Class 17: Vaccination Rate Mini Project

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Background

We're exploring a dataset on statewide vaccination rate from CA.gov

The goal of this hands-on mini-project is to examine and compare the Covid-19 vaccination rates around San Diego.

We will start by downloading the most recently dated "Statewide COVID-19 Vaccines Administered by ZIP Code" CSV file from: https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code

Data Input

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

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction          county
1 2021-01-05                   93609                     Fresno          Fresno
2 2021-01-05                   94086                Santa Clara     Santa Clara
3 2021-01-05                   94304                Santa Clara     Santa Clara
4 2021-01-05                   94110              San Francisco   San Francisco
5 2021-01-05                   93420            San Luis Obispo San Luis Obispo
6 2021-01-05                   93454              Santa Barbara   Santa Barbara
  vaccine_equity_metric_quartile                vem_source
1                              1 Healthy Places Index Score
2                              4 Healthy Places Index Score
3                              4 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 tot_population
1                4396.3                 4839           5177
2               42696.0                46412          50477
3                3263.5                 3576           3852
4               64350.7                68320          72380
5               26694.9                29253          30740
6               32043.4                36446          40432
  persons_fully_vaccinated persons_partially_vaccinated
1                       NA                           NA
2                       11                          640
3                       NA                           NA
4                       18                         1262
5                       NA                           NA
6                       NA                           NA
  percent_of_population_fully_vaccinated
1                                     NA
2                                0.000218
3                                     NA
4                                0.000249
5                                     NA
6                                     NA
  percent_of_population_partially_vaccinated
1                                         NA
2                                    0.012679
3                                         NA
4                                    0.017436
5                                         NA
6                                         NA
  percent_of_population_with_1_plus_dose booster_recip_count
1                                     NA                  NA
2                                0.012897                 NA
3                                     NA                  NA
4                                0.017685                 NA
5                                     NA                  NA
6                                     NA                  NA
  bivalent_dose_recip_count eligible_recipient_count
1                        NA                        1
2                        NA                       11
3                        NA                        6
4                        NA                       18
5                        NA                        4
6                        NA                        5
                                                    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
```

Correct way to store numeric dates: year-month-day

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

What is the earliest date in this dataset?

2021-01-05

Q4. What is the latest date in this dataset?

```
tail(vax)
```

```
       as_of_date zip_code_tabulation_area local_health_jurisdiction
201091 2023-03-07                   93662                     Fresno
201092 2023-03-07                   94801               Contra Costa
201093 2023-03-07                   93668                     Fresno
201094 2023-03-07                   93704                     Fresno
201095 2023-03-07                   94510                     Solano
201096 2023-03-07                   93726                     Fresno
             county vaccine_equity_metric_quartile                 vem_source
201091       Fresno                              1 Healthy Places Index Score
201092 Contra Costa                              1 Healthy Places Index Score
201093       Fresno                              1    CDPH-Derived ZCTA Score
201094       Fresno                              1 Healthy Places Index Score
201095       Solano                              4 Healthy Places Index Score
201096       Fresno                              1 Healthy Places Index Score
       age12_plus_population age5_plus_population tot_population
201091               24501.3                28311          30725
201092               25273.6                29040          31210
201093                1013.4                 1199           1219
```

```
201094               24803.5                27701          29740
201095               24819.2                27056          28350
201096               33707.7                39067          42824
       persons_fully_vaccinated persons_partially_vaccinated
201091                    20088                         2150
201092                    27375                         2309
201093                      644                           74
201094                    17887                         1735
201095                    22648                         2264
201096                    24121                         2682
       percent_of_population_fully_vaccinated
201091                               0.653800
201092                               0.877123
201093                               0.528302
201094                               0.601446
201095                               0.798871
201096                               0.563259
       percent_of_population_partially_vaccinated
201091                                   0.069976
201092                                   0.073983
201093                                   0.060705
201094                                   0.058339
201095                                   0.079859
201096                                   0.062628
       percent_of_population_with_1_plus_dose booster_recip_count
201091                               0.723776               10072
201092                               0.951106               14782
201093                               0.589007                 312
201094                               0.659785               10435
201095                               0.878730               16092
201096                               0.625887               12104
       bivalent_dose_recip_count eligible_recipient_count redacted
201091                      2578                    20066       No
201092                      5342                    27282       No
201093                        66                      644       No
201094                      4154                    17822       No
201095                      8797                    22501       No
201096                      3585                    24062       No
```

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

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

2023-03-07

Use Skimr to get an overview of the dataset

If you just want to use one function from a package and not load the whole package: package_name:: instead of library()

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

Table 1: Data summary

Name	vax
Number of rows	201096
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	114	0
local_health_jurisdiction	0	1	0	15	570	62	0
county	0	1	0	15	570	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	1817.38	90001	92257.75	93658.50	95380.50	97635.0	
vaccine_equity_metric_quartile	9918	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	13685.13	31756.12	82556.7	
age5_plus_population	0	1.00	20875.22	21105.97	0	1460.50	15364.00	34877.00	101902.0	
tot_population	9804	0.95	23372.72	22628.50	12	2126.00	18714.00	38168.00	111165.0	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
persons_fully_vaccinated	16621	0.92	13990.31	35073.66	11	932.00	8589.00	23346.00	87575.0	
persons_partially_vaccinated	16621	0.92	1702.31	2033.32	11	165.00	1197.00	2536.00	39973.0	
percent_of_population_fully_vaccinated	20965	0.90	0.57	0.25	0	0.42	0.61	0.74	1.0	
percent_of_population_partially_vaccinated	20965	0.90	0.08	0.09	0	0.05	0.06	0.08	1.0	
percent_of_population_with_1_plus_dose	22009	0.89	0.63	0.24	0	0.49	0.67	0.81	1.0	
booster_recip_count	72997	0.64	5882.76	7219.00	11	300.00	2773.00	9510.00	59593.0	
bivalent_dose_recip_count	158776	0.21	2978.23	3633.03	11	193.00	1467.50	4730.25	27694.0	
eligible_recipient_count	0	1.00	12830.88	34928.64	0	507.00	6369.00	22014.00	87248.0	

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?

16621

```
n.missing <- sum(is.na(vax$persons_fully_vaccinated))
n.missing
```

```
[1] 16621
```

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

```
round(n.missing/nrow(vax)*100, 2)
```

```
[1] 8.27
```

Working with dates

We will use the lubridate package to help ease the pain of working with times and dates

```
library(lubridate)
```

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

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

    date, intersect, setdiff, union
```

```
today()
```

```
[1] "2023-03-08"
```

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

```
Time difference of 792 days
```

How old am I in days?

```
today() - ymd("2000-01-27")
```

```
Time difference of 8441 days
```

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

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

```
Time difference of 1 days
```

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

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

```
Time difference of 1 days
```

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

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

```
[1] 114
```

```
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
```

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

```
[1] 114
```

Working with zipcodes

Can use zipcodeR package to make this easier to work with

```
library(zipcodeR)
geocode_zip("30022")
```

```
# A tibble: 1 x 3
  zipcode   lat   lng
  <chr>   <dbl> <dbl>
1 30022    34.0 -84.2
```

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

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

```
reverse_zipcode(c('92037', '92109', '30605') )
```

```
# A tibble: 3 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
3 30605   Standard  Athens  Athens~ <raw 18 B> Clark~ GA     33.9  -83.3 Eastern
# ... 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, ...
```

Finding best and worst ratio of household income to home prices

Find all SD zipcodes

```
sd.zip <- unique(vax$zip_code_tabulation_area[vax$county == "San Diego"])
length(sd.zip)
```

```
[1] 107
```

```
sd.eco <- reverse_zipcode(sd.zip)
sd.eco
```

```
# A tibble: 107 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 91901   Standard  Alpine  Alpine~ <raw 18 B> San D~ CA     32.8 -117. Pacific
 2 91902   Standard  Bonita  Bonita~ <raw 18 B> San D~ CA     32.7 -117. Pacific
 3 91905   Standard  Boulev~ Boulev~ <raw 21 B> San D~ CA     32.7 -116. Pacific
 4 91906   Standard  Campo   Campo,~ <raw 17 B> San D~ CA     32.7 -116. Pacific
 5 91910   Standard  Chula ~ Chula ~ <raw 23 B> San D~ CA     32.6 -117. Pacific
 6 91911   Standard  Chula ~ Chula ~ <raw 23 B> San D~ CA     32.6 -117. Pacific
 7 91913   Standard  Chula ~ Chula ~ <raw 23 B> San D~ CA     32.6 -117. Pacific
 8 91914   Standard  Chula ~ Chula ~ <raw 23 B> San D~ CA     32.7 -117. Pacific
 9 91915   Standard  Chula ~ Chula ~ <raw 23 B> San D~ CA     32.6 -117. Pacific
10 91916   Standard  Descan~ Descan~ <raw 20 B> San D~ CA     32.9 -117. Pacific
# ... with 97 more rows, 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, ...
```

Most expensive area?

```
ord <- order(sd.eco$median_household_income, decreasing=T)
head(sd.eco[ord,])
```

```
# A tibble: 6 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 92145   Unique     San Di~ San Di~ <raw 21 B> San D~ CA     32.9 -117. Pacific
2 92091   Standard   Rancho~ Rancho~ <raw 33 B> San D~ CA     33   -117. Pacific
3 92130   Standard   San Di~ San Di~ <raw 21 B> San D~ CA     33.0 -117. Pacific
4 92067   PO Box     Rancho~ Rancho~ <raw 33 B> San D~ CA     33.0 -117. Pacific
5 92131   Standard   San Di~ San Di~ <raw 21 B> San D~ CA     32.9 -117. Pacific
6 92127   Standard   San Di~ San Di~ <raw 21 B> San D~ CA     33.0 -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, ...
```

```
head(arrange(sd.eco, desc(median_home_value)))
```

```
# A tibble: 6 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 92014   Standard   Del Mar Del Ma~ <raw 19 B> San D~ CA     33.0 -117. Pacific
2 92037   Standard   La Jol~ La Jol~ <raw 20 B> San D~ CA     32.8 -117. Pacific
3 92067   PO Box     Rancho~ Rancho~ <raw 33 B> San D~ CA     33.0 -117. Pacific
4 92118   Standard   Corona~ Corona~ <raw 33 B> San D~ CA     32.6 -117. Pacific
5 92145   Unique     San Di~ San Di~ <raw 21 B> San D~ CA     32.9 -117. Pacific
6 92091   Standard   Rancho~ Rancho~ <raw 33 B> San D~ CA     33   -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, ...
```

```
sd.eco$median_home_value
```

```
  [1]  472500  495600  273700  187100  340300  294900  387800  461300  365800
 [10]  254700  182800   70700  340900  145600  503900  489200  344600  287700
 [19]      NA  263500  336200   78200  296400  344400      NA  521500  196300
 [28]  743200  615200  641100  484200  665300 1000001  405000  380200  299000
 [37]  685700  404000  359500  304100  423600  486900  320500 1000001  340900
 [46]  426200      NA  353100  341000  261900  298700      NA  356100  495800
 [55]  383500  300000 1000001  362800  362000  323500  950300  369700  390700
 [64]  439800  284000  391800  169000  986000  448700  278500  546800  427200
 [73]  266700  834800  650700  285000  717300  466300  387100  238200  272300
 [82]  365800  447200  447300 1000001  423700  455800  569000  576200  396100
 [91]  519100  378400  618400  491300  577700  832900  627000      NA      NA
[100]      NA  273400      NA 1000001      NA  269800      NA  254300
```

Focus on the San Diego area

Using **dplyr** here

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

nrow(sd)
```

```
[1] 12198
```

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

```
ind <- which.max(sd$age12_plus_population)
sd[ind,]
```

```
   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
67 2021-01-05                   92154                San Diego San Diego
   vaccine_equity_metric_quartile               vem_source
67                              2 Healthy Places Index Score
   age12_plus_population age5_plus_population tot_population
67               76365.2                82971          88979
   persons_fully_vaccinated persons_partially_vaccinated
67                       16                         1400
   percent_of_population_fully_vaccinated
67                                0.00018
   percent_of_population_partially_vaccinated
67                                   0.015734
   percent_of_population_with_1_plus_dose booster_recip_count
67                                0.015914                 NA
   bivalent_dose_recip_count eligible_recipient_count
67                        NA                       16
                                                                redacted
67 Information redacted in accordance with CA state privacy requirements
```

Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2023-03-07"?

```
library(dplyr)
sd.latest <- filter(sd, as_of_date == "2023-03-07")
mean(sd.latest$percent_of_population_fully_vaccinated, na.rm = TRUE)
```

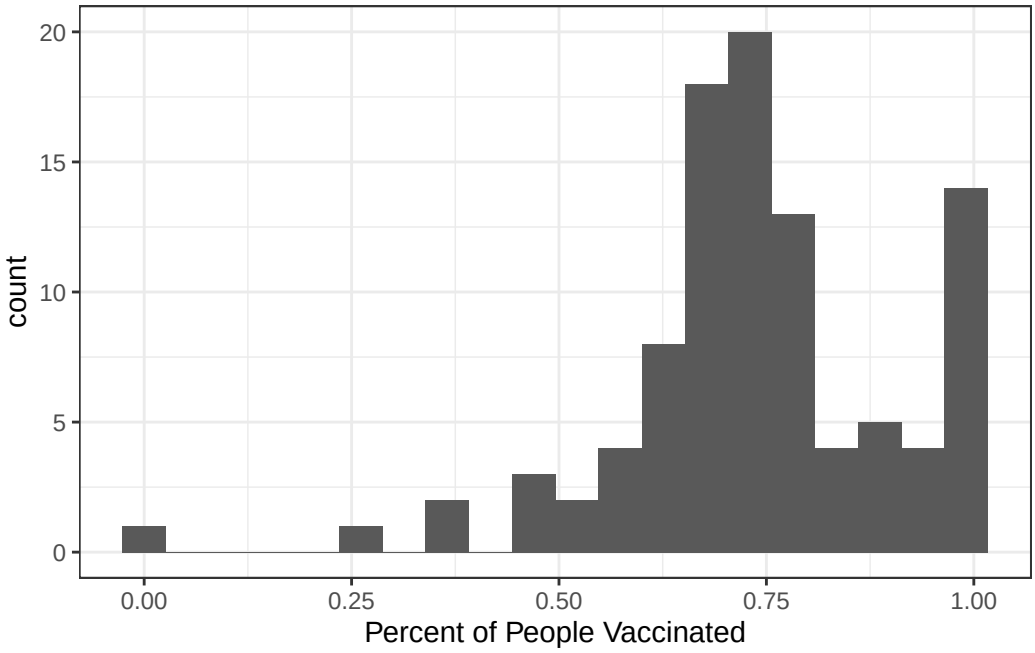
```
[1] 0.7402567
```

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 "2023-02-28"?

```
library(ggplot2)
ggplot(sd.latest) +
  aes(sd.latest$percent_of_population_fully_vaccinated) +
  geom_histogram(bins = 20) +
  theme_bw() +
  xlab("Percent of People Vaccinated")
```

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

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



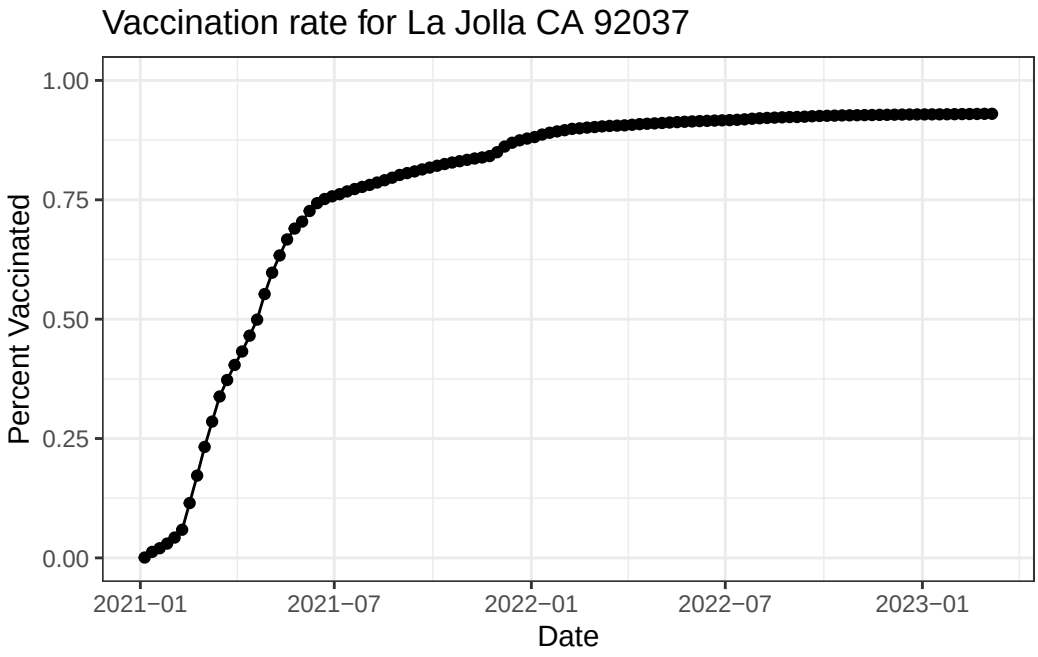
Focus on UCSD/La Jolla

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

```
[1] 36144
```

```
ljplot <- 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 Vaccinat
```

```
  theme_bw()
ljplot
```



Comparing to similar sized areas

```
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2023-03-07")
head(vax.36)
```

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction         county
1 2023-03-07                   94116             San Francisco  San Francisco
2 2023-03-07                   92703                    Orange         Orange
3 2023-03-07                   94118             San Francisco  San Francisco
4 2023-03-07                   92376           San Bernardino San Bernardino
5 2023-03-07                   92692                    Orange         Orange
6 2023-03-07                   95148               Santa Clara    Santa Clara
  vaccine_equity_metric_quartile               vem_source
1                              4 Healthy Places Index Score
2                              1 Healthy Places Index Score
```

```
3                            4 Healthy Places Index Score
4                            1 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               42334.3                45160          47346
2               57182.7                64387          69112
3               37628.5                40012          42095
4               70232.1                79686          86085
5               41008.9                44243          46800
6               42163.3                46202          48273
  persons_fully_vaccinated persons_partially_vaccinated
1                    41255                         2450
2                    57887                         7399
3                    33284                         3040
4                    51367                         5674
5                    35117                         2603
6                    42298                         2684
  percent_of_population_fully_vaccinated
1                               0.871351
2                               0.837582
3                               0.790688
4                               0.596701
5                               0.750363
6                               0.876225
  percent_of_population_partially_vaccinated
1                                   0.051747
2                                   0.107058
3                                   0.072218
4                                   0.065912
5                                   0.055620
6                                   0.055600
  percent_of_population_with_1_plus_dose booster_recip_count
1                               0.923098               34108
2                               0.944640               28297
3                               0.862906               27401
4                               0.662613               23832
5                               0.805983               23695
6                               0.931825               31583
  bivalent_dose_recip_count eligible_recipient_count redacted
1                     19158                    41000       No
2                      7627                    57775       No
3                     15251                    33146       No
```

4	6393	51276	No
5	10169	35031	No
6	12604	42120	No

How many unique zipcodes?

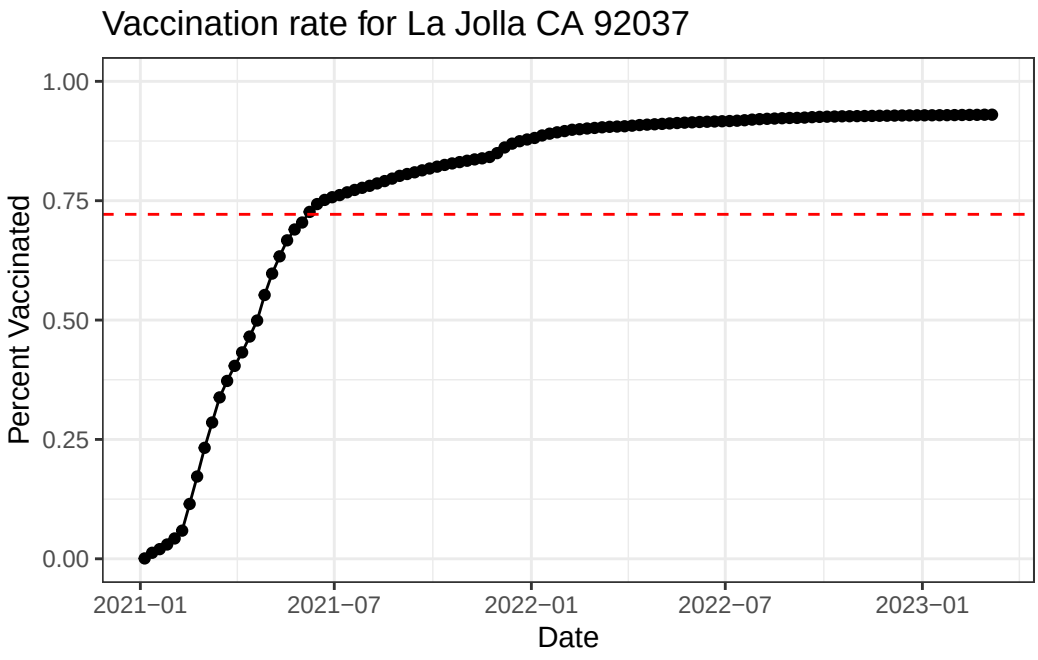
```
n_distinct(vax.36$zip_code_tabulation_area)
```

```
[1] 411
```

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 "2023-02-28". Add this as a straight horizontal line to your plot from above with the geom_hline() function

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

```
ljplot +
  geom_hline(yintercept = avg.36, color = "red", 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 "2023-02-28"?

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

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
 0.3805  0.6459  0.7183  0.7215  0.7908  1.0000 
```

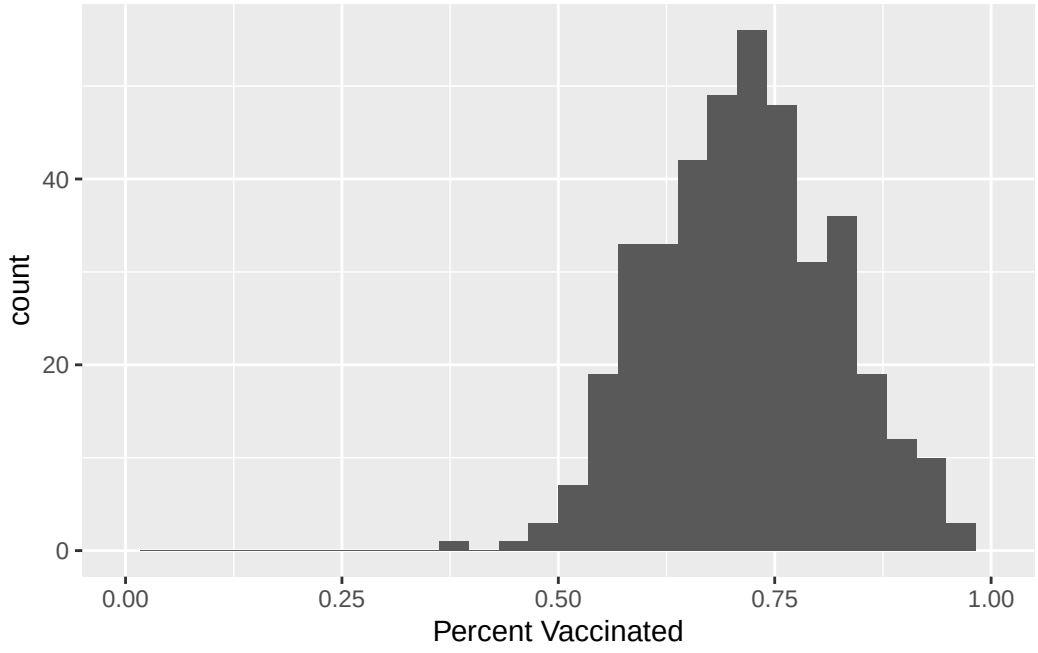
Q18. Using ggplot generate a histogram of this data.

```
ggplot(vax.36) +
  aes(vax.36$percent_of_population_fully_vaccinated) +
  geom_histogram() +
  xlim(0,1) +
  labs(x = "Percent Vaccinated")
```

```
Warning: Use of `vax.36$percent_of_population_fully_vaccinated` is discouraged.
i Use `percent_of_population_fully_vaccinated` instead.

`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?

```
filter(vax.36, zip_code_tabulation_area %in% c("92109", "92040"))
```

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction    county
1 2023-03-07                   92109                San Diego San Diego
2 2023-03-07                   92040                San Diego San Diego
  vaccine_equity_metric_quartile                vem_source
1                              3 Healthy Places Index Score
2                              3 Healthy Places Index Score
  age12_plus_population age5_plus_population tot_population
1               43222.5                44953          47111
2               39405.0                42833          46306
  persons_fully_vaccinated persons_partially_vaccinated
1                    32725                         4234
2                    25493                         2156
  percent_of_population_fully_vaccinated
1                               0.694636
2                               0.550533
  percent_of_population_partially_vaccinated
1                                   0.089873
2                                   0.046560
  percent_of_population_with_1_plus_dose booster_recip_count
1                               0.784509               19677
2                               0.597093               14175
  bivalent_dose_recip_count eligible_recipient_count redacted
1                      8109                    32622       No
2                      4649                    25433       No
```

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(x = as_of_date, y = percent_of_population_fully_vaccinated, group = zip_code_tabulat
  geom_line(alpha = 0.2, color = "blue") +
  ylim(0,1) +
  labs(x = "Date", y = "Percent Vaccinated", title = "Vaccination rate across California",
  geom_hline(yintercept = avg.36, linetype = 2)
```

```
Warning: Removed 183 rows containing missing values (`geom_line()`).
```