Class17_Covid19MiniProject

Camryn McCann (PID: A15437387)

11/23/2021

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)

```
filter(sd, zip_code_tabulation_area == "92037")
```

```
##    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
## 7  2021-02-16                   92037                San Diego San Diego
## 8  2021-02-23                   92037                San Diego San Diego
## 9  2021-03-02                   92037                San Diego San Diego
## 10 2021-03-09                   92037                San Diego San Diego
## 11 2021-03-16                   92037                San Diego San Diego
## 12 2021-03-23                   92037                San Diego San Diego
## 13 2021-03-30                   92037                San Diego San Diego
## 14 2021-04-06                   92037                San Diego San Diego
## 15 2021-04-13                   92037                San Diego San Diego
## 16 2021-04-20                   92037                San Diego San Diego
## 17 2021-04-27                   92037                San Diego San Diego
## 18 2021-05-04                   92037                San Diego San Diego
## 19 2021-05-11                   92037                San Diego San Diego
## 20 2021-05-18                   92037                San Diego San Diego
## 21 2021-05-25                   92037                San Diego San Diego
## 22 2021-06-01                   92037                San Diego San Diego
```

```
## 23 2021-06-08                    92037                San Diego San Diego
## 24 2021-06-15                    92037                San Diego San Diego
## 25 2021-06-22                    92037                San Diego San Diego
## 26 2021-06-29                    92037                San Diego San Diego
## 27 2021-07-06                    92037                San Diego San Diego
## 28 2021-07-13                    92037                San Diego San Diego
## 29 2021-07-20                    92037                San Diego San Diego
## 30 2021-07-27                    92037                San Diego San Diego
## 31 2021-08-03                    92037                San Diego San Diego
## 32 2021-08-10                    92037                San Diego San Diego
## 33 2021-08-17                    92037                San Diego San Diego
## 34 2021-08-24                    92037                San Diego San Diego
## 35 2021-08-31                    92037                San Diego San Diego
## 36 2021-09-07                    92037                San Diego San Diego
## 37 2021-09-14                    92037                San Diego San Diego
## 38 2021-09-21                    92037                San Diego San Diego
## 39 2021-09-28                    92037                San Diego San Diego
## 40 2021-10-05                    92037                San Diego San Diego
## 41 2021-10-12                    92037                San Diego San Diego
## 42 2021-10-19                    92037                San Diego San Diego
## 43 2021-10-26                    92037                San Diego San Diego
## 44 2021-11-02                    92037                San Diego San Diego
## 45 2021-11-09                    92037                San Diego San Diego
## 46 2021-11-16                    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
## 7                               4 Healthy Places Index Score
## 8                               4 Healthy Places Index Score
## 9                               4 Healthy Places Index Score
## 10                              4 Healthy Places Index Score
## 11                              4 Healthy Places Index Score
## 12                              4 Healthy Places Index Score
## 13                              4 Healthy Places Index Score
## 14                              4 Healthy Places Index Score
## 15                              4 Healthy Places Index Score
## 16                              4 Healthy Places Index Score
## 17                              4 Healthy Places Index Score
## 18                              4 Healthy Places Index Score
## 19                              4 Healthy Places Index Score
## 20                              4 Healthy Places Index Score
## 21                              4 Healthy Places Index Score
## 22                              4 Healthy Places Index Score
## 23                              4 Healthy Places Index Score
## 24                              4 Healthy Places Index Score
## 25                              4 Healthy Places Index Score
## 26                              4 Healthy Places Index Score
## 27                              4 Healthy Places Index Score
## 28                              4 Healthy Places Index Score
## 29                              4 Healthy Places Index Score
```

```
## 30                             4 Healthy Places Index Score
## 31                             4 Healthy Places Index Score
## 32                             4 Healthy Places Index Score
## 33                             4 Healthy Places Index Score
## 34                             4 Healthy Places Index Score
## 35                             4 Healthy Places Index Score
## 36                             4 Healthy Places Index Score
## 37                             4 Healthy Places Index Score
## 38                             4 Healthy Places Index Score
## 39                             4 Healthy Places Index Score
## 40                             4 Healthy Places Index Score
## 41                             4 Healthy Places Index Score
## 42                             4 Healthy Places Index Score
## 43                             4 Healthy Places Index Score
## 44                             4 Healthy Places Index Score
## 45                             4 Healthy Places Index Score
## 46                             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
## 7                33675.6                36144                     4403
## 8                33675.6                36144                     6672
## 9                33675.6                36144                     8991
## 10               33675.6                36144                    10996
## 11               33675.6                36144                    13129
## 12               33675.6                36144                    14522
## 13               33675.6                36144                    15769
## 14               33675.6                36144                    16847
## 15               33675.6                36144                    18136
## 16               33675.6                36144                    19464
## 17               33675.6                36144                    21614
## 18               33675.6                36144                    23481
## 19               33675.6                36144                    24968
## 20               33675.6                36144                    26321
## 21               33675.6                36144                    27188
## 22               33675.6                36144                    27760
## 23               33675.6                36144                    28598
## 24               33675.6                36144                    29204
## 25               33675.6                36144                    29532
## 26               33675.6                36144                    29753
## 27               33675.6                36144                    29926
## 28               33675.6                36144                    30140
## 29               33675.6                36144                    30312
## 30               33675.6                36144                    30481
## 31               33675.6                36144                    30632
## 32               33675.6                36144                    30817
## 33               33675.6                36144                    31000
## 34               33675.6                36144                    31214
## 35               33675.6                36144                    31422
## 36               33675.6                36144                    31552
```

```
## 37              33675.6              36144                    31705
## 38              33675.6              36144                    31877
## 39              33675.6              36144                    32031
## 40              33675.6              36144                    32179
## 41              33675.6              36144                    32335
## 42              33675.6              36144                    32472
## 43              33675.6              36144                    32605
## 44              33675.6              36144                    32733
## 45              33675.6              36144                    32859
## 46              33675.6              36144                    32955
##    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
## 7                          8739                                0.121818
## 8                          7780                                0.184595
## 9                          7040                                0.248755
## 10                         6435                                0.304228
## 11                         5543                                0.363241
## 12                         6009                                0.401782
## 13                         6419                                0.436283
## 14                         7534                                0.466108
## 15                         8140                                0.501771
## 16                         8237                                0.538513
## 17                         7343                                0.597997
## 18                         6333                                0.649651
## 19                         5384                                0.690792
## 20                         5009                                0.728226
## 21                         4888                                0.752213
## 22                         4639                                0.768039
## 23                         4097                                0.791224
## 24                         3765                                0.807990
## 25                         3715                                0.817065
## 26                         3734                                0.823180
## 27                         3754                                0.827966
## 28                         3757                                0.833887
## 29                         3823                                0.838645
## 30                         3921                                0.843321
## 31                         4012                                0.847499
## 32                         4079                                0.852617
## 33                         4193                                0.857680
## 34                         4323                                0.863601
## 35                         4439                                0.869356
## 36                         4544                                0.872953
## 37                         4637                                0.877186
## 38                         4730                                0.881944
## 39                         4865                                0.886205
## 40                         4993                                0.890300
## 41                         5129                                0.894616
## 42                         5199                                0.898406
## 43                         5438                                0.902086
```

```
## 44                          5737                                0.905627
## 45                          6354                                0.909114
## 46                          7005                                0.911770
##    percent_of_population_partially_vaccinated
## 1                                    0.034999
## 2                                    0.043299
## 3                                    0.096973
## 4                                    0.171453
## 5                                    0.232072
## 6                                    0.266545
## 7                                    0.241783
## 8                                    0.215250
## 9                                    0.194776
## 10                                   0.178038
## 11                                   0.153359
## 12                                   0.166252
## 13                                   0.177595
## 14                                   0.208444
## 15                                   0.225210
## 16                                   0.227894
## 17                                   0.203160
## 18                                   0.175216
## 19                                   0.148960
## 20                                   0.138585
## 21                                   0.135237
## 22                                   0.128348
## 23                                   0.113352
## 24                                   0.104167
## 25                                   0.102783
## 26                                   0.103309
## 27                                   0.103862
## 28                                   0.103945
## 29                                   0.105771
## 30                                   0.108483
## 31                                   0.111000
## 32                                   0.112854
## 33                                   0.116008
## 34                                   0.119605
## 35                                   0.122814
## 36                                   0.125719
## 37                                   0.128292
## 38                                   0.130865
## 39                                   0.134600
## 40                                   0.138142
## 41                                   0.141905
## 42                                   0.143841
## 43                                   0.150454
## 44                                   0.158726
## 45                                   0.175797
## 46                                   0.193808
##    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
## 7                                0.363601       No
## 8                                0.399845       No
## 9                                0.443531       No
## 10                               0.482266       No
## 11                               0.516600       No
## 12                               0.568034       No
## 13                               0.613878       No
## 14                               0.674552       No
## 15                               0.726981       No
## 16                               0.766407       No
## 17                               0.801157       No
## 18                               0.824867       No
## 19                               0.839752       No
## 20                               0.866811       No
## 21                               0.887450       No
## 22                               0.896387       No
## 23                               0.904576       No
## 24                               0.912157       No
## 25                               0.919848       No
## 26                               0.926489       No
## 27                               0.931828       No
## 28                               0.937832       No
## 29                               0.944416       No
## 30                               0.951804       No
## 31                               0.958499       No
## 32                               0.965471       No
## 33                               0.973688       No
## 34                               0.983206       No
## 35                               0.992170       No
## 36                               0.998672       No
## 37                               1.000000       No
## 38                               1.000000       No
## 39                               1.000000       No
## 40                               1.000000       No
## 41                               1.000000       No
## 42                               1.000000       No
## 43                               1.000000       No
## 44                               1.000000       No
## 45                               1.000000       No
## 46                               1.000000       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")
```

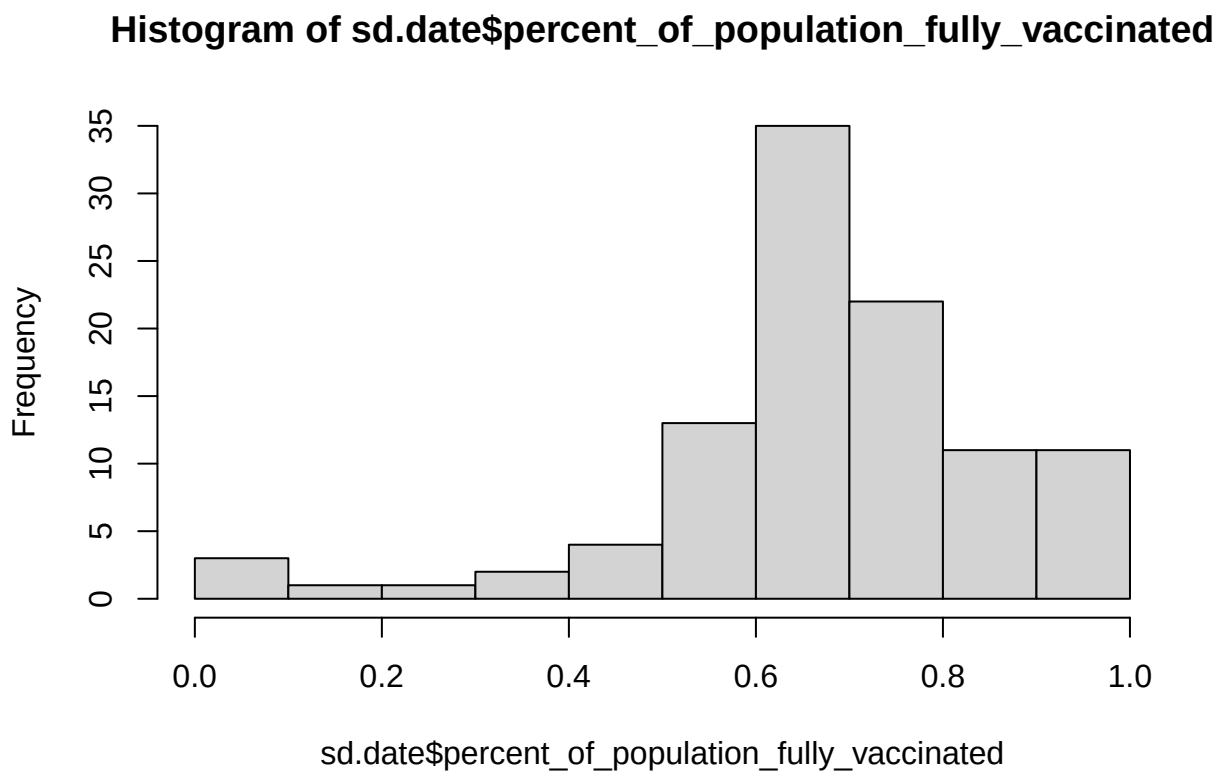
** Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2021-11-09"?**

```
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"?

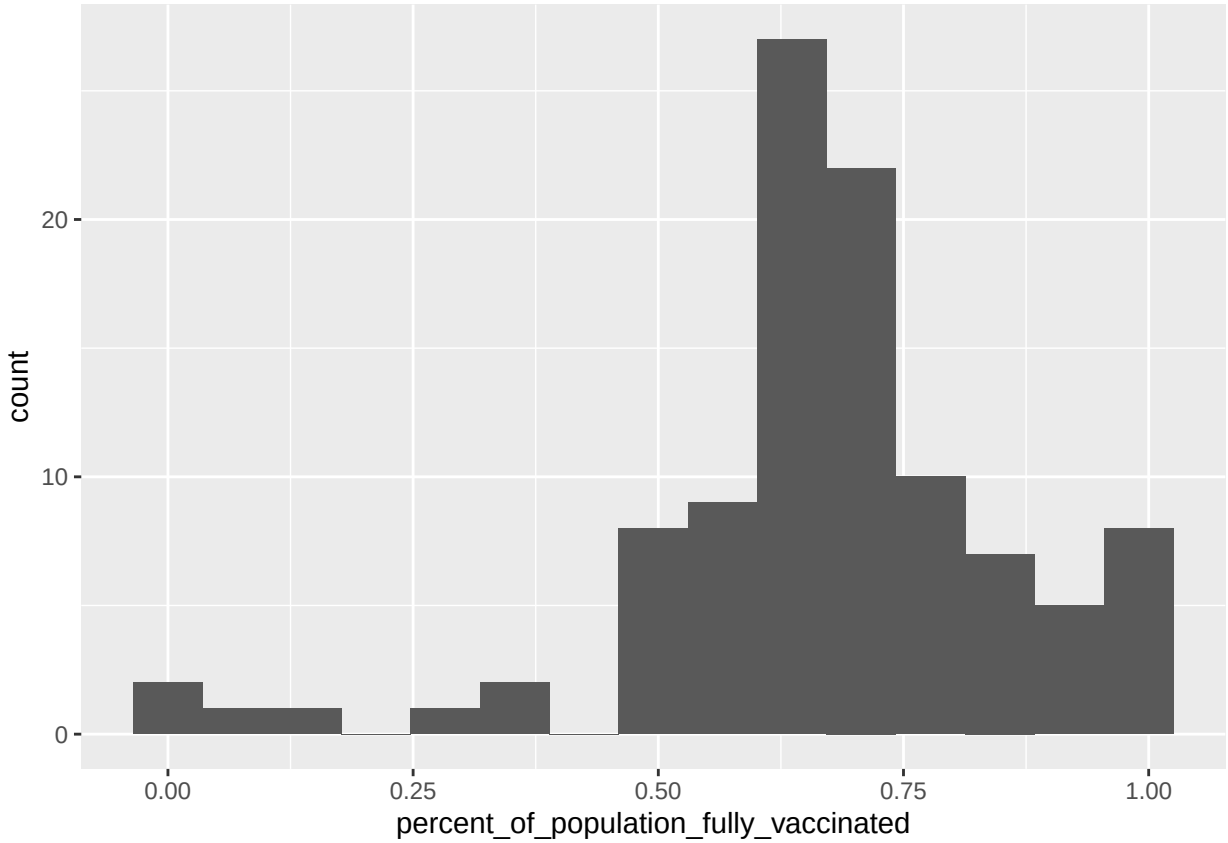
```
hist(sd.date$percent_of_population_fully_vaccinated)
```



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.

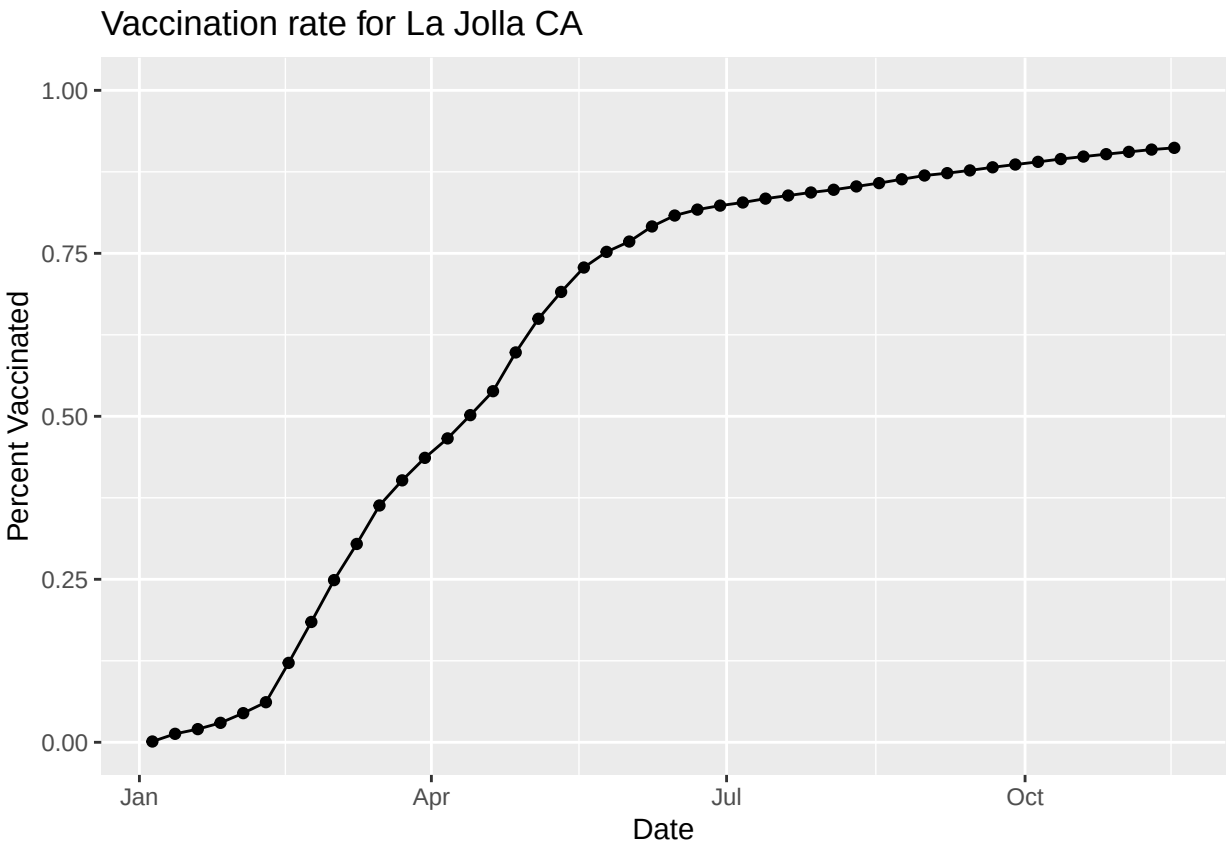
```
ucsd <- filter(sd, zip_code_tabulation_area=="92037")
ucsd[1,]$age5_plus_population
```

```
## [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)
```

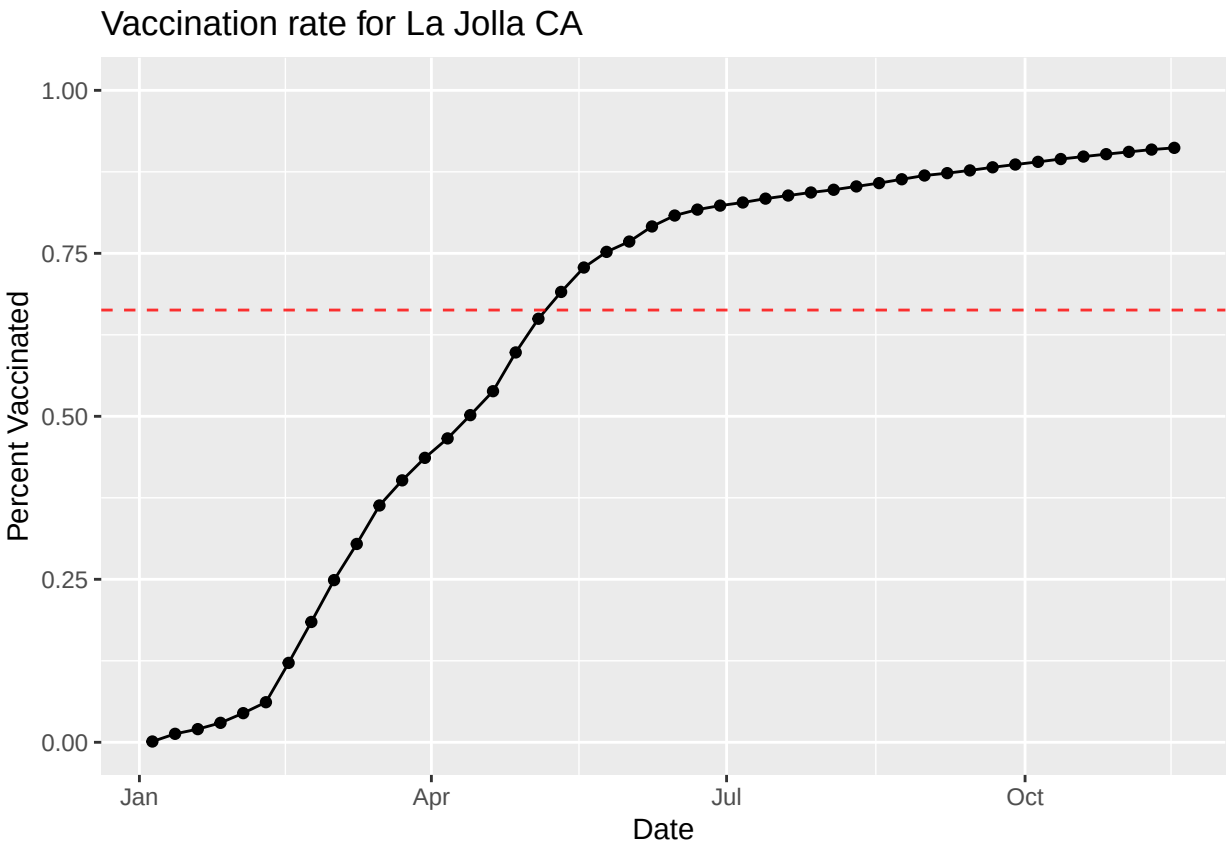
```
## [1] 411
```

** 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( yin
```



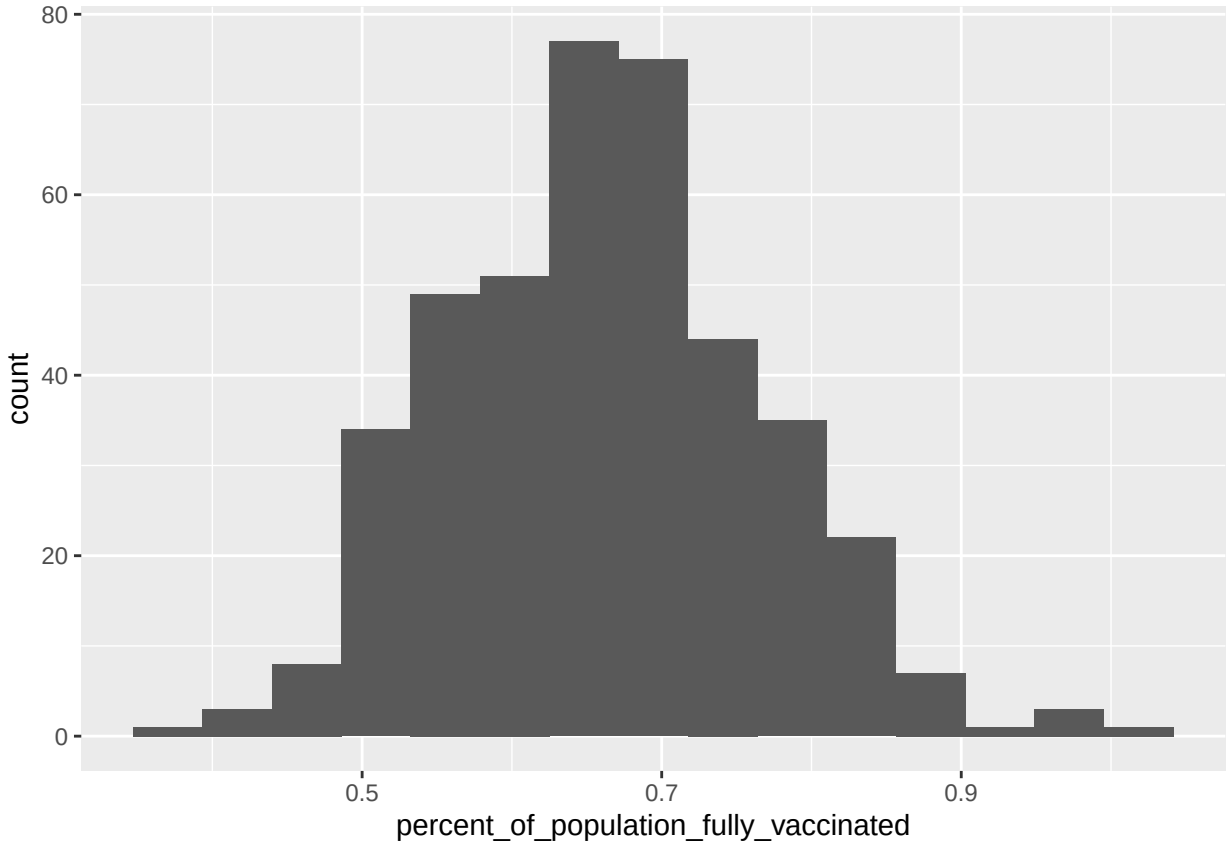
** Q17. What is the 6 number summary (Min, 1st Qu., Median, Mean, 3rd Qu., and Max) of the "Percent of Population Fully Vaccinated" values for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16"?**

```
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).
```