Class 17: Mini Project

Christina Mac

We will start by downloading the most recently dated “Statewide COVID-19 Vaccines Administered by ZIP code” CSV file:

```r
# 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                    95446                    Sonoma    Sonoma
2 2021-01-05                    96014                  Siskiyou  Siskiyou
3 2021-01-05                    96087                    Shasta    Shasta
4 2021-01-05                    96008                    Shasta    Shasta
5 2021-01-05                    95410                 Mendocino Mendocino
6 2021-01-05                    95527                   Trinity   Trinity
  vaccine_equity_metric_quartile                 vem_source
1                              2 Healthy Places Index Score
2                              2    CDPH-Derived ZCTA Score
3                              2    CDPH-Derived ZCTA Score
4                             NA            No VEM Assigned
5                              3    CDPH-Derived ZCTA Score
6                              2    CDPH-Derived ZCTA Score
  age12_plus_population age5_plus_population tot_population
1                4840.7                 5057           5168
2                 135.0                  135            135
3                 513.9                  544            544
4                1125.3                 1164             NA
5                 926.3                  988            997
6                 476.6                  485            499
  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                        0
3                        NA                        2
4                        NA                        2
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 11, “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

```
head(sort(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? 2023-02-28

```
head(sort(vax$as_of_date, decreasing = TRUE))
```

```
[1] "2023-02-28" "2023-02-28" "2023-02-28" "2023-02-28" "2023-02-28"
[6] "2023-02-28"
```

We can use the skim() function for a quick overview of a new dataset like this:

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

Table 1: Data summary

Name	vax
Number of rows	199332
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	113	0
local_health_jurisdiction	0	1	0	15	565	62	0
county	0	1	0	15	565	59	0
vem_source	0	1	15	26	0	3	0

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
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	1817.38	90001	92257.75	93658.50	95380.50	97635.0	
vaccine_equity_metric_quartile	9831	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.87	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21105.97	0	1460.50	15364.00	34877.00	101902.0	
tot_population	9718	0.95	23372.77	22628.51	12	2126.00	18714.00	38168.00	111165.0	
persons_fully_vaccinated	16525	0.92	13962.33	15054.09	11	930.00	8566.00	23302.00	87566.0	
persons_partially_vaccinated	16525	0.92	1701.64	2030.18	11	165.00	1196.00	2535.00	39913.0	
percent_of_population_fully_vaccinated	20825	0.90	0.57	0.25	0	0.42	0.60	0.74	1.0	
percent_of_population_partially_vaccinated	20825	0.90	0.08	0.09	0	0.05	0.06	0.08	1.0	
percent_of_population_with_1_plus_dose	21859	0.89	0.63	0.24	0	0.49	0.67	0.81	1.0	
booster_recip_count	72872	0.63	5837.31	7165.81	11	297.00	2748.00	9438.25	59553.0	
bivalent_dose_recip_count	158664	0.20	2924.93	3583.45	11	190.00	1418.00	4626.25	27458.0	
eligible_recipient_count	0	1.00	12801.84	14908.33	0	504.00	6338.00	21973.00	87234.0	

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

Q6. Note that there are "missing values" in the dataset. How many NA values there in the persons_fully_vaccinated column? 16525

```r
sum(is.na(vax$persons_fully_vaccinated))
```

```
[1] 16525
```

What percent of persons_fully_vaccinated values are missing (to 2 significant figures)? 8.3%

```r
length(vax$persons_fully_vaccinated)
```

```
[1] 199332
```

```r
round((sum(is.na(vax$persons_fully_vaccinated))/length(vax$persons_fully_vaccinated))*100,
[1] 8.29
```

##Working with dates

the lubridate package makes working with dates and times in R much less of a pain. Let’s have a first play with this package here.

```r
library(lubridate)
```

```

Attaching package: 'lubridate'

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

    date, intersect, setdiff, union
```

```r
today()
```

```
[1] "2023-03-07"
```

```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)
```

We can now magically do math with dates

```r
today()-ymd("2021-01-05")
```

```
Time difference of 791 days
```

How old am I?

```r
today()-ymd("2001-02-11")
```

```
Time difference of 8059 days
```

Let's treat the whole col

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

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

```
Time difference of 791 days
```

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

```
Time difference of 784 days
```

Q9. How many days have passed since the last update of the dataset? 7 days

```
today()-ymd(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)? 113 dates

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

```
[1] 113
```

Working with ZIP codes

ZIP codes are also rather annoying things to work with as they are nmeric but no in the conventional sense of doing math.

Just like dates we have speial packages to help us work with ZIP codes.

```
library(zipcodeR)
```

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

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

```r
zip_distance('92037','95148')
```

```
  zipcode_a zipcode_b distance
1     92037     95148    405.6
```

```r
reverse_zipcode(c('92037', "95148") )
```

```
# 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 95148   Standard   San Jo~ San Jo~ <raw 20 B> Santa~ CA     37.3 -122. 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 the San Diego area

Let’s now focus on the San Diego county

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

```r
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
```

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

nrow(sd)
```

```
[1] 12091
```

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

```r
head(sd.10)
```

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction    county
1 2021-01-05                    92040                 San Diego San Diego
2 2021-01-05                    92154                 San Diego San Diego
3 2021-01-05                    92122                 San Diego San Diego
4 2021-01-05                    92120                 San Diego San Diego
5 2021-01-05                    92115                 San Diego San Diego
6 2021-01-05                    92114                 San Diego San Diego
  vaccine_equity_metric_quartile                 vem_source
1                              3 Healthy Places Index Score
2                              2 Healthy Places Index Score
3                              4 Healthy Places Index Score
4                              4 Healthy Places Index Score
5                              2 Healthy Places Index Score
6                              2 Healthy Places Index Score
  age12_plus_population age5_plus_population tot_population
1               39405.0                42833          46306
2               76365.2                82971          88979
3               44091.1                45951          48071
4               26372.9                28414          30550
5               56152.4                60409          64343
```

```
6               59050.7                64945          68851
  persons_fully_vaccinated persons_partially_vaccinated
1                       14                          585
2                       16                         1397
3                       19                         1249
4                       25                          906
5                       28                          874
6                       12                         1213
  percent_of_population_fully_vaccinated
1                               0.000302
2                               0.000180
3                               0.000395
4                               0.000818
5                               0.000435
6                               0.000174
  percent_of_population_partially_vaccinated
1                                   0.012633
2                                   0.015700
3                                   0.025982
4                                   0.029656
5                                   0.013583
6                                   0.017618
  percent_of_population_with_1_plus_dose booster_recip_count
1                               0.012935                  NA
2                               0.015880                  NA
3                               0.026377                  NA
4                               0.030474                  NA
5                               0.014018                  NA
6                               0.017792                  NA
  bivalent_dose_recip_count eligible_recipient_count
1                        NA                       14
2                        NA                       16
3                        NA                       19
4                        NA                       25
5                        NA                       28
6                        NA                       12
                                                               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
```

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

```
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
```

```
x <-sd %>%
  filter(as_of_date == "2023-02-28")
```

Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2022-02-28"? 74%

```
sd.today <- filter(sd, as_of_date == "2023-02-28")
```

```
mean(sd.today$percent_of_population_fully_vaccinated, na.rm = T)
```

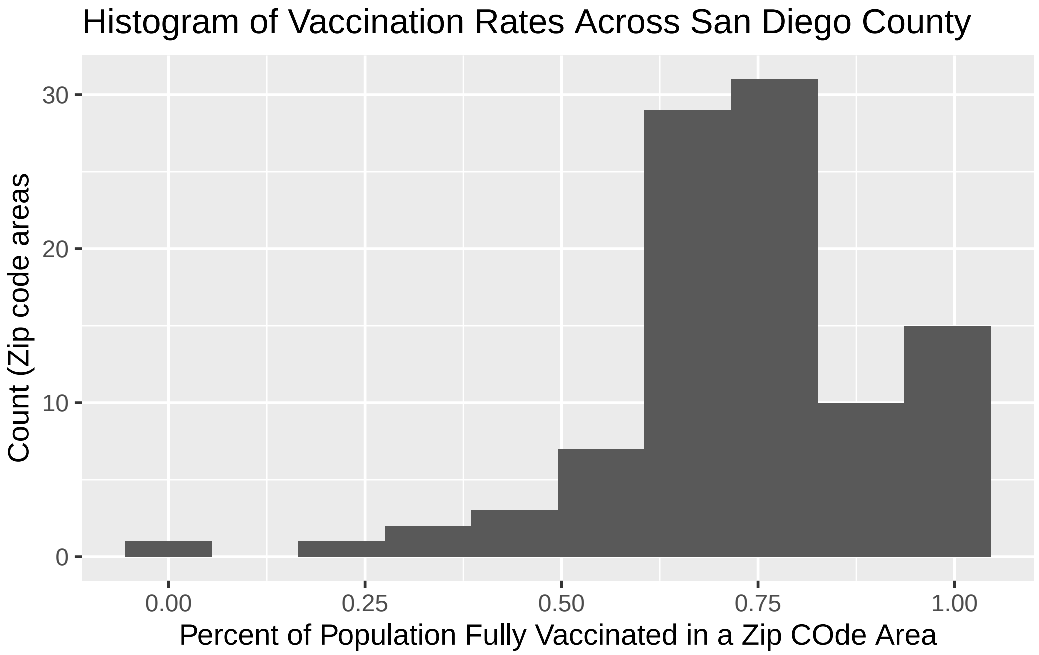
```
[1] 0.7400878
```

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 "2022-02-28"?

```
library(ggplot2)
```

```
ggplot(sd.today, aes(x=sd.today$percent_of_population_fully_vaccinated, )) +
  geom_histogram(bins = 10, na.rm=T) +
  labs(x= "Percent of Population Fully Vaccinated in a Zip COde Area", y="Count (Zip code
  ggtitle("Histogram of Vaccination Rates Across San Diego County")
```

```
Warning: Use of `sd.today$percent_of_population_fully_vaccinated` is discouraged.
i Use `percent_of_population_fully_vaccinated` instead.
```

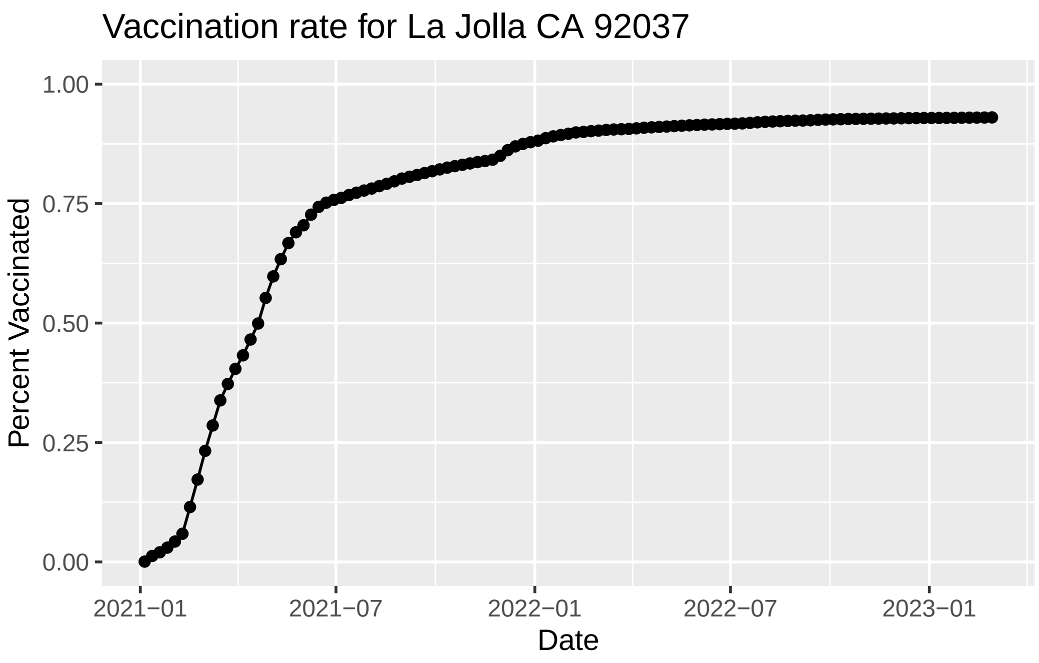


```r
ucsd <- filter(sd, zip_code_tabulation_area=="92037")
ucsd[1,]$age5_plus_population
```

```
[1] 36144
```

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

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



```
# 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)
```

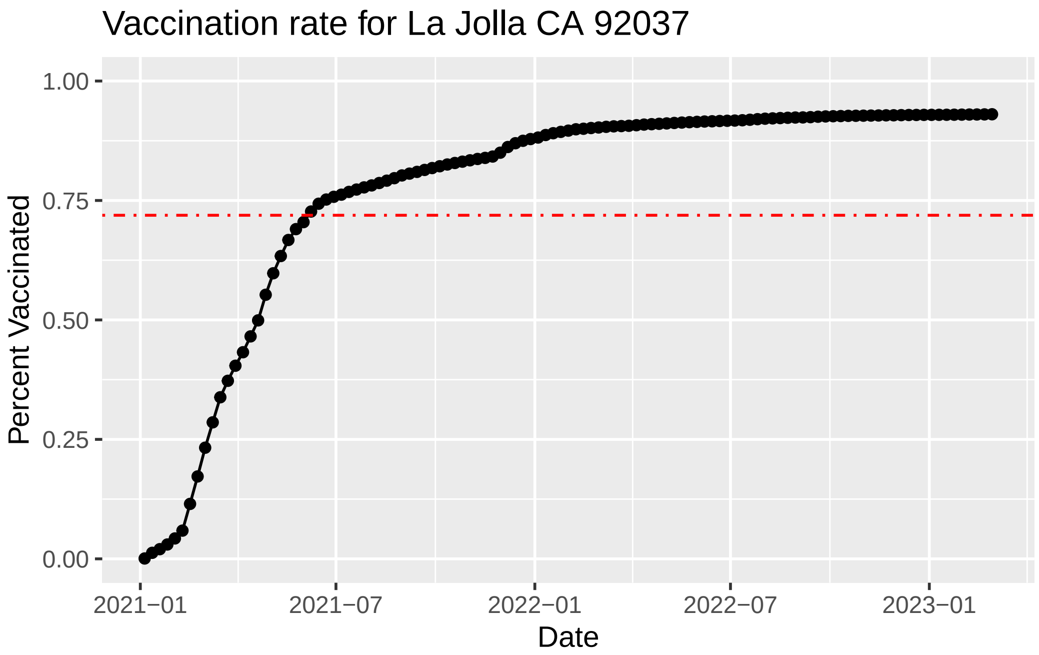
```
  as_of_date zip_code_tabulation_area local_health_jurisdiction         county
1 2022-11-15                    90022               Los Angeles    Los Angeles
2 2022-11-15                    92346            San Bernardino San Bernardino
3 2022-11-15                    92231                  Imperial       Imperial
4 2022-11-15                    95404                    Sonoma         Sonoma
5 2022-11-15                    92253                 Riverside      Riverside
6 2022-11-15                    92345            San Bernardino San Bernardino
  vaccine_equity_metric_quartile                 vem_source
1                              1 Healthy Places Index Score
2                              2 Healthy Places Index Score
3                              1 Healthy Places Index Score
4                              3 Healthy Places Index Score
5                              3 Healthy Places Index Score
6                              1 Healthy Places Index Score
  age12_plus_population age5_plus_population tot_population
1               55192.3                62369          67014
```

```
2               52408.8                58874          63857
3               32448.6                36867          40064
4               35138.9                38436          40497
5               35435.2                38922          40929
6               66047.5                75539          82110
  persons_fully_vaccinated persons_partially_vaccinated
1                    49419                         5537
2                    34564                         3266
3                    70739                        38805
4                    30573                         2342
5                    27448                         3453
6                    41672                         4283
  percent_of_population_fully_vaccinated
1                               0.737443
2                               0.541272
3                               1.000000
4                               0.754945
5                               0.670625
6                               0.507514
  percent_of_population_partially_vaccinated
1                                   0.082625
2                                   0.051146
3                                   0.968575
4                                   0.057831
5                                   0.084366
6                                   0.052162
  percent_of_population_with_1_plus_dose booster_recip_count
1                               0.820068               21942
2                               0.592418               16624
3                               1.000000               26706
4                               0.812776               17977
5                               0.754991               14896
6                               0.559676               16576
  bivalent_dose_recip_count eligible_recipient_count redacted
1                      4061                    49392       No
2                      3818                    34542       No
3                      2737                    70617       No
4                      7156                    30525       No
5                      4804                    27434       No
6                      3191                    41649       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?

```
average_percent <- mean(vax.36$percent_of_population_fully_vaccinated)
```

```
ggplot(ucsd) +
  aes(x=as_of_date,
      y=percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  ylim(c(0,1)) +
  labs(title = "Vaccination rate for La Jolla CA 92037", x= "Date", y="Percent Vaccinated"
  geom_hline(yintercept = average_percent,color = "red", linetype=10)
```



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.
```

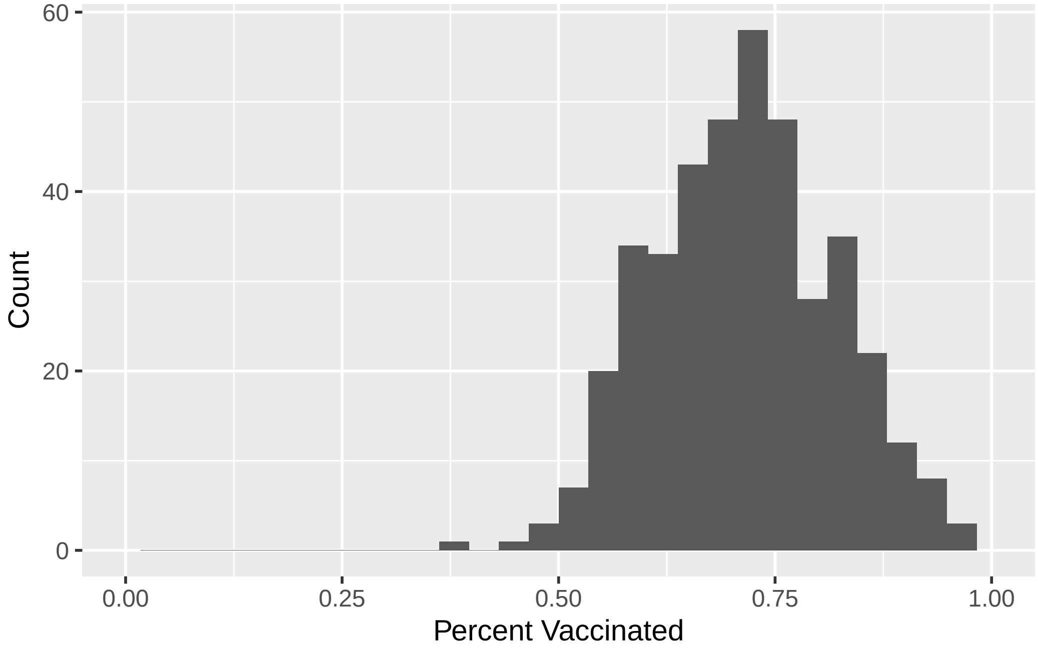
```
 0.3784  0.6444  0.7162  0.7191  0.7882  1.0000
```

Q18. Using ggplot generate a histogram of this data.

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

```
x <- filter(vax.36, zip_code_tabulation_area %in% c("92109", "92040"))
x$percent_of_population_fully_vaccinated
```

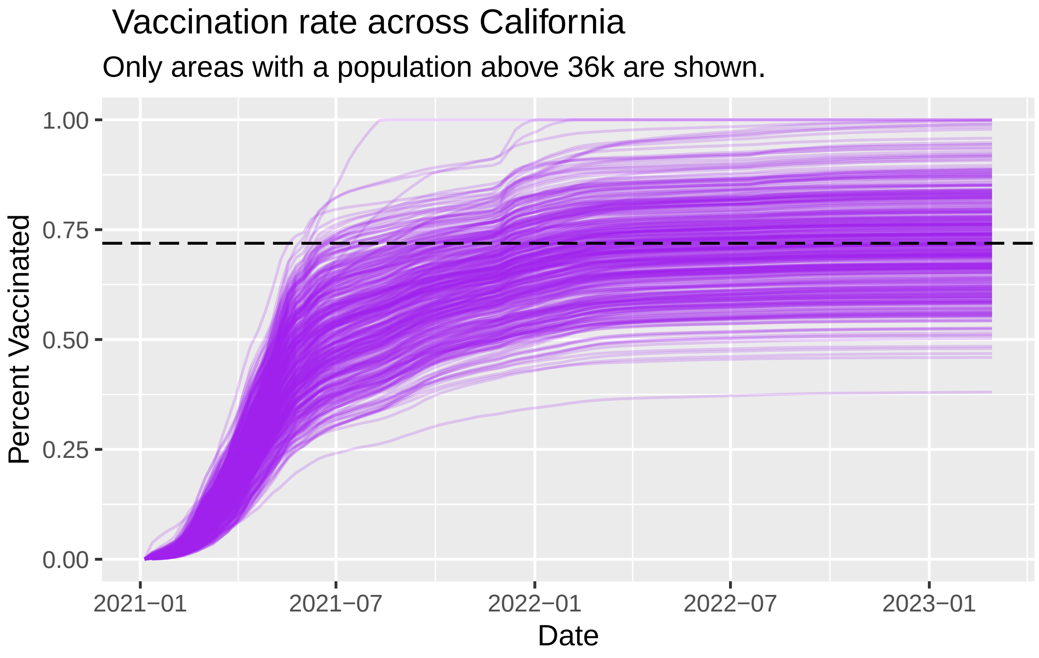
```
[1] 0.548849 0.692874
```

```
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                               0.548849
```

```
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="purple", na.rm = T) +
  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 = average_percent, linetype=5)
```



Q21. How do you feel about traveling for Thanksgiving Break and meeting for in-person class afterwards? Would be tiring, but I would be okay with it!