Class17_Covid19MiniProject

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First we need to import the Covid19 Vaccinatin Data by Zipcode! We use data from the following website: https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code

```
# Import vaccination data
vax <- read.csv("15702a90-aa5d-49bc-8621-a8129630725a.csv")
head(vax)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   92804                    Orange    Orange
## 2 2021-01-05                   92626                    Orange    Orange
## 3 2021-01-05                   92250                  Imperial  Imperial
## 4 2021-01-05                   92637                    Orange    Orange
## 5 2021-01-05                   92155                 San Diego San Diego
## 6 2021-01-05                   92259                  Imperial  Imperial
##   vaccine_equity_metric_quartile                vem_source
## 1                              2 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                             NA            No VEM Assigned
## 6                              1    CDPH-Derived ZCTA Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               76455.9                84200                       19
## 2               44238.8                47883                       NA
## 3                7098.5                 8026                       NA
## 4               16027.4                16053                       NA
## 5                 456.0                  456                       NA
## 6                 119.0                  121                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         1282                                0.000226
## 2                           NA                                      NA
## 3                           NA                                      NA
## 4                           NA                                      NA
## 5                           NA                                      NA
## 6                           NA                                      NA
##   percent_of_population_partially_vaccinated
## 1                                   0.015226
## 2                                         NA
## 3                                         NA
## 4                                         NA
## 5                                         NA
```

```
## 6                                          NA
##   percent_of_population_with_1_plus_dose
## 1                               0.015452
## 2                                     NA
## 3                                     NA
## 4                                     NA
## 5                                     NA
## 6                                     NA
##                                                                    redacted
## 1                                                                        No
## 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
```

Now we need to ensure the date column is useful. To do this, we will use the *lubridate* package to make life a lot easier when dealing with dates and times.

```
library(lubridate)
```

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

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

```
today()
```

```
## [1] "2021-11-23"
```

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?

2021-01-05

Q4. What is the latest date in this dataset?

2021-11-16

Let's take a quick look at the data. As we have done in other classes, we can use th function *skim* to get a quick overview.

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

Table 1: Data summary

Name	vax
Number of rows	81144
Number of columns	14
Column type frequency:	
character	5
numeric	9
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	46	0
local_health_jurisdiction	0	1	0	15	230	62	0
county	0	1	0	15	230	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	1002	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.94	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21106.05	0	1460.50	15364.00	34877.00	101902.0	
persons_fully_vaccinated	8256	0.90	9456.49	11498.25	11	506.00	4105.00	15859.00	71078.0	
persons_partially_vaccinated	8256	0.90	1900.61	2113.07	11	200.00	1271.00	2893.00	20185.0	
percent_of_population_fully_vaccinated	8256	0.90	0.42	0.27	0	0.19	0.44	0.62	1.0	
percent_of_population_partially_vaccinated	8256	0.90	0.10	0.10	0	0.06	0.07	0.11	1.0	
percent_of_population_with_1_plus_dose	8256	0.90	0.50	0.26	0	0.30	0.53	0.70	1.0	

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?

8256

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

10.17%

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

Here we make our 'as_of_date' column lubridate format.

```
# Speciffy that we are using the Year-mont-day format
vax$as_of_date <- ymd(vax$as_of_date)
```

Now we can do math with these dates.

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

```
## Time difference of 322 days
```

**Q9. How many days have passed since the last update of the dataset? AND How many days between the first and last entry?

```
#since last update
today() - vax$as_of_date[81144]
```

```
## Time difference of 7 days
```

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

```
## Time difference of 7 days
```

```
#between first and last entry
vax$as_of_date[nrow(vax)] - vax$as_of_date[1]
```

```
## Time difference of 315 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] 46
```

We can also download a special tool to read zipcodes!

```
#first we use 'install.packages" in the console
library(zipcodeR)
```

Now we can do a lot with our zipcodes.

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

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

We can calculate the 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
```

We can also pull 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>
```

Let's focus in on the San Diego area

```
sd <- vax$county == "San Diego"
```

Instead..let's use *dplyr* to do a more convenient subset.

```
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
```

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

nrow(sd)
```

```
## [1] 4922
```

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

```
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?

```
sd.10 <- filter(vax, county == "San Diego" &
                age12_plus_population > 10000)
which.max(sd.10$age12_plus_population)
```

```
## [1] 14
```

Row 14, which is for the San Diego Zip code **92154**.

What is the population in the univeristy zipcode ? (92037)

```
pop_university <- filter(sd, zip_code_tabulation_area == "92037")
head(pop_university)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   92037                San Diego San Diego
## 2 2021-01-12                   92037                San Diego San Diego
## 3 2021-01-19                   92037                San Diego San Diego
## 4 2021-01-26                   92037                San Diego San Diego
## 5 2021-02-02                   92037                San Diego San Diego
## 6 2021-02-09                   92037                San Diego San Diego
##   vaccine_equity_metric_quartile               vem_source
## 1                              4 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              4 Healthy Places Index Score
## 4                              4 Healthy Places Index Score
## 5                              4 Healthy Places Index Score
## 6                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               33675.6                36144                       44
## 2               33675.6                36144                      470
## 3               33675.6                36144                      730
## 4               33675.6                36144                     1079
## 5               33675.6                36144                     1616
## 6               33675.6                36144                     2222
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
```

```
## 1                          1265                                  0.001217
## 2                          1565                                  0.013004
## 3                          3505                                  0.020197
## 4                          6197                                  0.029853
## 5                          8388                                  0.044710
## 6                          9634                                  0.061476
##   percent_of_population_partially_vaccinated
## 1                                   0.034999
## 2                                   0.043299
## 3                                   0.096973
## 4                                   0.171453
## 5                                   0.232072
## 6                                   0.266545
##   percent_of_population_with_1_plus_dose redacted
## 1                                0.036216       No
## 2                                0.056303       No
## 3                                0.117170       No
## 4                                0.201306       No
## 5                                0.276782       No
## 6                                0.328021       No
```

Using dplyr select all San Diego "county" entries on "as_of_date" "2021-11-09" and use this for the following questions.

```
sd.date <- filter(vax, county == "San Diego" & as_of_date == "2021-11-09")
```

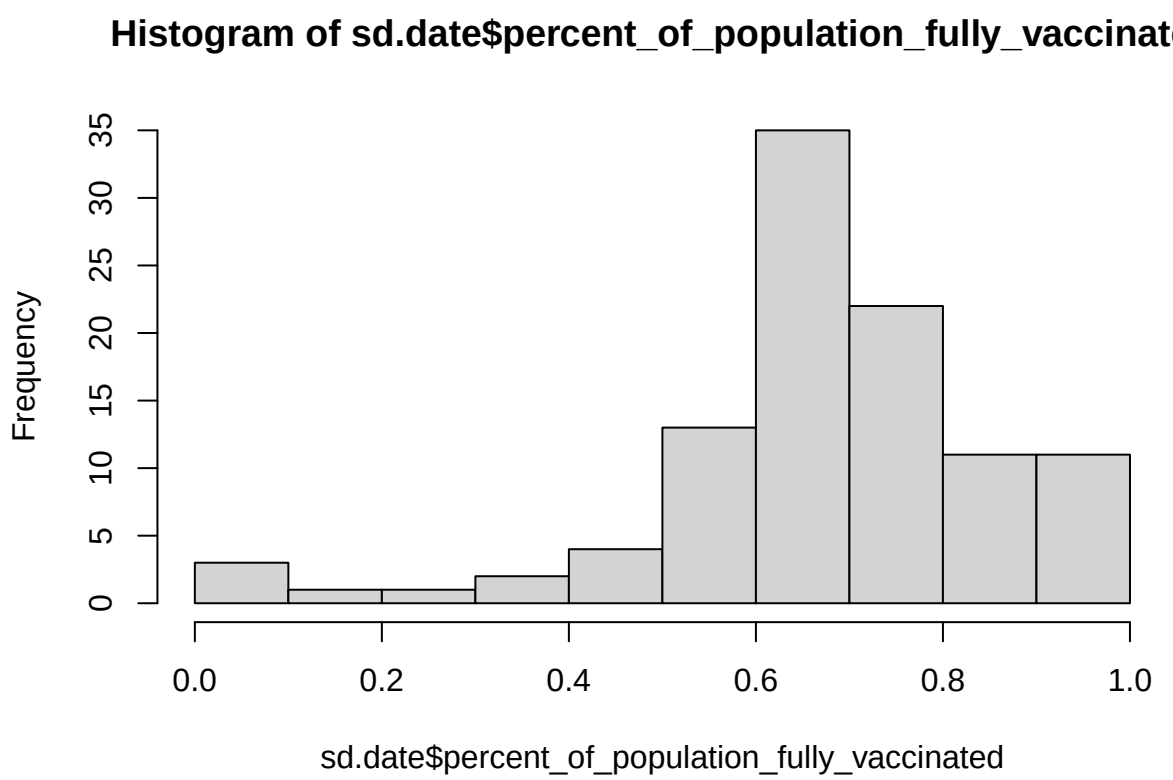
** Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2021-11-09"?**

```
mean(sd.date$percent_of_population_fully_vaccinated, na.rm = TRUE)
```

```
## [1] 0.6727567
```

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 "2021-11-09"?

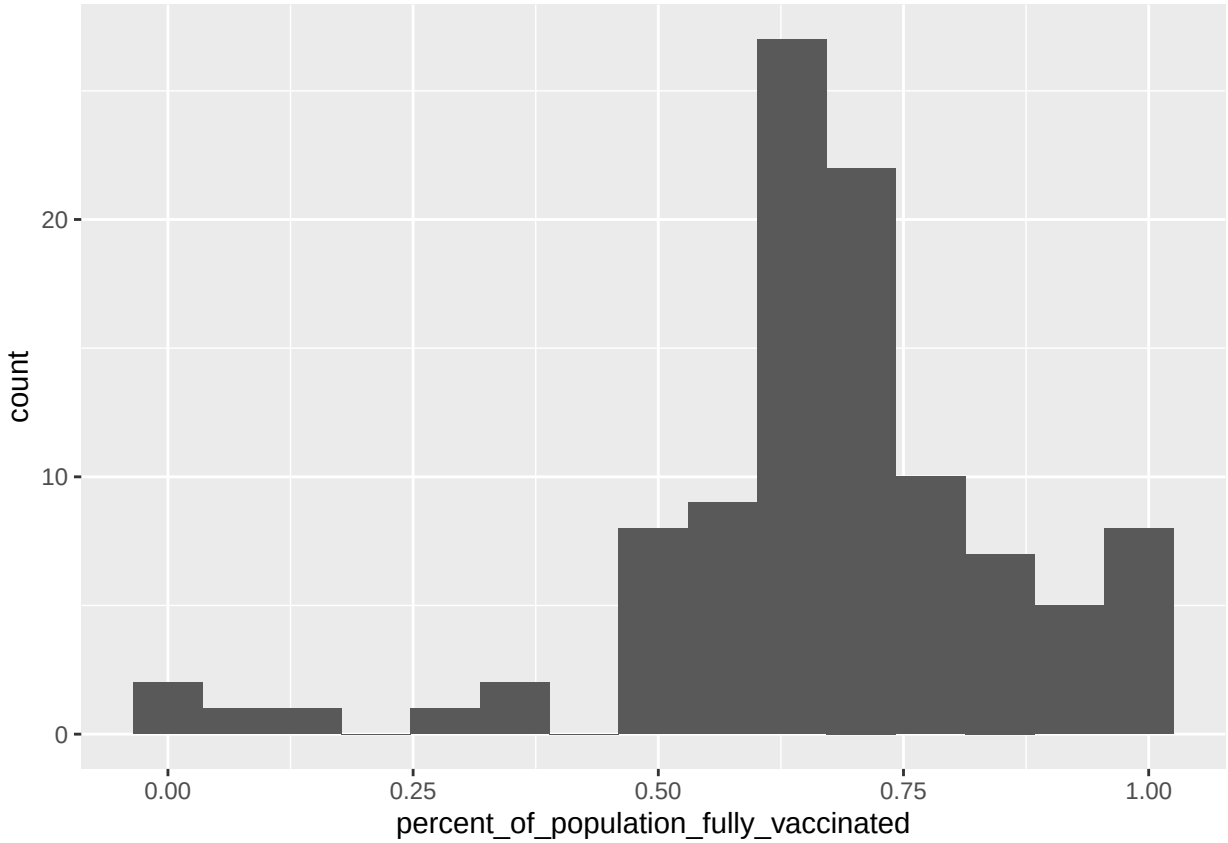
```
hist(sd.date$percent_of_population_fully_vaccinated)
```



Using ggplot

```
library(ggplot2)
ggplot(sd.date) + aes(percent_of_population_fully_vaccinated) + geom_histogram(bins=15)
```

```
## Warning: Removed 4 rows containing non-finite values (stat_bin).
```



#Now, let's focus just on UCSD/La Jolla area.

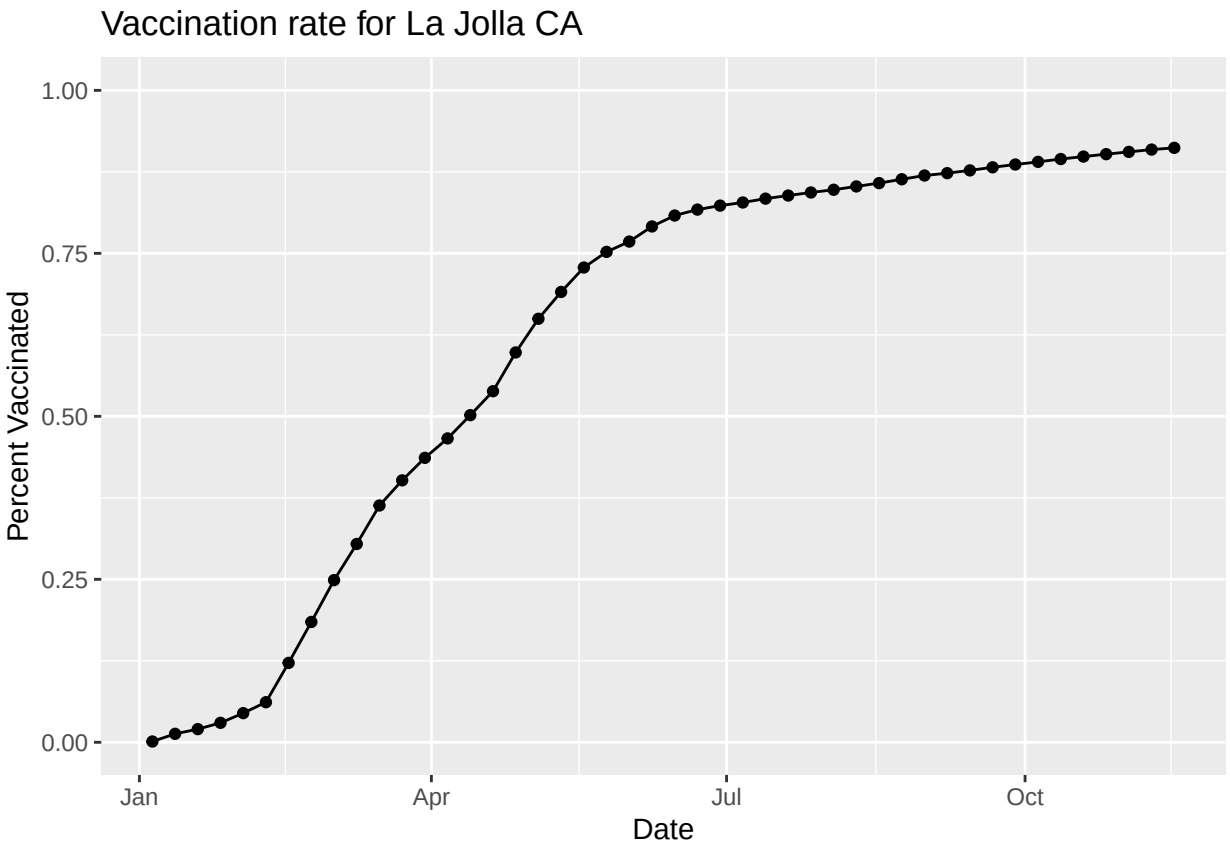
```
ucsd <- filter(sd, zip_code_tabulation_area=="92037")
ucsd[1,]$age5_plus_population
```

```
## [1] 36144
```

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

```
library(ggplot2)

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")
```



#To better understand, we can compare 92037 to other simialr 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 == "2021-11-16")
nrow(vax.36)
```

```
## [1] 411
```

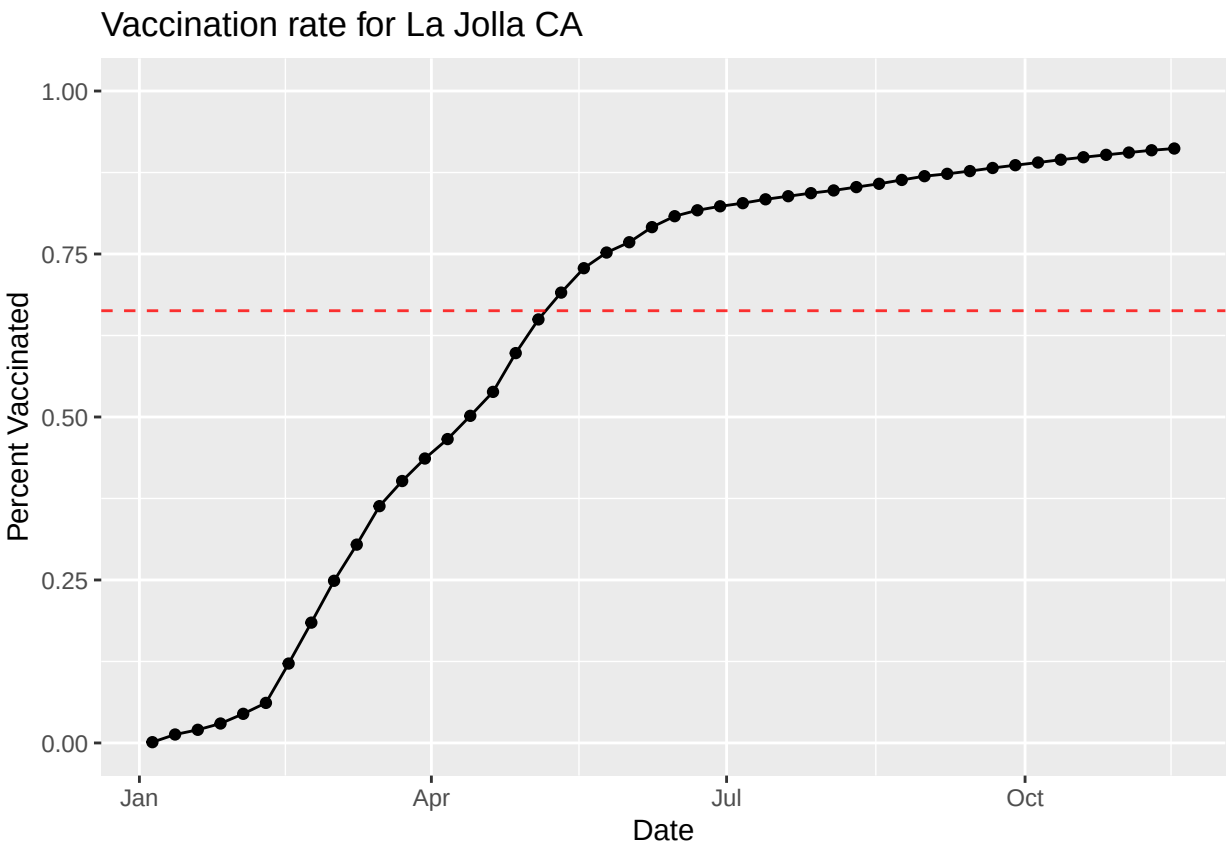
Q16. Calculate the mean "Percent of Population Fully Vaccinated" for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

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

```
## [1] 0.6629812
```

```
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")  +
  geom_hline( yintercept = 0.6629812, col = "red",
              alpha = 0.8, linetype= "dashed")
```



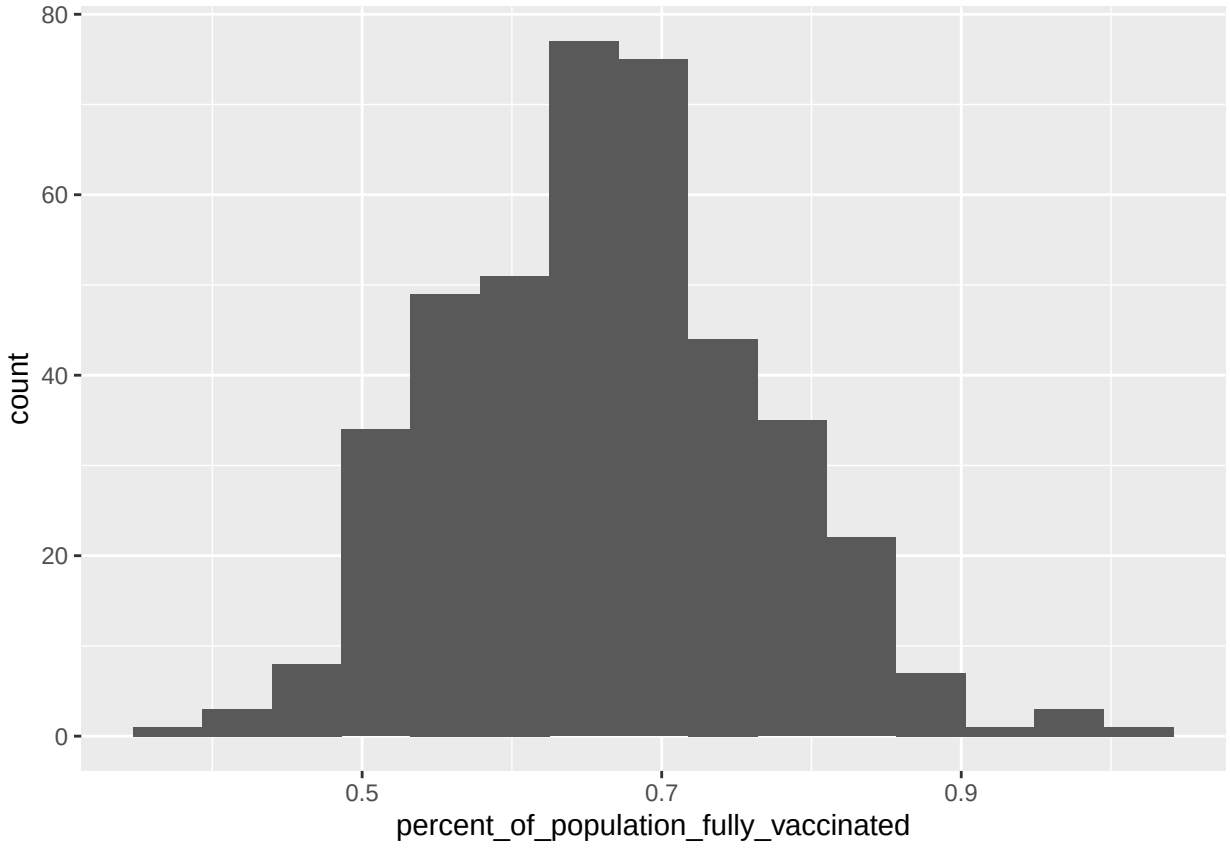
** Q17. What is the 6 number summary (Min, 1st Qu., Median, Mean, 3rd Qu., and Max) of the "Percent of Population Fully Vaccinated" values for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16"?**

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.3519  0.5891  0.6649  0.6630  0.7286  1.0000
```

Q18. Using ggplot generate a histogram of this data.

```
ggplot(vax.36) +aes(percent_of_population_fully_vaccinated) + geom_histogram(bins=15)
```



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

```
vax %>% filter(as_of_date == "2021-11-16") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                               0.520463
```

```
vax %>% filter(as_of_date == "2021-11-16") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

```
##   percent_of_population_fully_vaccinated
## 1                               0.687763
```

Zipcode 92040 falls below the average calculated for all these above. Zipcode 92109 falls above the average calculated for all these above.

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

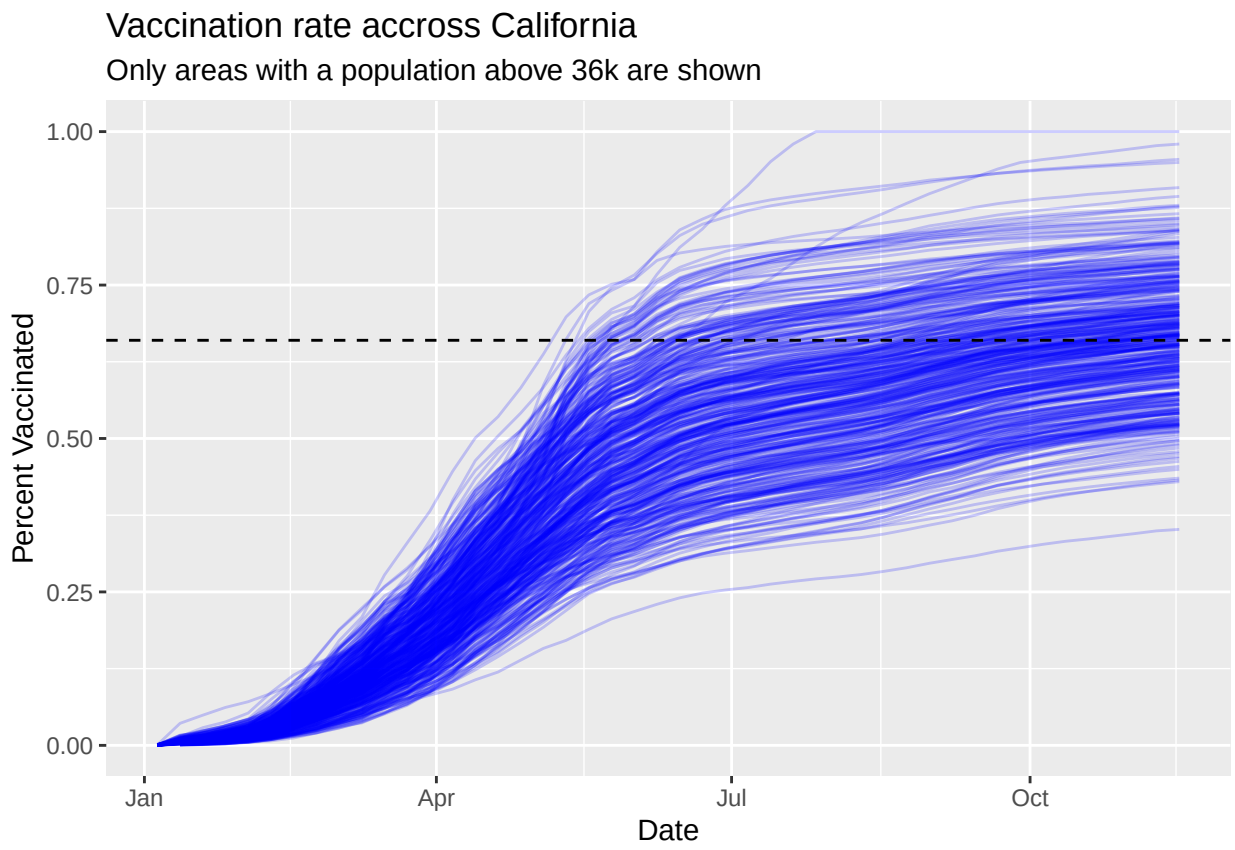
We can also look at overall zip codes similar to that of UCSD/La Jolla but not by date.

```
vax.36.all <- filter(vax, age5_plus_population > 36144)
mean(vax.36.all$percent_of_population_fully_vaccinated, na.rm=TRUE)
```

```
## [1] 0.406147
```

```
ggplot(vax.36.all) + aes(as_of_date, percent_of_population_fully_vaccinated, group=zip_code_tabulation_a
```

```
## Warning: Removed 180 row(s) containing missing values (geom_path).
```



Q21 I think that following along virtual on tuesday would be the safest option, considering a lot ofpeople are traveling and seeing large groups.