Class 14: COVID 19 Mini Project

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3/3/2022

Read input of our data

Here we downloaded 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.

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

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         county
## 1 2021-01-05                    92549                 Riverside      Riverside
## 2 2021-01-05                    92130                 San Diego      San Diego
## 3 2021-01-05                    92397            San Bernardino San Bernardino
## 4 2021-01-05                    94563              Contra Costa   Contra Costa
## 5 2021-01-05                    94519              Contra Costa   Contra Costa
## 6 2021-01-05                    91042               Los Angeles    Los Angeles
##   vaccine_equity_metric_quartile                 vem_source
## 1                              3 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              3 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 persons_fully_vaccinated
## 1                2348.4                 2461                       NA
## 2               46300.3                53102                       61
## 3                3695.6                 4225                       NA
## 4               17216.1                18896                       NA
## 5               16861.2                18678                       NA
## 6               23962.2                25741                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                           27                               0.001149
## 3                           NA                                     NA
## 4                           NA                                     NA
## 5                           NA                                     NA
## 6                           NA                                     NA
##   percent_of_population_partially_vaccinated
## 1                                          NA
## 2                                    0.000508
## 3                                          NA
## 4                                         NA
## 5                                         NA
## 6                                         NA
##   percent_of_population_with_1_plus_dose booster_recip_count
## 1                                     NA                  NA
## 2                               0.001657                  NA
## 3                                     NA                  NA
## 4                                     NA                  NA
## 5                                     NA                  NA
## 6                                     NA                  NA
##                                                                 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?

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?

03/01/2022

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

```
## [1] "2022-03-01"
```

> Q4. What is the latest date in this dataset?

01/05/2021

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

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

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

Table 1: Data summary

Name	vax
Number of rows	107604

Table 1: Data summary

Number of columns	15
Column type frequency:	
character	5
numeric	10
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	61	0
local_health_jurisdiction	0	1	0	15	305	62	0
county	0	1	0	15	305	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	5307	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.91	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21106.02	0	1460.50	15364.00	34877.00	101902.0	
persons_fully_vaccinated	18338	0.83	12155.61	13063.88	11	1066.25	7374.50	20005.00	77744.0	
persons_partially_vaccinated	18338	0.83	831.74	1348.68	11	76.00	372.00	1076.00	34219.0	
percent_of_population_fully_vaccinated	18338	0.83	0.51	0.26	0	0.33	0.54	0.70	1.0	
percent_of_population_partially_vaccinated	18338	0.83	0.05	0.09	0	0.01	0.03	0.05	1.0	
percent_of_population_with_1_plus_dose	18338	0.83	0.54	0.28	0	0.36	0.58	0.75	1.0	
booster_recip_count	64317	0.40	4100.55	5900.21	11	176.00	1136.00	6154.50	50602.0	

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

9

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

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

```
## [1] 18338
```

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

```
round((18338/107604)*100, 2)
```

```
## [1] 17.04
```

Working with dates

One of the “character” columns of the data is as_of_date, which contains dates in the Year-Month-Day format.

Dates and times can be annoying to work with at the best of times. However, in R we have the excellent lubridate package, which can make life allot easier. Here is a quick example to get you started:

```
library(lubridate)
```

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

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
today()
```

```
## [1] "2022-03-03"
```

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

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

```
## Time difference of 422 days
```

How many days does the dataset span?

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

```
## Time difference of 420 days
```

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

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

```
## Time difference of 2 days
```

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

```
unique_dates <- unique(vax$as_of_date)
length(unique_dates)
```

```
## [1] 61
```

Working with ZIP codes

One of the numeric columns in the dataset (namely vax$zip_code_tabulation_area) are actually ZIP codes - a postal code used by the United States Postal Service (USPS). In R we can use the zipcodeR package to make working with these codes easier. For example, let's install and then load up this package and to find the centroid of the La Jolla 92037 (i.e. UC San Diego) ZIP code area.

```
library(zipcodeR)
geocode_zip('92037')
```

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

Distance between the centroids of any two ZIP codes in miles.

```
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_type major_city post_office_city common_city_list county state
##   <chr>   <chr>        <chr>      <chr>                      <blob> <chr>  <chr>
## 1 92037   Standard     La Jolla   La Jolla, CA           <raw 20 B> San D~ CA
## 2 92109   Standard     San Diego  San Diego, CA          <raw 21 B> San D~ CA
## # ... with 17 more variables: lat <dbl>, lng <dbl>, timezone <chr>,
## #   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>
```

Focus on San Diego Area

Let's now focus in on the San Diego County area by restricting ourselves first to vax$county == "San Diego" entries. We have two main choices on how to do this. The first using base R the second using the dplyr package:

```
sd <- vax[ '92037', ]
```

```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] 6527
```

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

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

```r
uzip <- unique(sd$zip_code_tabulation_area)
length(uzip)
```

```
## [1] 107
```

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

92154

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

```
## [1] 91
```

```r
sd$zip_code_tabulation_area[91]
```

```
## [1] 92154
```

> Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2022-03-01"?

70.53%

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

```
## [1] "2022-03-01"
```

```
sd.latest <- filter(sd, as_of_date == "2022-03-01")
mean(sd.latest$percent_of_population_fully_vaccinated, na.rm= TRUE)
```

```
## [1] 0.7052904
```

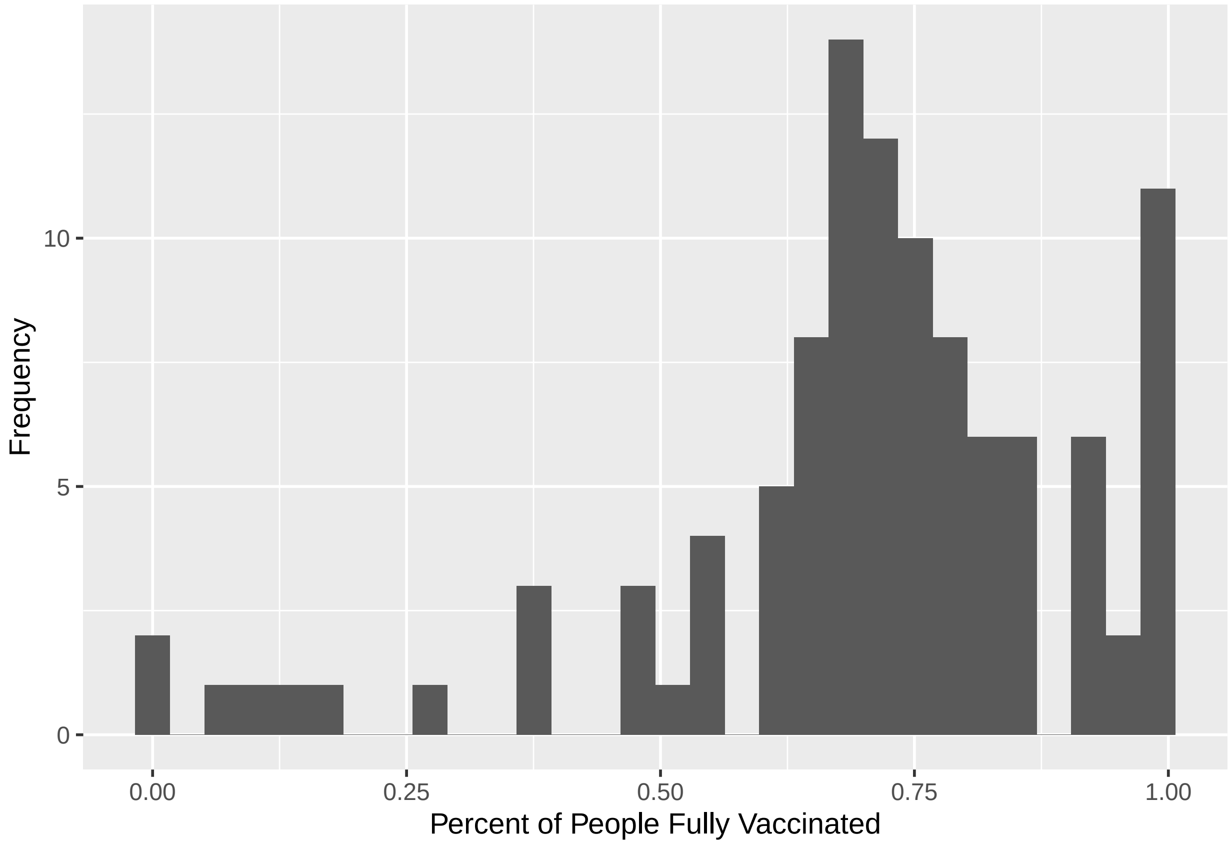
> Q14. Using either ggplot or base R graphics make a summary figure that shows the distribution of Percent of Population Fully Vaccinated values as of "2022-03-01"?

```
library(ggplot2)

ggplot(sd.latest) +
  aes(percent_of_population_fully_vaccinated) +
  geom_histogram() +
  labs(x= "Percent of People Fully Vaccinated", y="Frequency")
```

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

```
## Warning: Removed 1 rows containing non-finite values (stat_bin).
```



Focus on UCSD/La Jolla

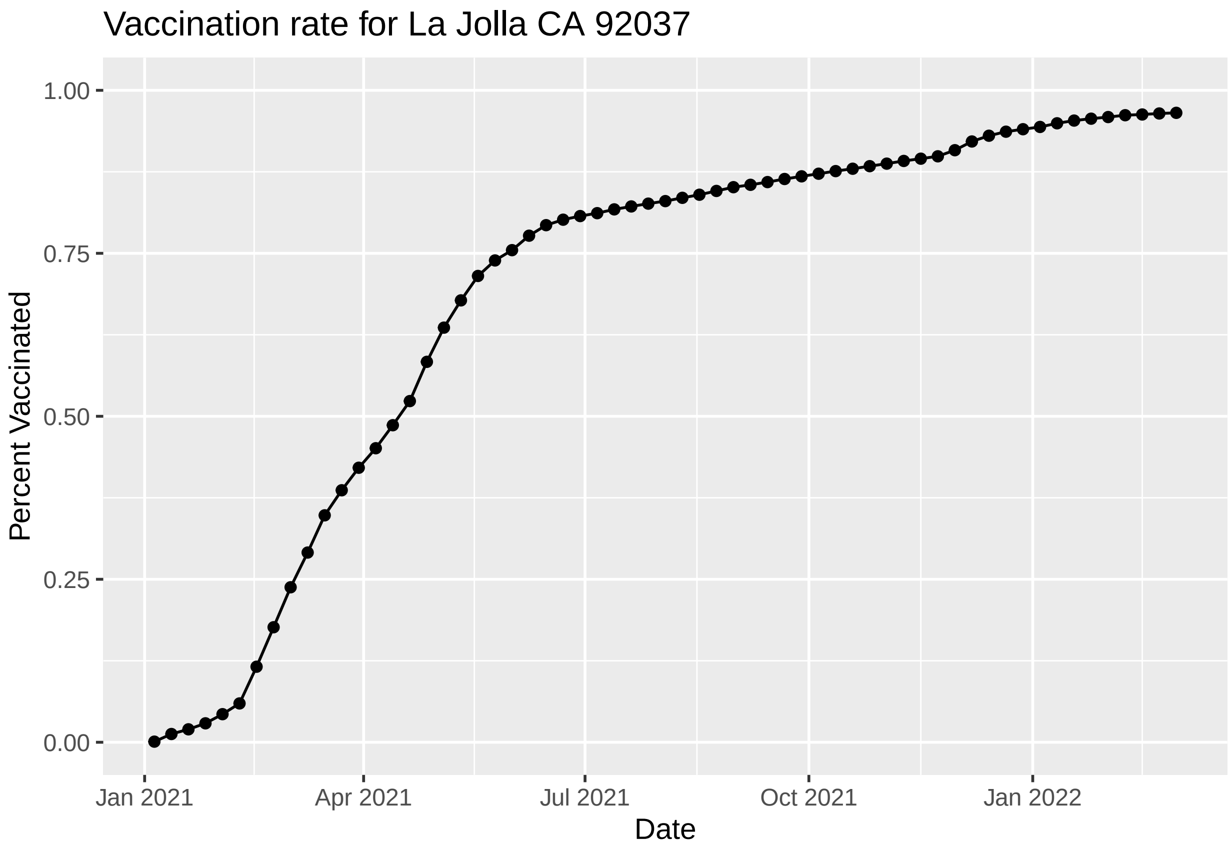
UC San Diego resides in the 92037 ZIP code area and is listed with an age 5+ population size of 36,144.

```
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

```
baseplot <- 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") +
  ggtitle("Vaccination rate for La Jolla CA 92037")
baseplot
```



Comparing to similar sized areas

```
vax.36 <- filter(vax, age5_plus_population > 36144 &
                as_of_date == "2022-02-22")
head(vax.36)
```

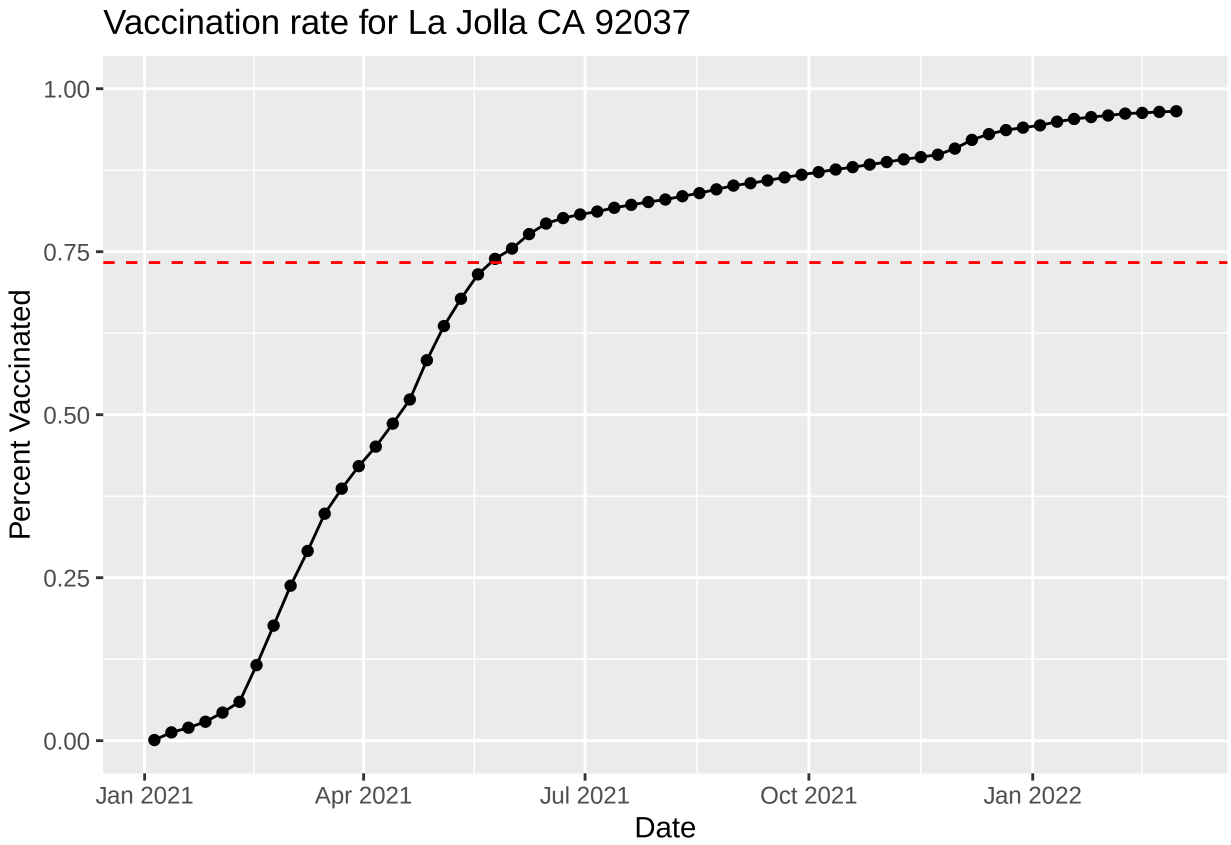
```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction      county
## 1 2022-02-22                    92840                    Orange      Orange
## 2 2022-02-22                    92064                 San Diego   San Diego
## 3 2022-02-22                    92508                 Riverside   Riverside
## 4 2022-02-22                    95403                    Sonoma      Sonoma
## 5 2022-02-22                    90001               Los Angeles Los Angeles
## 6 2022-02-22                    92802                    Orange      Orange
##   vaccine_equity_metric_quartile                 vem_source
## 1                              2 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                              1 Healthy Places Index Score
## 6                              2 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               47302.5                51902                    40725
## 2               42177.1                46855                    34266
## 3               32415.3                36303                    21925
## 4               38545.9                42294                    33158
## 5               47175.7                54805                    43075
## 6               35113.6                39393                    29268
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         4324                               0.784652
## 2                         6861                               0.731320
## 3                         1714                               0.603945
## 4                         2833                               0.783988
## 5                        13917                               0.785968
## 6                         6138                               0.742975
##   percent_of_population_partially_vaccinated
## 1                                   0.083311
## 2                                   0.146430
## 3                                   0.047214
## 4                                   0.066983
## 5                                   0.253937
## 6                                   0.155814
##   percent_of_population_with_1_plus_dose booster_recip_count redacted
## 1                               0.867963               20654       No
## 2                               0.877750               15499       No
## 3                               0.651159               10753       No
## 4                               0.850971               18659       No
## 5                               1.000000               13408       No
## 6                               0.898789               12816       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 "2022-02-22". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

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

```
## [1] 0.733385
```

```
baseplot + geom_hline(yintercept= hline.36,linetype="dashed", col= "red")
```



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 "2022-02-22"?

```
summary(hline.36)
```

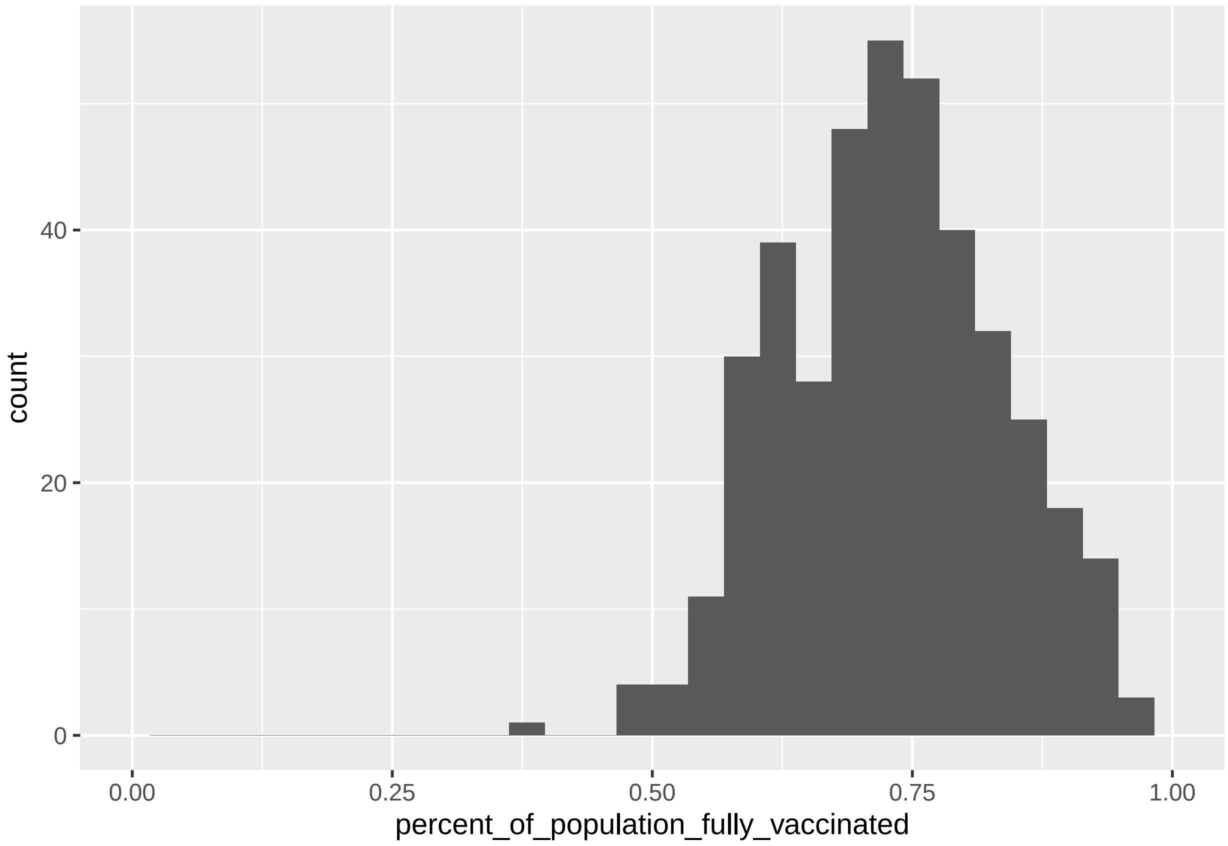
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
##  0.7334  0.7334  0.7334  0.7334  0.7334  0.7334
```

Q18. Using ggplot generate a histogram of this data.

```
ggplot(vax.36) +
  aes(percent_of_population_fully_vaccinated) +
  xlim(c(0,1)) +
  geom_histogram()
```

```
## `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 are below

```
vax %>% filter(as_of_date == "2022-02-22") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                               0.551304
```

```
vax %>% filter(as_of_date == "2022-02-22") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

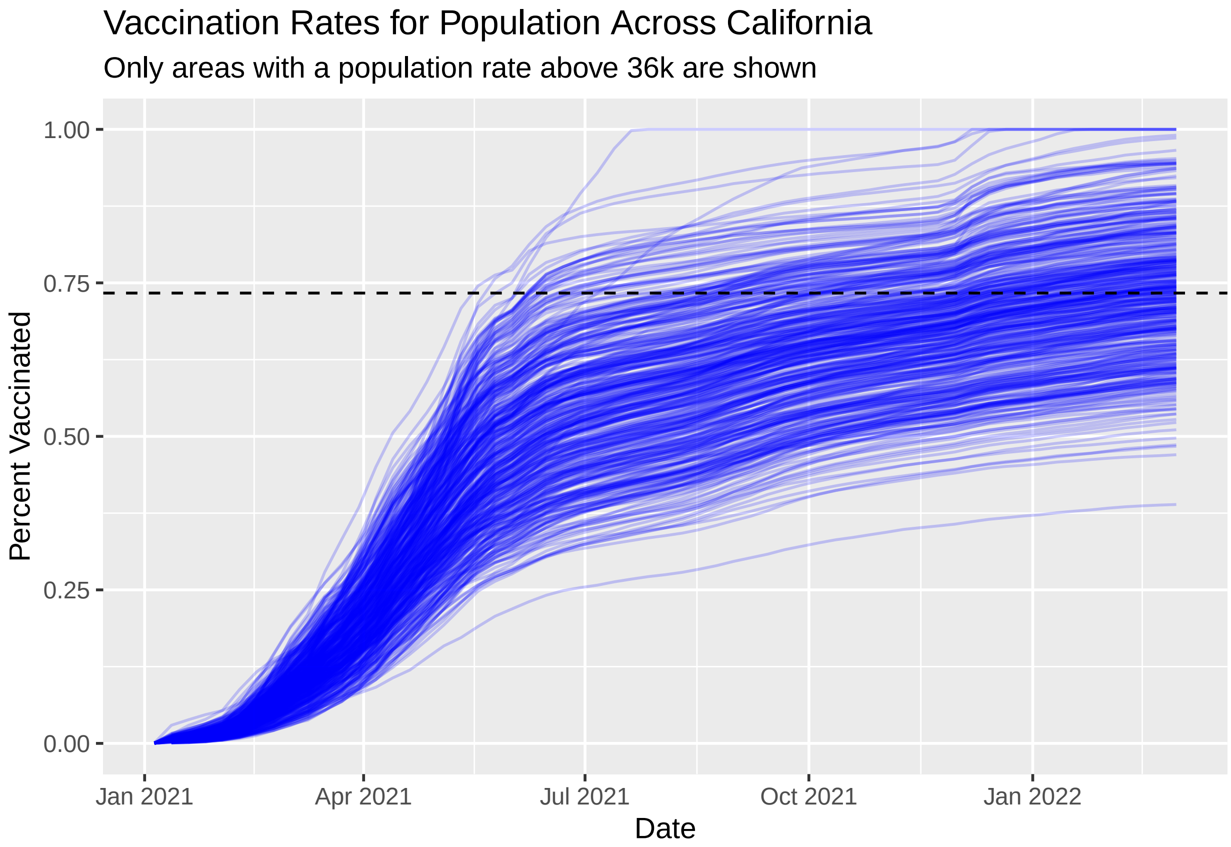
```
##   percent_of_population_fully_vaccinated
## 1                               0.723044
```

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 Rates for Population Across California",
       subtitle= "Only areas with a population rate above 36k are shown") +
  geom_hline(yintercept = hline.36, linetype= "dashed")
```

```
## Warning: Removed 311 row(s) containing missing values (geom_path).
```



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

I am very open to going back to in-person class after Spring break, but hope everyone still wears their mask!