class 17

Nicole Manuguid

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#Covid Vaccination Rates

We will take data from the CA.gov site here:

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

```
# Import vaccination data
vax <- read.csv("covid19vaccinesbyzipcode_test.csv")
head(vax)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   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
```

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 data

Q3. What is the earliest date in this dataset?

21-01-05

Q4. What is the latest date in this dataset?

21-11-16

Quick look at data structure

As before we can use the **skimr()** function to quicky overview and summarize the dataset

```
library(skimr)
```

```
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	402	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	13685.50	31756.25	82556.7	
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?

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

```
## [1] 8256
```

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

```
round (sum( is.na(vax$persons_fully_vaccinated) )/nrow(vax)*100,2)
```

```
## [1] 10.17
```

#Ensure the data column is useful

We will use the **lubridate** package to make life a lot easier

```
#install.packages("lubridate")
```

```
library(lubridate)
```

```
## Warning: package 'lubridate' was built under R version 4.1.2
```

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

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

```
today()
```

```
## [1] "2021-11-28"
```

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

Q. how many days since the first entry?

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

```
## Time difference of 327 days
```

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

```
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
```

Working with ZIP codes

We will use the **zipcodeR** package to help make sense of zip codes

```
#install.packages("zipcodeR")
```

```
library(zipcodeR)
```

```
## Warning: package 'zipcodeR' was built under R version 4.1.2
```

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

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

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

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

```
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>
```

#Foucs on San Diego County

```
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
```

```
table(vax$county)
```

```
##
##                         Alameda          Alpine          Amador           Butte
##             230            2254              46             552             828
##       Calaveras          Colusa    Contra Costa       Del Norte       El Dorado
##             828             322            1978             184            1012
##          Fresno           Glenn       Humboldt        Imperial           Inyo
##            2530             276            1610             690             460
##            Kern           Kings            Lake          Lassen     Los Angeles
##            2254             322             644             598           13340
##          Madera          Marin        Mariposa       Mendocino          Merced
##             552            1288             368            1196             874
##           Modoc           Mono        Monterey            Napa          Nevada
##             506             322            1288             460             552
##          Orange          Placer          Plumas       Riverside      Sacramento
##            4048            1334             736            3220            2484
##      San Benito  San Bernardino       San Diego   San Francisco     San Joaquin
##             184            4094            4922            1242            1472
## San Luis Obispo       San Mateo   Santa Barbara     Santa Clara      Santa Cruz
##            1012            1334            1058            2668             782
##          Shasta          Sierra        Siskiyou          Solano          Sonoma
##            1196             322             966             690            1656
##      Stanislaus          Sutter          Tehama         Trinity          Tulare
##            1104             414             598             598            1518
##        Tuolumne         Ventura            Yolo            Yuba
##             598            1242             782             506
```

We can subset with base R

```
inds <- vax$county == "San Diego"
head(vax[inds,])
```

```
##    as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 5  2021-01-05                   92155                San Diego San Diego
## 14 2021-01-05                   92147                San Diego San Diego
## 16 2021-01-05                   92124                San Diego San Diego
## 24 2021-01-05                   92145                San Diego San Diego
## 34 2021-01-05                   91935                San Diego San Diego
## 36 2021-01-05                   92102                San Diego San Diego
##    vaccine_equity_metric_quartile               vem_source
## 5                              NA           No VEM Assigned
## 14                             NA           No VEM Assigned
## 16                              3 Healthy Places Index Score
## 24                             NA           No VEM Assigned
## 34                              3 Healthy Places Index Score
## 36                              1 Healthy Places Index Score
##    age12_plus_population age5_plus_population persons_fully_vaccinated
## 5                  456.0                  456                       NA
## 14                 518.0                  518                       NA
## 16               25422.4                29040                       29
## 24                1603.5                 1821                       NA
```

```
## 34                7390.0                 8101                         NA
## 36               37042.3                41033                         29
##    persons_partially_vaccinated percent_of_population_fully_vaccinated
## 5                            NA                                     NA
## 14                           NA                                     NA
## 16                          573                                0.000999
## 24                           NA                                     NA
## 34                           NA                                     NA
## 36                         1495                                0.000707
##    percent_of_population_partially_vaccinated
## 5                                          NA
## 14                                         NA
## 16                                   0.019731
## 24                                         NA
## 34                                         NA
## 36                                   0.036434
##    percent_of_population_with_1_plus_dose
## 5                                      NA
## 14                                     NA
## 16                               0.020730
## 24                                     NA
## 34                                     NA
## 36                               0.037141
##                                                                  redacted
## 5  Information redacted in accordance with CA state privacy requirements
## 14 Information redacted in accordance with CA state privacy requirements
## 16                                                                   No
## 24 Information redacted in accordance with CA state privacy requirements
## 34 Information redacted in accordance with CA state privacy requirements
## 36                                                                   No
```

Use **dplyr** package and it's **filter** function:

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

#How many entries are there for San Diego county?
nrow(sd)
```

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

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

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?

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

```
##    as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 23 2021-01-05                   92154                San Diego San Diego
##    vaccine_equity_metric_quartile                vem_source
## 23                              2 Healthy Places Index Score
##    age12_plus_population age5_plus_population persons_fully_vaccinated
## 23               76365.2                82971                       32
##    persons_partially_vaccinated percent_of_population_fully_vaccinated
## 23                         1336                                0.000386
##    percent_of_population_partially_vaccinated
## 23                                   0.016102
##    percent_of_population_with_1_plus_dose redacted
## 23                                 0.016488       No
```

What is the population in the 92037 ZIP code area?

```
filter(sd, zip_code_tabulation_area =="92037")[1,]
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   92037                San Diego San Diego
##   vaccine_equity_metric_quartile                vem_source
## 1                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1              33675.6                36144                       44
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         1265                                0.001217
##   percent_of_population_partially_vaccinated
## 1                                   0.034999
##   percent_of_population_with_1_plus_dose redacted
## 1                                 0.036216       No
```

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

```
sd.now <- filter(sd, as_of_date == "2021-11-09")

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

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

We can look at the 6-number summary

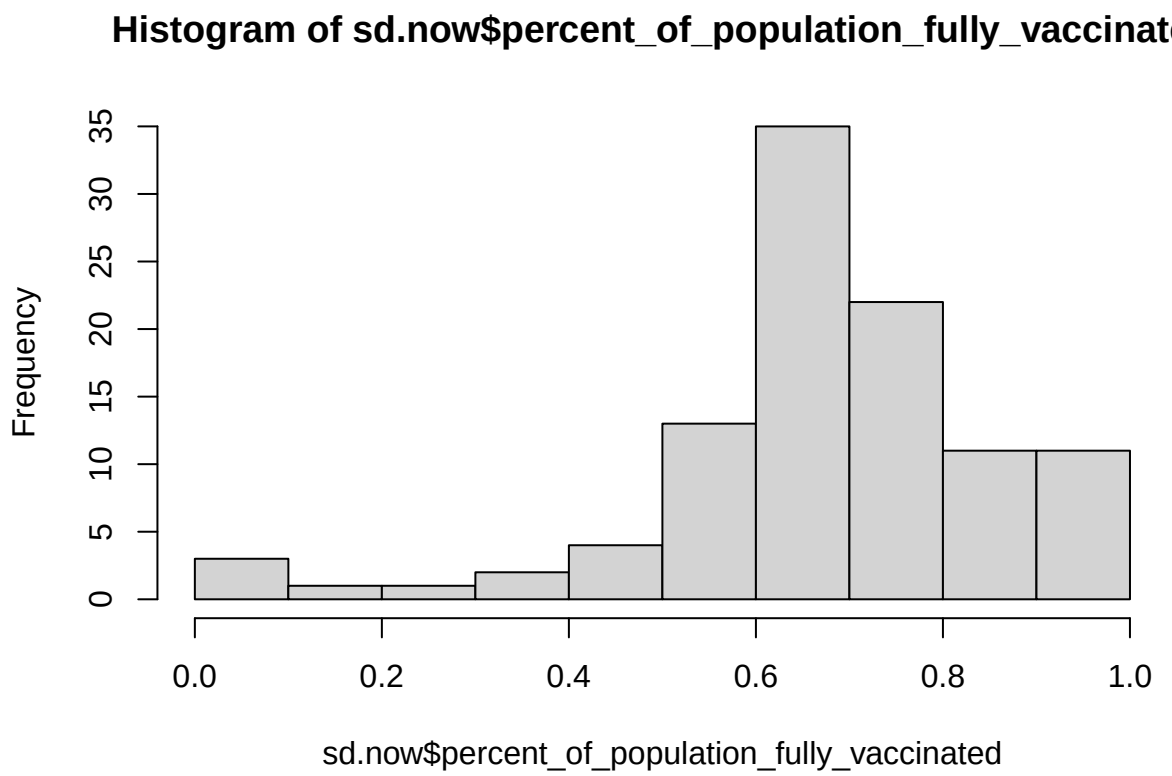
```
summary(sd.now$percent_of_population_fully_vaccinated)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
## 0.01017 0.60776 0.67700 0.67276 0.76164 1.00000       4
```

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"?

Using base R plots

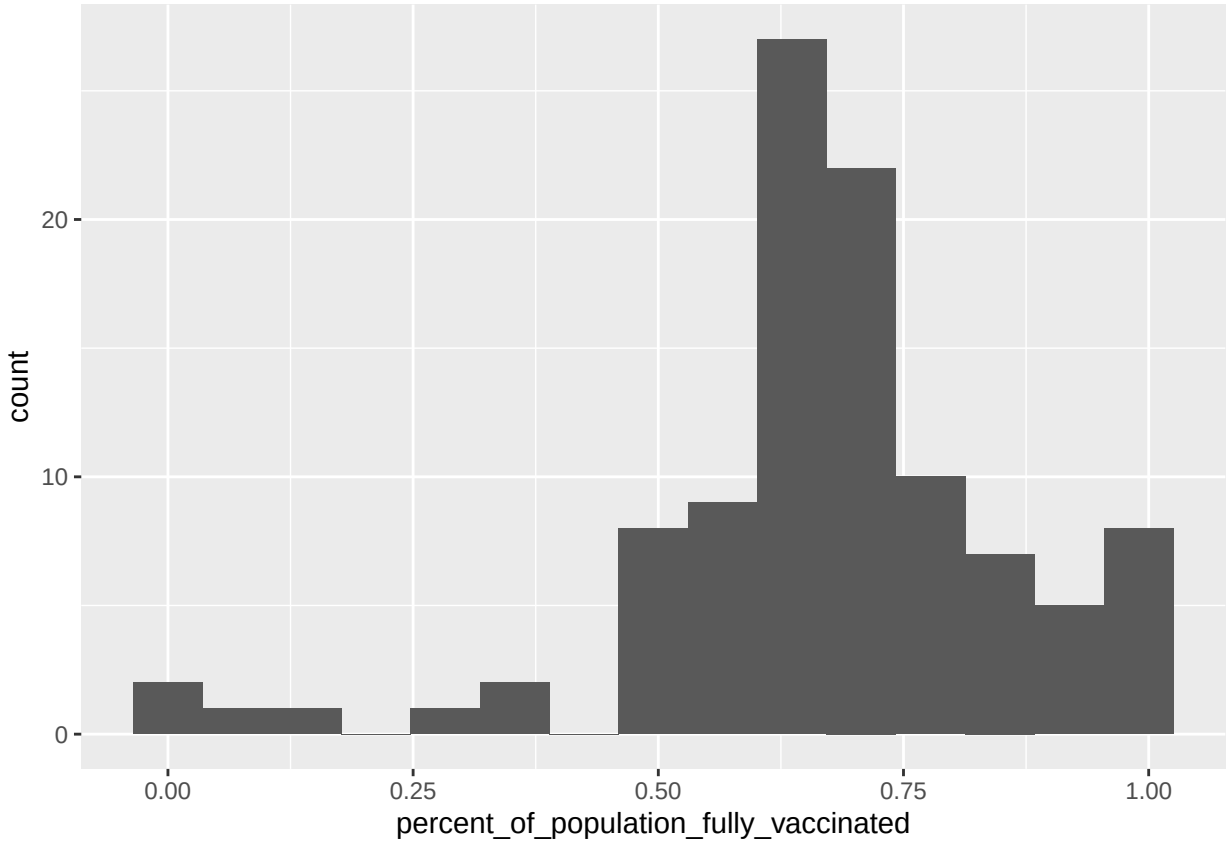
```
hist(sd.now$percent_of_population_fully_vaccinated)
```




```
library(ggplot2)
```

```
ggplot(sd.now) +
  aes(percent_of_population_fully_vaccinated) +
  geom_histogram(bins = 15)
```

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



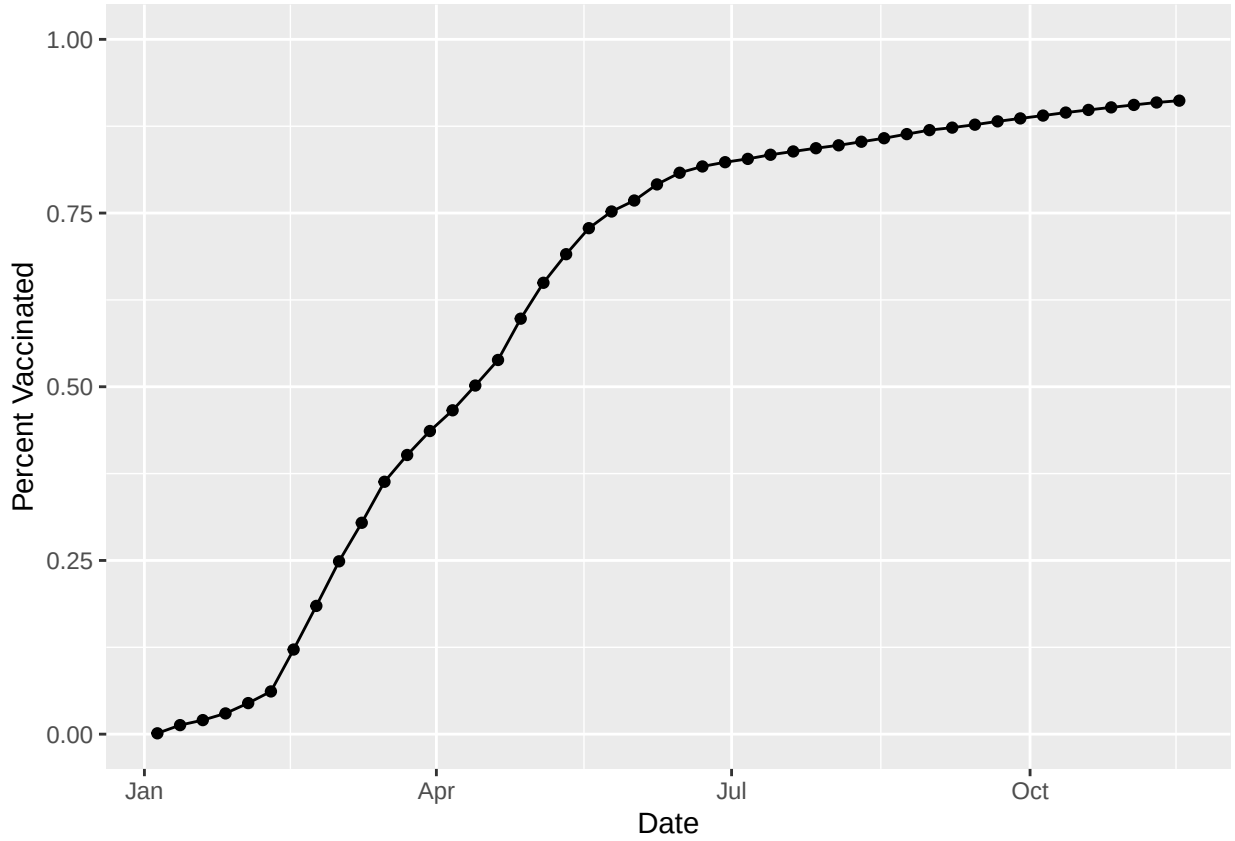
#Focus on UCSD/La Jolla

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

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

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

```
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")
```



#Comparing 92037 to other similar sized areas?

```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2021-11-16")

head(vax.36)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         county
## 1 2021-11-16                   92833                    Orange         Orange
## 2 2021-11-16                   92234                 Riverside      Riverside
## 3 2021-11-16                   92507                 Riverside      Riverside
## 4 2021-11-16                   92555                 Riverside      Riverside
## 5 2021-11-16                   92345           San Bernardino San Bernardino
## 6 2021-11-16                   91306              Los Angeles    Los Angeles
##   vaccine_equity_metric_quartile               vem_source
## 1                              3 Healthy Places Index Score
## 2                              1 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              2 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               43985.4                48623                    34668
## 2               46401.1                51202                    34191
## 3               51432.5                55253                    31704
```

```
## 4               36725.7               41446                    23776
## 5               66047.5               75539                    35332
## 6               42671.1               46573                    31858
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         3377                                0.712996
## 2                         3966                                0.667767
## 3                         3434                                0.573797
## 4                         2424                                0.573662
## 5                         4428                                0.467732
## 6                         3372                                0.684044
##   percent_of_population_partially_vaccinated
## 1                                   0.069453
## 2                                   0.077458
## 3                                   0.062150
## 4                                   0.058486
## 5                                   0.058619
## 6                                   0.072402
##   percent_of_population_with_1_plus_dose redacted
## 1                               0.782449       No
## 2                               0.745225       No
## 3                               0.635947       No
## 4                               0.632148       No
## 5                               0.526351       No
## 6                               0.756446       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 "2021-11-16". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

```
ucsd.now <- filter(vax.36, as_of_date == "2021-11-16")
mean(ucsd.now$percent_of_population_fully_vaccinated, na.rm = TRUE)
```

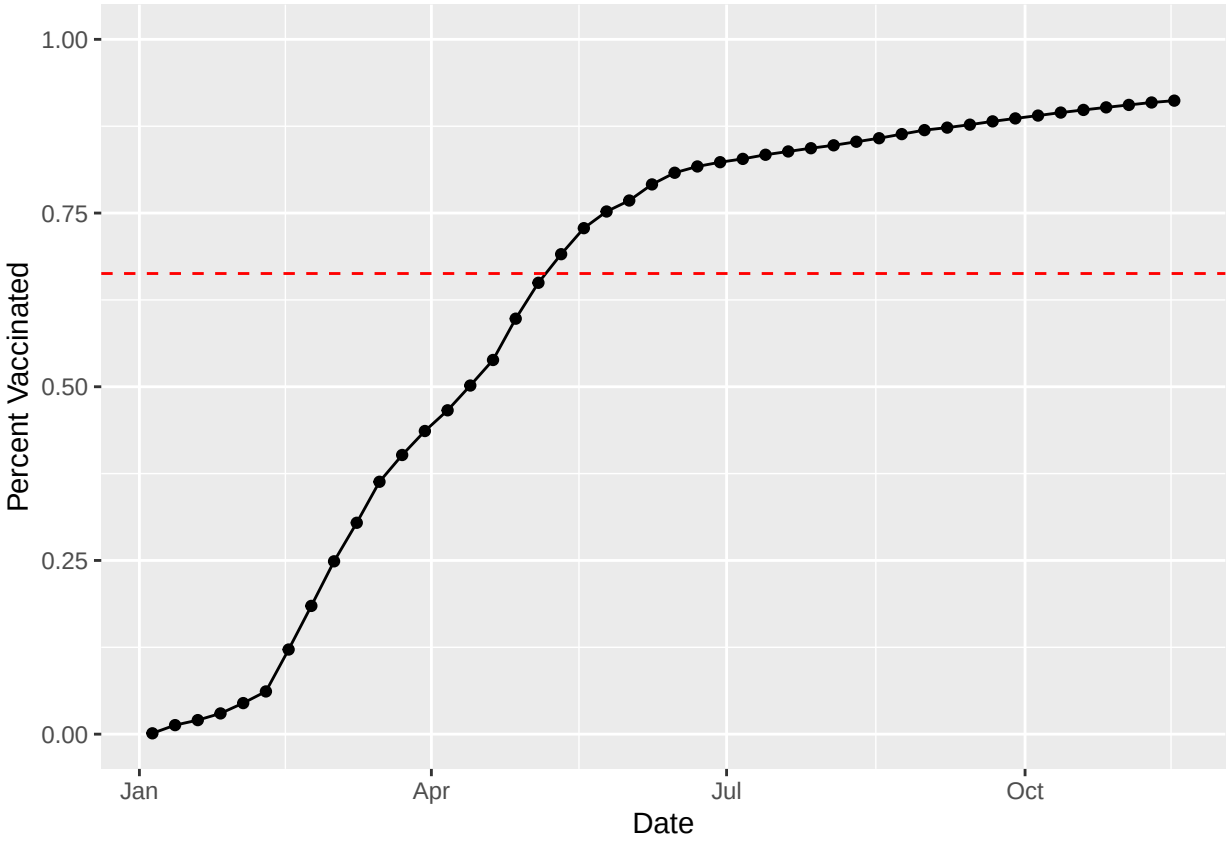
```
## [1] 0.6629812
```

#Time series of vaccination rate for 92037

First select all data for the UCSD 92037 area

```
ucsd <- filter(vax, zip_code_tabulation_area == "92037")
```

```
ggplot(ucsd) +
  aes(as_of_date,percent_of_population_fully_vaccinated) +
  geom_point()+
  geom_line(group=1) +
  geom_hline(yintercept = 0.6629812, col="red", linetype="dashed")+
  ylim(c(0,1)) +
  labs(x="Date", y="Percent Vaccinated")
```



Population in the 92037 ZIP code area

```
ucsd[1,]$age5_plus_population
```

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

First we need to subset the full 'vax' dataset to include only ZIP code areas iwth a population as large as 92037

```
vax.36.all <-filter(vax, age5_plus_population > 36144)
nrow(vax.36.all)
```

```
## [1] 18906
```

How many unique zip codes have a population as large as 92037?

```
length(unique(vax.36.all$zip_code_tabulation_area))
```

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

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(ucsd.now$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.

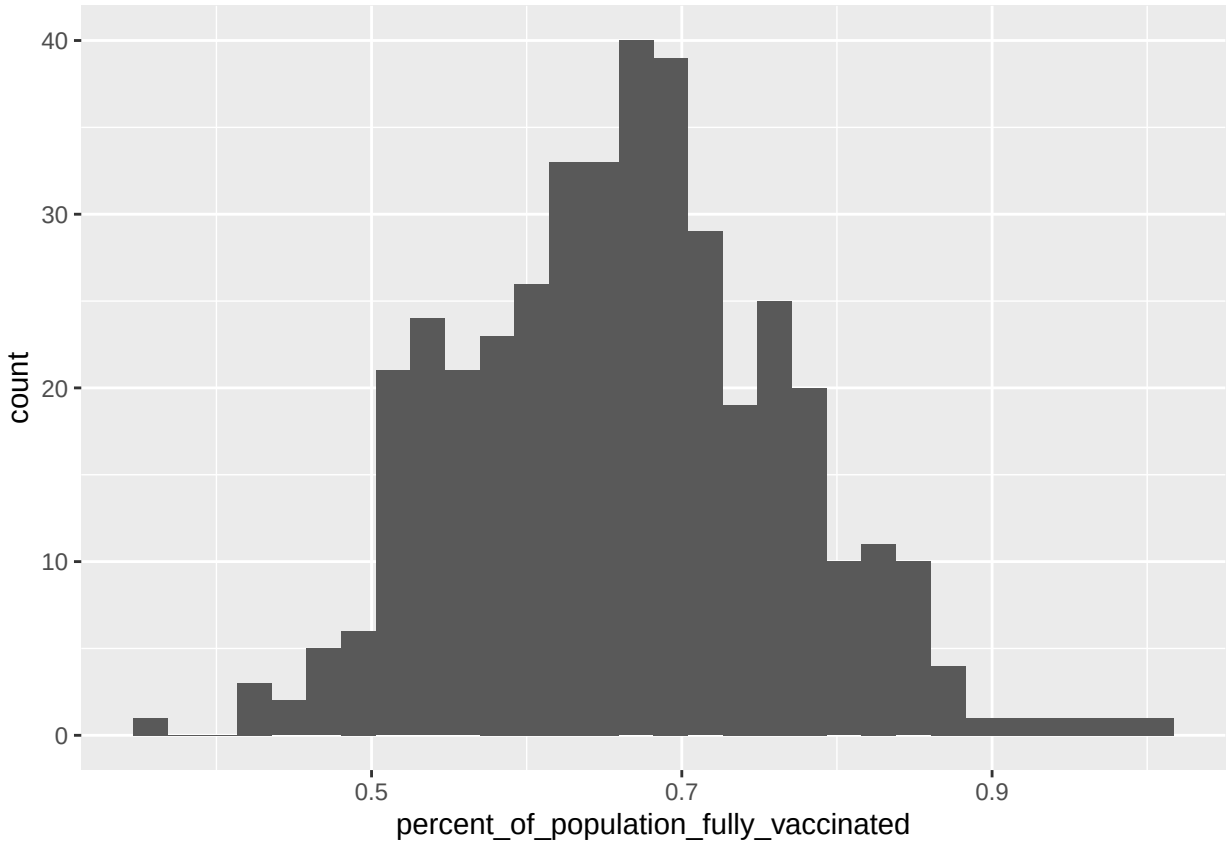
```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2021-11-16")

head(vax.36)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         county
## 1 2021-11-16                   92833                    Orange         Orange
## 2 2021-11-16                   92234                 Riverside      Riverside
## 3 2021-11-16                   92507                 Riverside      Riverside
## 4 2021-11-16                   92555                 Riverside      Riverside
## 5 2021-11-16                   92345           San Bernardino San Bernardino
## 6 2021-11-16                   91306              Los Angeles    Los Angeles
##   vaccine_equity_metric_quartile                vem_source
## 1                              3 Healthy Places Index Score
## 2                              1 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                              2 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               43985.4                48623                    34668
## 2               46401.1                51202                    34191
## 3               51432.5                55253                    31704
## 4               36725.7                41446                    23776
## 5               66047.5                75539                    35332
## 6               42671.1                46573                    31858
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         3377                                0.712996
## 2                         3966                                0.667767
## 3                         3434                                0.573797
## 4                         2424                                0.573662
## 5                         4428                                0.467732
## 6                         3372                                0.684044
##   percent_of_population_partially_vaccinated
## 1                                   0.069453
## 2                                   0.077458
## 3                                   0.062150
## 4                                   0.058486
## 5                                   0.058619
## 6                                   0.072402
##   percent_of_population_with_1_plus_dose redacted
## 1                               0.782449       No
## 2                               0.745225       No
## 3                               0.635947       No
```

```
## 4                                0.632148       No
## 5                                0.526351       No
## 6                                0.756446       No
```

```
ggplot(vax.36) +
  aes(percent_of_population_fully_vaccinated) +
  geom_histogram()
```

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



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

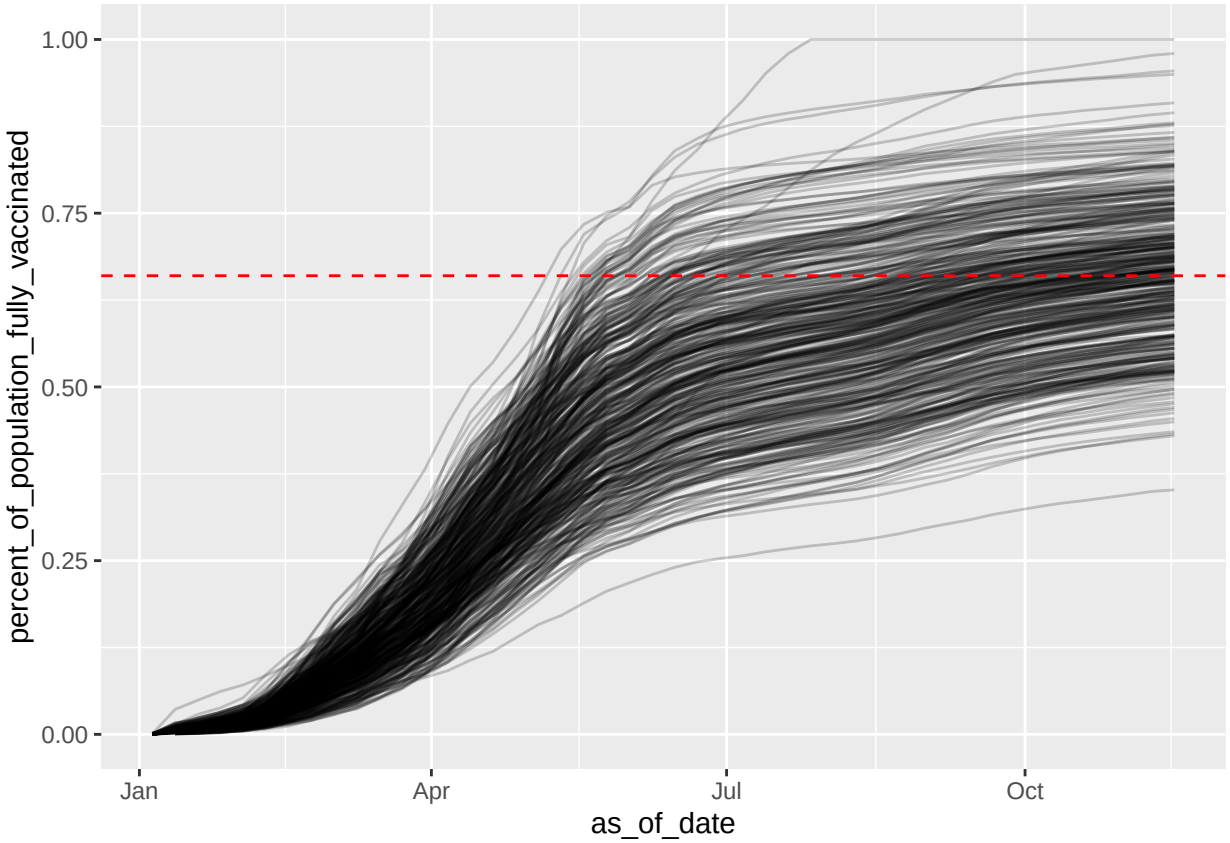
```
vax %>% filter(as_of_date == "2021-11-16") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

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

Q20. Finally make a time course plot of vaccination progress for all areas in the full dataset with a 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) +
  geom_hline(yintercept = 0.66, col="red", linetype="dashed")
```

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



Q21. How do you feel about traveling for Thanksgiving and meeting for in-person class next Week?

I am unsure how I feel given the data and observations. Living in California I always thought there was a higher amount of people vaccinated but the data says otherwise. I think its inevitable that people will meet and gather so I'm feeling the same about in-person class, all I can do is try to protect myself by stayin safe.