Lab_15

RUNQI ZHANG

Table of contents

Getting Started

```
# 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                   92240                 Riverside       Riverside
2 2021-01-05                   91302               Los Angeles     Los Angeles
3 2021-01-05                   93420           San Luis Obispo San Luis Obispo
4 2021-01-05                   91901                 San Diego       San Diego
5 2021-01-05                   94110             San Francisco   San Francisco
6 2021-01-05                   91902                 San Diego       San Diego
  vaccine_equity_metric_quartile                vem_source
1                              1 Healthy Places Index Score
2                              4 Healthy Places Index Score
3                              3 Healthy Places Index Score
4                              3 Healthy Places Index Score
5                              4 Healthy Places Index Score
6                              4 Healthy Places Index Score
  age12_plus_population age5_plus_population tot_population
1               29270.5                33093          35278
```

```
2             23163.9                25899          26712
3             26694.9                29253          30740
4             15549.8                16905          18162
5             64350.7                68320          72380
6             16620.7                18026          18896
  persons_fully_vaccinated persons_partially_vaccinated
1                       NA                           NA
2                       15                          614
3                       NA                           NA
4                       NA                           NA
5                       17                         1268
6                       15                          397
  percent_of_population_fully_vaccinated
1                                     NA
2                               0.000562
3                                     NA
4                                     NA
5                               0.000235
6                               0.000794
  percent_of_population_partially_vaccinated
1                                         NA
2                                   0.022986
3                                         NA
4                                         NA
5                                   0.017519
6                                   0.021010
  percent_of_population_with_1_plus_dose booster_recip_count
1                                     NA                  NA
2                               0.023548                  NA
3                                     NA                  NA
4                                     NA                  NA
5                               0.017754                  NA
6                               0.021804                  NA
  bivalent_dose_recip_count eligible_recipient_count
1                        NA                        2
2                        NA                       15
3                        NA                        4
4                        NA                        8
5                        NA                       17
6                        NA                       15
                                                         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"
```

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

```
[1] "2022-11-22" "2022-11-22" "2022-11-22" "2022-11-22" "2022-11-22"
[6] "2022-11-22"
```

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

A: persons_fully_vaccinated

Q2. What column details the Zip code tabulation area?

A: zip_code_tabulation_area

Q3. What is the earliest date in this dataset?

A: 2021-01-05

Q4. What is the latest date in this dataset?

A: 2022-11-22

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

Table 1: Data summary

Name	vax

Table 1: Data summary

Number of rows	174636
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	99	0
local_health_jurisdiction	0	1	0	15	495	62	0
county	0	1	0	15	495	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	8613	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	13685.50	31756.25	88556.7	
age5_plus_population	0	1.00	20875.24	21105.98	0	1460.50	15364.00	34877.00	101902.0	
tot_population	8514	0.95	23372.72	22628.51	12	2126.00	18714.00	38168.00	111165.0	
persons_fully_vaccinated	14921	0.91	13466.31	14722.46	11	883.00	8024.00	22529.00	67186.0	
persons_partially_vaccinated	14921	0.91	1707.50	1998.80	11	167.00	1194.00	2547.00	39204.0	
percent_of_population_fully_vaccinated	18665	0.89	0.55	0.25	0	0.39	0.59	0.73	1.0	
percent_of_population_partially_vaccinated	18665	0.89	0.08	0.09	0	0.05	0.06	0.08	1.0	
percent_of_population_with_1_plus_dose	19562	0.89	0.61	0.25	0	0.46	0.65	0.79	1.0	
booster_recip_count	70421	0.60	5655.17	6867.49	11	280.00	2575.00	9421.00	58304.0	
bivalent_dose_recip_count	156958	0.10	1646.02	2161.84	11	109.00	719.00	2443.00	18109.0	
eligible_recipient_count	0	1.00	12309.11	14555.83	0	466.00	5810.00	21140.00	86696.0	

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

```
[1] 14921
```

```
  sum (is.na(vax$persons_fully_vaccinated))/nrow(vax)
```

```
[1] 0.08544057
```

Q5. How many numeric columns are in this dataset?

A: 13

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

A: 14921

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

A: 0.085

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

Working with dates

```
  library(lubridate)
```

```
Warning: package 'lubridate' was built under R version 4.2.2
```

```
Loading required package: timechange
```

```
Warning: package 'timechange' was built under R version 4.2.2
```

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

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

    date, intersect, setdiff, union
```

```
  today()
```

```
[1] "2022-11-27"
```

```
  # 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 691 days
```

```
  # Using the last and the first date value we can now determine how many days the dataset s
  vax$as_of_date[nrow(vax)] - vax$as_of_date[1]
```

```
Time difference of 686 days
```

```
  # Finding how many unique dates are in the dataset
  sum( !is.na( unique(vax$as_of_date) ))
```

```
[1] 99
```

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

A: 691

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

A: 99

Working with ZIP codes

```
  library(terra)
```

```
terra 1.6.17
```

```
library(zipcodeR)
```

```
Warning: package 'zipcodeR' was built under R version 4.2.2
```

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

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

```
# Calculate the distance between the centroids of any two ZIP codes in miles, e.g.
zip_distance('92037','92109')
```

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

```
# More usefully, we can pull census data about ZIP code areas (including median household
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, ...
```

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

Focus on the San Diego area

```
library(dplyr)
```

```
Attaching package: 'dplyr'
```

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

    intersect, union
```

```
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] 10593
```

```
sum( !is.na( unique(sd$zip_code_tabulation_area) ))
```

```
[1] 107
```

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

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

```
[1] 92154
```

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

A: 107

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

A: 92154

Using dplyr select all San Diego "county" entries on "as_of_date" "2022-11-15" and use this for the following questions.

```
sd.221115 <- filter(vax, county == "San Diego" &
                    as_of_date == "2022-11-15")

sum(sd.221115$persons_fully_vaccinated[!is.na(sd.221115$persons_fully_vaccinated)])/sum(sd
```

```
[1] 0.752562
```

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

A: persons_fully_vaccinated / tot_population = 0.752562

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"?

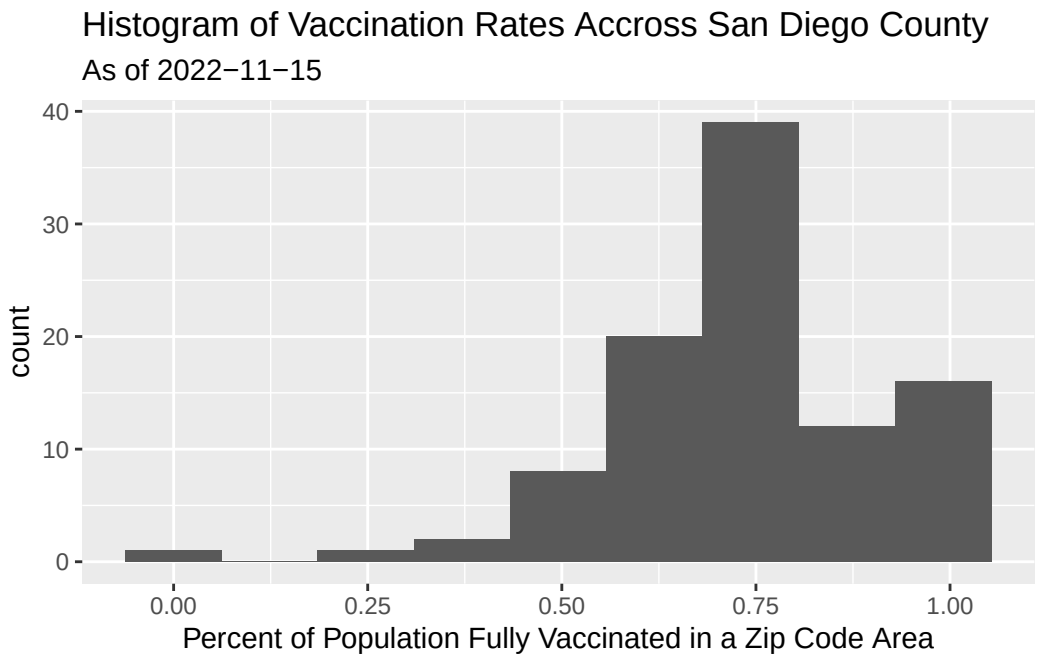
A: see plot below

```
library(ggplot2)

p1 <- ggplot(sd.221115, aes(percent_of_population_fully_vaccinated))+
        geom_histogram(bins=9)+
        xlab("Percent of Population Fully Vaccinated in a Zip Code Area")+
        ylab("count")

p1 + labs(title="Histogram of Vaccination Rates Accross San Diego County",
          subtitle="As of 2022-11-15")
```

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



Focuse on UCSD/La Jolla

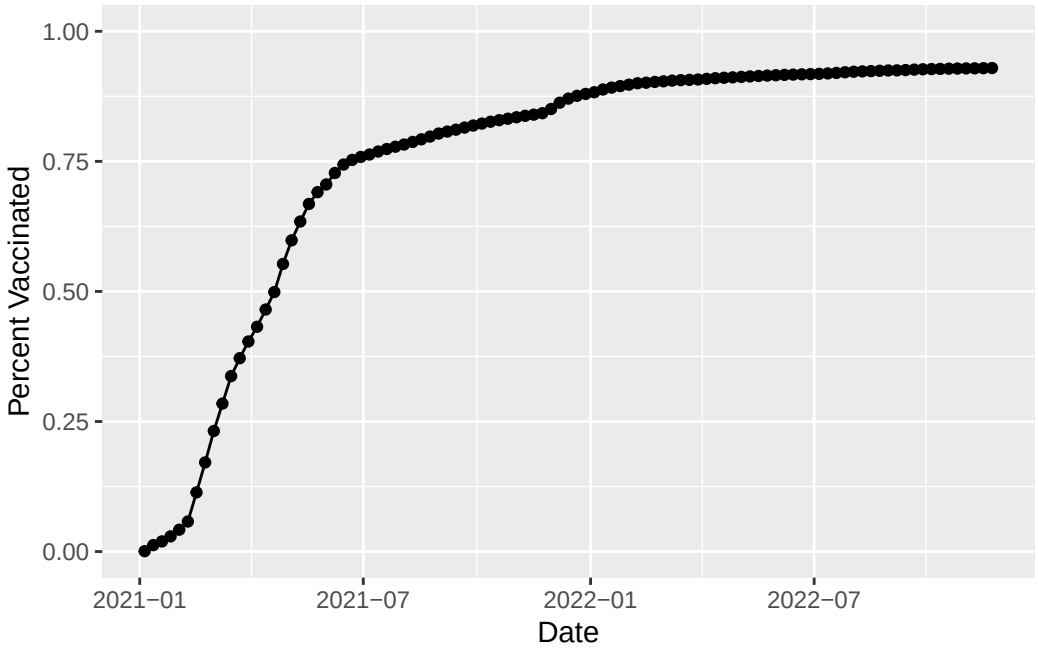
```
ucsd <- filter(sd, zip_code_tabulation_area=="92037")
ucsd[1,]$age5_plus_population
```

```
[1] 36144
```

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

```
p2 <- 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")
p2
```



Comparing to similar sized areas

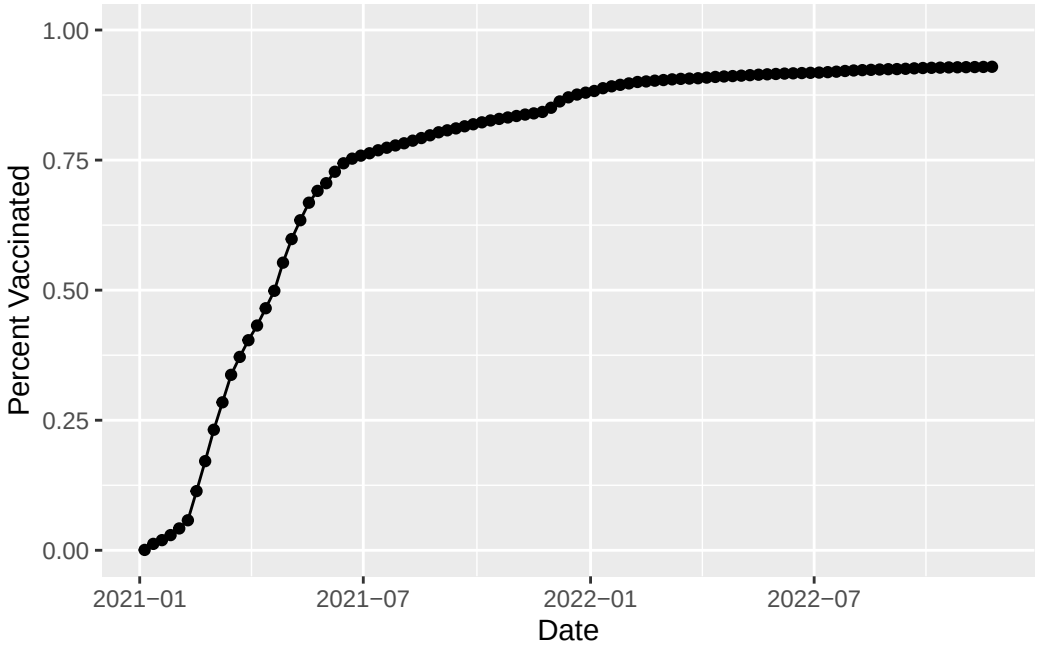
```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2022-11-15")
#head(vax.36)

sum(vax.36$persons_fully_vaccinated[!is.na(vax.36$persons_fully_vaccinated)])/sum(vax.36$t
```

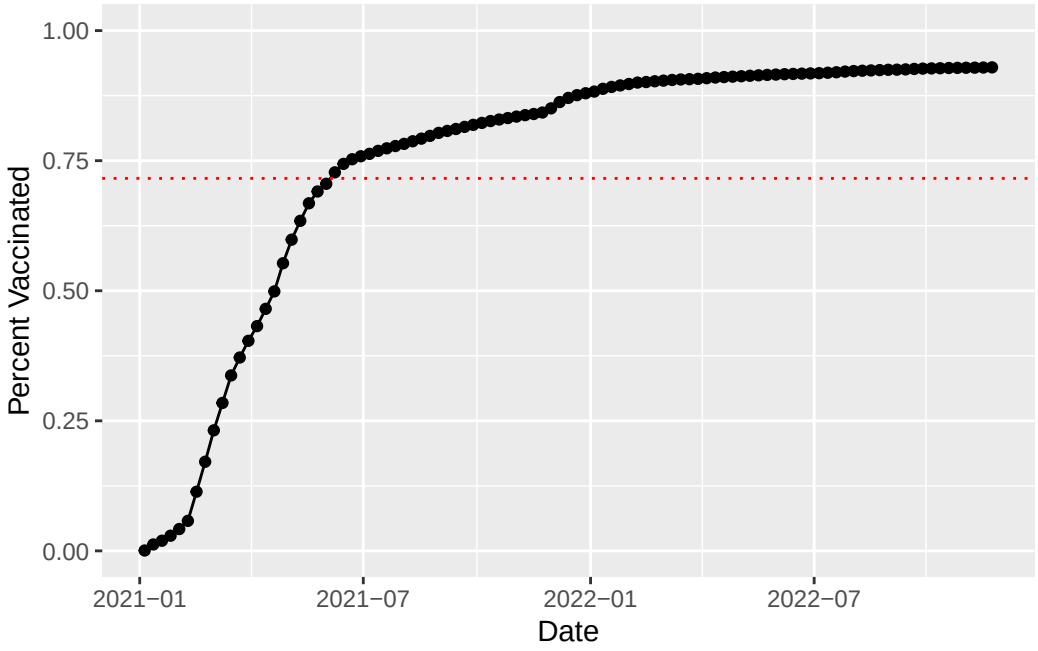
```
[1] 0.7159711
```

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?

```
p2
```




```
p2 + geom_hline(aes(yintercept=0.7159711),
                col="RED",
                linetype="dotted")
```




```
skimr::skim(vax.36)
```

Table 4: Data summary

Name	vax.36
Number of rows	411
Number of columns	18
Column type frequency:	
character	4
Date	1
numeric	13
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
local_health_jurisdiction	0	1	4	15	0	37	0
county	0	1	4	15	0	36	0
vem_source	0	1	26	26	0	1	0

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
redacted	0	1	2	2	0	1	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
as_of_date	0	1	2022-11-15	2022-11-15	2022-11-15	1

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
zip_code_tabulation_area	0	1	92862.11	716.60	90001.00	92761.50	92646.00	94517.00	96003.00	
vaccine_equity_metric_quartile	0	1	2.35	1.11	1.00	1.00	2.00	3.00	4.00	
age12_plus_population	0	1	46847.41	12057.32	21650.00	37693.50	45985.50	53931.50	88556.00	
age5_plus_population	0	1	52012.32	13620.13	36181.00	41612.50	48573.00	59167.50	101902.00	
tot_population	0	1	55640.91	14745.13	38007.00	44393.00	52212.00	62910.00	111165.00	
persons_fully_vaccinated	0	1	39837.28	11739.80	17422.00	31926.50	37064.00	45033.50	87151.00	
persons_partially_vaccinated	0	1	4077.70	2620.74	1733.00	2813.00	3542.00	4666.00	39160.00	
percent_of_population_fully_vaccinated	0	1	0.72	0.11	0.38	0.64	0.72	0.79	1.00	
percent_of_population_partially_vaccinated	0	1	0.07	0.05	0.04	0.06	0.06	0.08	0.98	
percent_of_population_with_1_plus_dose	0	1	0.79	0.11	0.44	0.71	0.79	0.86	1.00	
booster_recip_count	0	1	22817.37	7812.12	8603.00	17134.50	21640.00	27265.50	56744.00	
bivalent_dose_recip_count	0	1	5618.65	2952.70	1375.00	3418.50	4941.00	7269.50	16829.00	
eligible_recipient_count	0	1	39609.31	11653.38	17321.00	31819.50	36758.00	44903.50	86696.00	

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"?

A: Mean: 7.172851e-01
Min: 3.78501e-01 1st Q: 6.396185e-01
Median: 7.15524e-01
3rd Q: 7.879820e-01
Max: 1.00000e+00

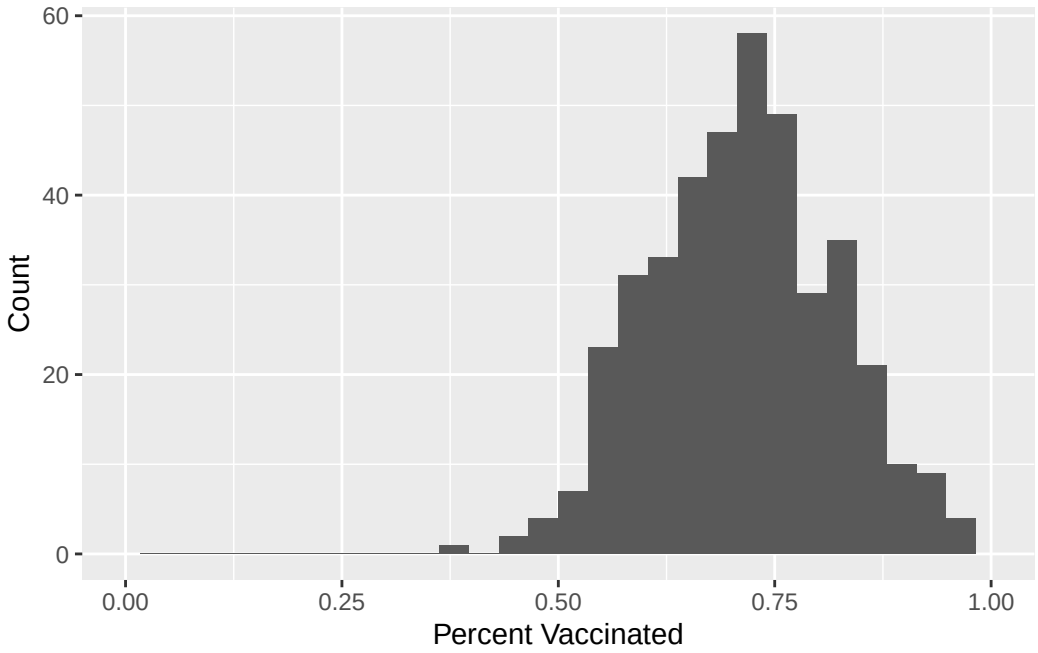
Q18. Using ggplot generate a histogram of this data.

A: see plot below

```
p3 <- ggplot(vax.36, aes(percent_of_population_fully_vaccinated))+
        geom_histogram()+
        xlab("Percent Vaccinated")+
        ylab("Count")+
        xlim(0,1)
p3
```

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

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




```
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                               0.546646
```

```
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                               0.693299
```

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

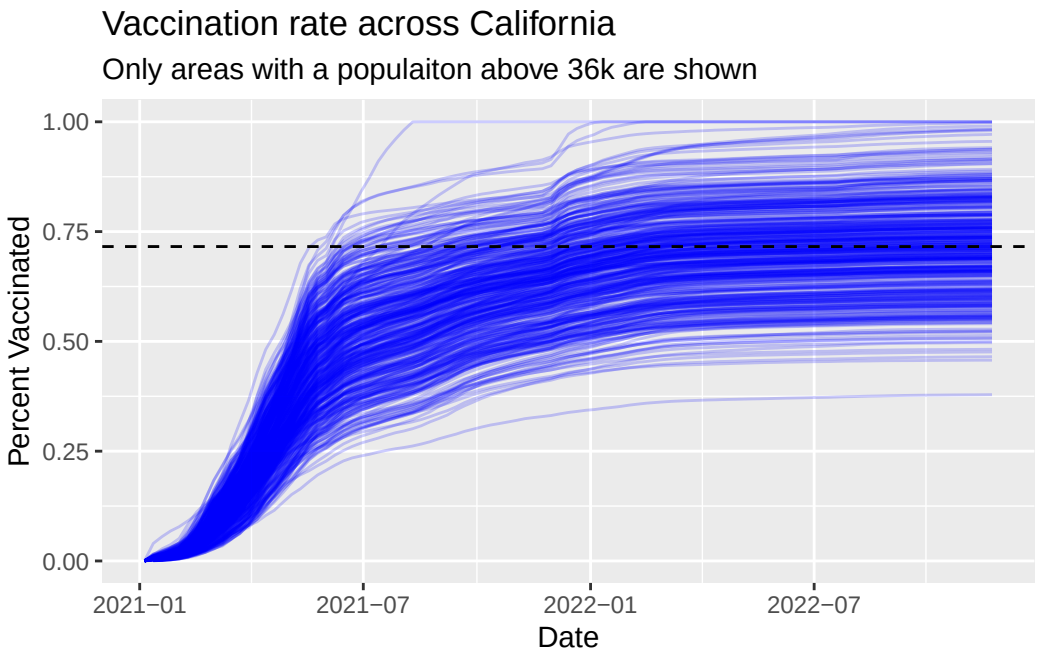
A: both are below the average value previously calculated

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 populaiton above 36k are shown') +
  geom_hline(yintercept=0.7159711 , linetype='dashed')
```

```
Warning: Removed 184 row(s) containing missing values (geom_path).
```



Q21. How do you feel about traveling for Thanksgiving Break and meeting for in-person class afterwards? A: I prefer Online class for next week so I can be more flexible with my schedule