population_fully_vaccinated
1                                0.547251
```

```r
vax_92109 <- vax %>% filter(as_of_date == "2022-11-15") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
vax_92109
```

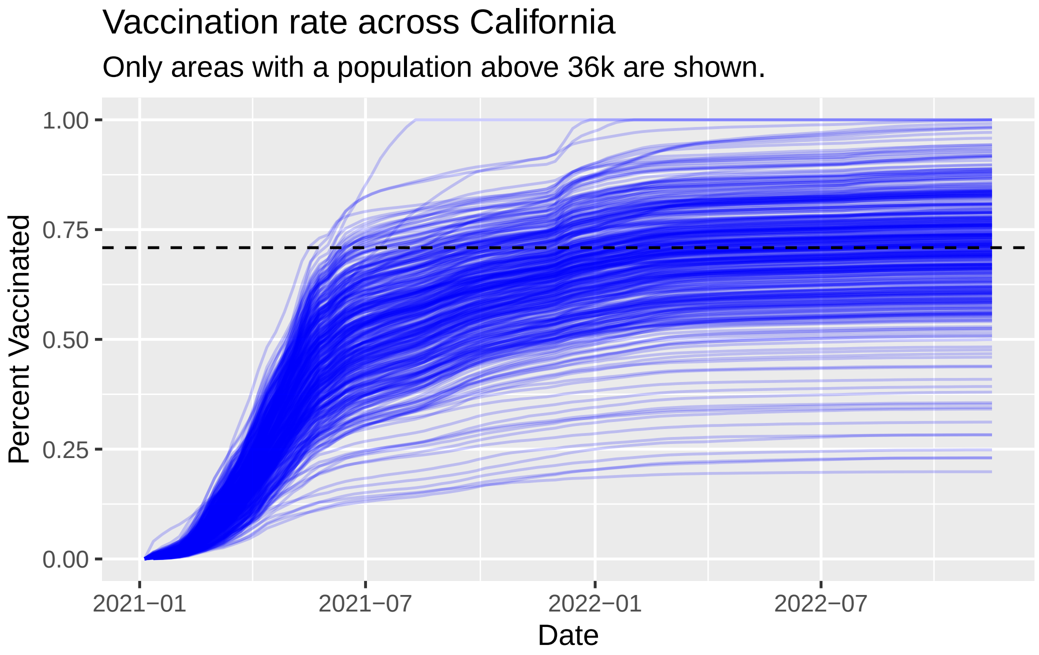
```
  percent_of_population_fully_vaccinated
1                                0.695676
```

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

```r
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 population above 36k are shown.") +
  geom_hline(yintercept = h_line, linetype=2)
```

```
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? # I'm staying in SD for break so I don't mind meeting in person for class.