Class17: COVID-19 vaccination rate mini project

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Background

In this begore Thanksgiving class when many of our class mates are traveling let's have a look at COVID-19 vaccination rates around the State.

We get vaccination rate data from CA.GOV here:

https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code

Import data

```
vax <- read.csv("covid19vaccinesbyzipcode.csv")
head(vax)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         county
## 1 2021-01-05                   92395           San Bernardino San Bernardino
## 2 2021-01-05                   93206                     Kern           Kern
## 3 2021-01-05                   91006              Los Angeles    Los Angeles
## 4 2021-01-05                   91901                San Diego      San Diego
## 5 2021-01-05                   92230                Riverside      Riverside
## 6 2021-01-05                   92662                   Orange         Orange
##   vaccine_equity_metric_quartile               vem_source
## 1                              1 Healthy Places Index Score
## 2                              1 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                              1 Healthy Places Index Score
## 6                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               35915.3                40888                       NA
## 2                1237.5                 1521                       NA
## 3               28742.7                31347                       19
## 4               15549.8                16905                       12
## 5                2320.2                 2526                       NA
## 6                2349.5                 2397                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                           NA                                     NA
## 3                          873                               0.000606
```

```
## 4                           271                                0.000710
## 5                            NA                                      NA
## 6                            NA                                      NA
##   percent_of_population_partially_vaccinated
## 1                                         NA
## 2                                         NA
## 3                                   0.027850
## 4                                   0.016031
## 5                                         NA
## 6                                         NA
##   percent_of_population_with_1_plus_dose
## 1                                     NA
## 2                                     NA
## 3                                0.028456
## 4                                0.016741
## 5                                     NA
## 6                                     NA
##                                                                  redacted
## 1 Information redacted in accordance with CA state privacy requirements
## 2 Information redacted in accordance with CA state privacy requirements
## 3                                                                      No
## 4                                                                      No
## 5 Information redacted in accordance with CA state privacy requirements
## 6 Information redacted in accordance with CA state privacy requirements
```

Q. How many entries do we have?

```
nrow(vax)
```

```
## [1] 82908
```

We can use the **skimr** package and the `skim()` function to get a quick overview of structure of this dataset.

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

Table 1: Data summary

Name	vax
Number of rows	82908
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	47	0
local_health_jurisdiction	0	1	0	15	235	62	0
county	0	1	0	15	235	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	1089	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	21106.04	0	1460.50	15364.00	34877.00	101902.0	
persons_fully_vaccinated	8355	0.90	9585.35	11609.12	11	516.00	4210.00	16095.00	71219.0	
persons_partially_vaccinated	8355	0.90	1894.87	2105.55	11	198.00	1269.00	2880.00	20159.0	
percent_of_population_fully_vaccinated	8355	0.90	0.43	0.27	0	0.20	0.44	0.63	1.0	
percent_of_population_partially_vaccinated	8355	0.90	0.10	0.10	0	0.06	0.07	0.11	1.0	
percent_of_population_with_1_plus_dose	8355	0.90	0.51	0.26	0	0.31	0.53	0.71	1.0	

Notice that one of these columns is a date column. Working with time and dates get's annoying quickly. We can use the **lubridate** package to make this easy…

```
library(lubridate)
```

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

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

```
today()
```

```
## [1] "2021-11-24"
```

Q. How many days since the first entry in the dataset?

```
vax$as_of_date[1]
```

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

This will not work because our data column was read as character..

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

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

```
today() - d[1]
```

```
## Time difference of 323 days
```

I will make the `as_of_date` coulumn Date format...

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

> Q. When was the dataset last updated? What it is the last date in this dataset? How many days since the last update?

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

```
## Time difference of 1 days
```

> Q. How many days does the dateset span?

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

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

> Q. How many different ZIP code areas are in this dataset?

```
length(unique(vax$zip_code_tabulation_area))
```

```
## [1] 1764
```

To work with ZIP codes we can use the **zipcodeR**

```
library(zipcodeR)

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 in on San Diego County

We want to subset the full CA `vax` data down to just San Diego County.

We could do this with base R

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

```
## [1] 5029
```

Subsetting can get tedious and complicated quickly when you have multiple things we want to subset by.

```
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
```

We will use the `filter()` function to do our subsetting from now on.

We want to focus in on San Diego County

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

```
## [1] 5029
```

More complicated subsetting...

```
sd.20 <- filter(vax, county=="San Diego",
       age5_plus_population > 20000)

nrow(sd.20)
```

```
## [1] 3055
```

Q. What is the average vaccination rate of San Diego count as of yesterday?

```
sd.now <- filter(vax, county=="San Diego",
                 as_of_date=="2021-11-23")

head(sd.now)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-11-23                   92120                San Diego San Diego
## 2 2021-11-23                   91962                San Diego San Diego
## 3 2021-11-23                   92155                San Diego San Diego
## 4 2021-11-23                   92147                San Diego San Diego
## 5 2021-11-23                   91913                San Diego San Diego
## 6 2021-11-23                   92114                San Diego San Diego
##   vaccine_equity_metric_quartile               vem_source
## 1                              4 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                             NA            No VEM Assigned
## 4                             NA            No VEM Assigned
## 5                              3 Healthy Places Index Score
## 6                              2 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               26372.9                28414                    21234
## 2                1758.7                 2020                      948
## 3                 456.0                  456                       70
## 4                 518.0                  518                       NA
## 5               43514.7                50461                    37974
## 6               59050.7                64945                    43708
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         3198                                0.747308
## 2                          126                                0.469307
## 3                           20                                0.153509
## 4                           NA                                      NA
## 5                         6690                                0.752542
## 6                         6261                                0.673000
##   percent_of_population_partially_vaccinated
## 1                                   0.112550
## 2                                   0.062376
## 3                                   0.043860
## 4                                         NA
## 5                                   0.132578
## 6                                   0.096405
##   percent_of_population_with_1_plus_dose
## 1                               0.859858
## 2                               0.531683
## 3                               0.197369
## 4                                     NA
## 5                               0.885120
## 6                               0.769405
##                                                                redacted
## 1                                                                    No
## 2                                                                    No
## 3                                                                    No
## 4 Information redacted in accordance with CA state privacy requirements
## 5                                                                    No
## 6                                                                    No
```

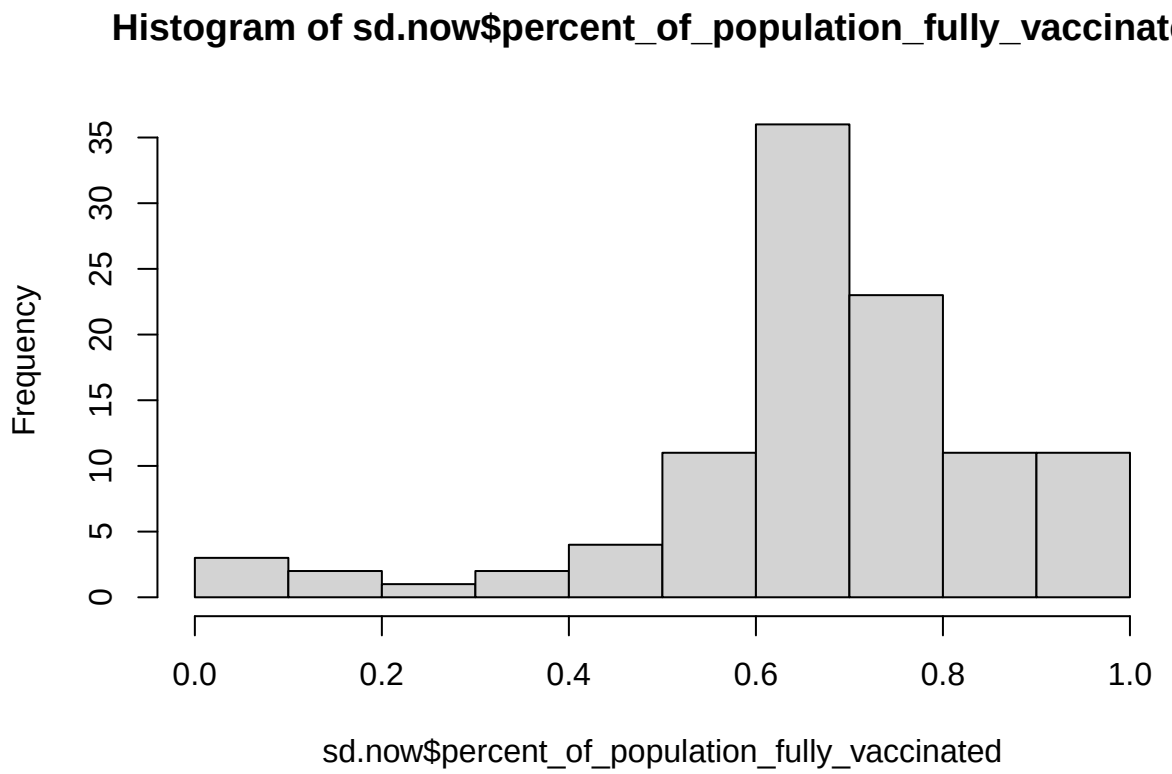
```
summary(sd.now$percent_of_population_fully_vaccinated)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
## 0.01017 0.61301 0.67965 0.67400 0.76932 1.00000       3
```

Q. Make a histogram of these values.

Base R histogram

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



This plot above is going to be susceptible to being skewed by ZIP code areas with small populations. Thes will have big effects for just a small number of unvax-ed folks…

Q. What is the population of the 92037 ZIP code area?

```
lj <- filter(sd.now, zip_code_tabulation_area=="92037")
lj$age5_plus_population
```

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

Q. What is the average vaccination value for this UCSD/La Jolla ZIP code area?

```
lj$percent_of_population_fully_vaccinated
```

```
## [1] 0.916196
```

Q. What about this ZIP code 92122

```
lj2 <- filter(sd.now, zip_code_tabulation_area=="92122")
lj2$age5_plus_population
```

```
## [1] 45951
```

```
lj2$percent_of_population_fully_vaccinated
```

```
## [1] 0.771474
```

```
filter(sd.now, zip_code_tabulation_area=="92124")
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-11-23                   92124                San Diego San Diego
##   vaccine_equity_metric_quartile                vem_source
## 1                              3 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               25422.4                29040                    16245
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         2677                                0.559401
##   percent_of_population_partially_vaccinated
## 1                                   0.092183
##   percent_of_population_with_1_plus_dose redacted
## 1                                0.651584       No
```

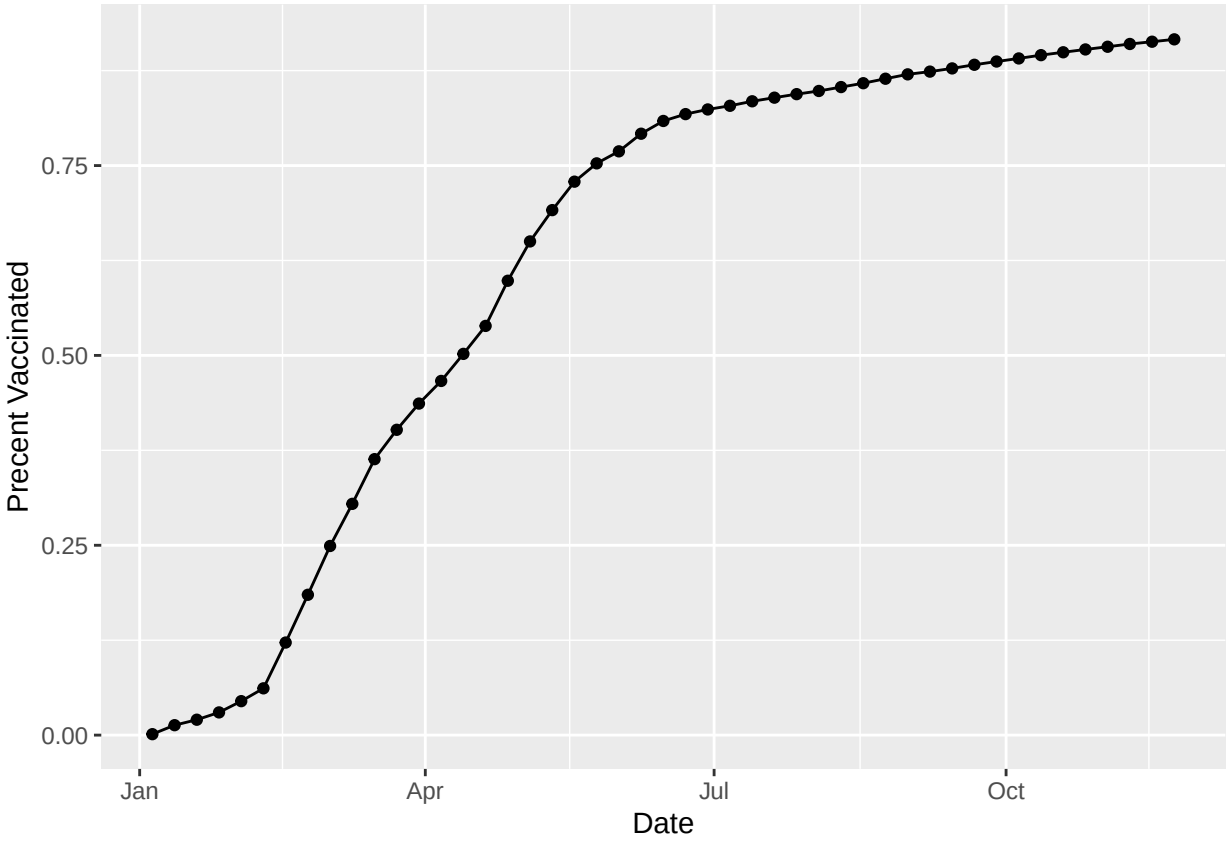
Time series of vaccination rate for a given ZIP code area. Start with 92037.

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

Use ggplot for this:

```
library(ggplot2)

ggplot(lj) +
  aes(x=as_of_date,
      y=percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  labs(x="Date", y="Precent Vaccinated")
```



Let's make this plot for all San Diego County ZIP code areas that have a population as least as large as 92037.

```
sd.36 <- filter(vax, county=="San Diego",
             age5_plus_population > 36144)

head(sd.36)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   92058                San Diego San Diego
## 2 2021-01-05                   92078                San Diego San Diego
## 3 2021-01-05                   92019                San Diego San Diego
## 4 2021-01-05                   92117                San Diego San Diego
## 5 2021-01-05                   92057                San Diego San Diego
## 6 2021-01-05                   91913                San Diego San Diego
##   vaccine_equity_metric_quartile                vem_source
## 1                              1 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              3 Healthy Places Index Score
## 5                              2 Healthy Places Index Score
## 6                              3 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               34956.0                39695                       NA
## 2               41789.5                47476                       37
## 3               37439.4                40464                       25
```

```
## 4               50041.6               53839                        42
## 5               51927.0               56906                        22
## 6               43514.7               50461                        37
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                          688                                0.000779
## 3                          610                                0.000618
## 4                         1143                                0.000780
## 5                          691                                0.000387
## 6                         1993                                0.000733
##   percent_of_population_partially_vaccinated
## 1                                         NA
## 2                                   0.014492
## 3                                   0.015075
## 4                                   0.021230
## 5                                   0.012143
## 6                                   0.039496
##   percent_of_population_with_1_plus_dose
## 1                                     NA
## 2                               0.015271
## 3                               0.015693
## 4                               0.022010
## 5                               0.012530
## 6                               0.040229
##                                                                  redacted
## 1 Information redacted in accordance with CA state privacy requirements
## 2                                                                      No
## 3                                                                      No
## 4                                                                      No
## 5                                                                      No
## 6                                                                      No
```

How many ZIP code areas in San Diego county have a population larger than 92037

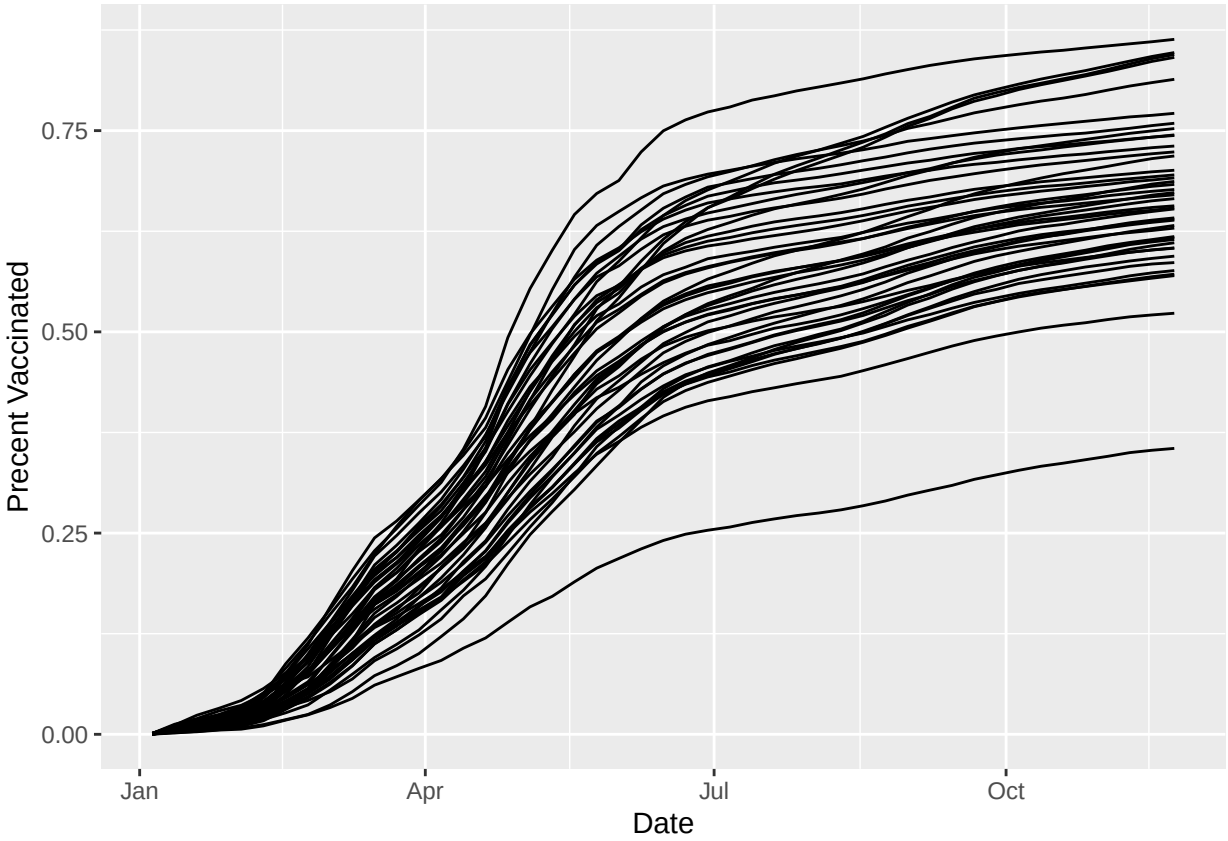
```
length(unique(sd.36$zip_code_tabulation_area))
```

```
## [1] 43
```

Lets make the plot

```
ggplot(sd.36) +
  aes(x=as_of_date,
      y=percent_of_population_fully_vaccinated,
      group=zip_code_tabulation_area) +
  geom_line() +
  labs(x="Date", y="Precent Vaccinated")
```

```
## Warning: Removed 1 row(s) containing missing values (geom_path).
```



> Q. Make a plot like this for the all ZIP code areas in the State with a population at least as large as La Jolla.

```
ca <- filter(vax, age5_plus_population > 36144)
```

How many

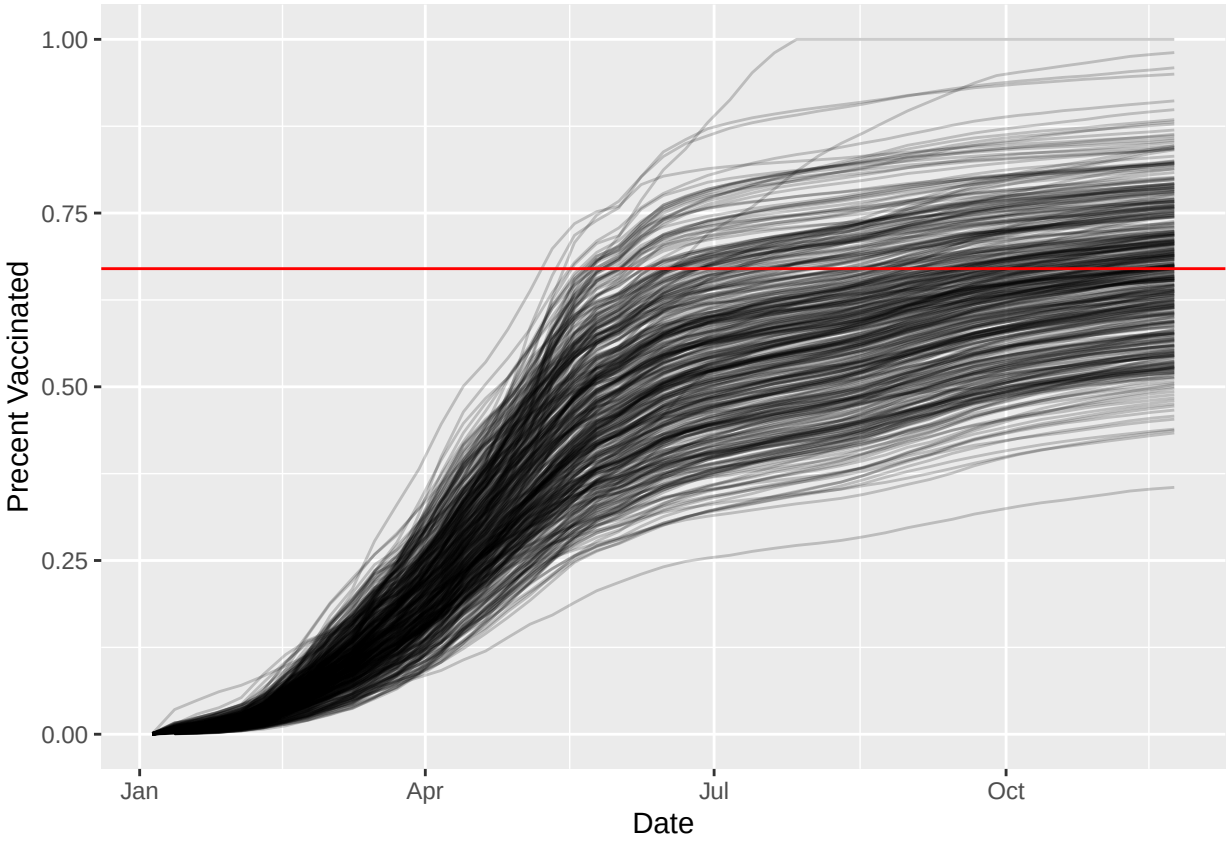
```
length(unique(ca$zip_code_tabulation_area))
```

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

Make our big monster plot

```
ggplot(ca) +
  aes(x=as_of_date,
      y=percent_of_population_fully_vaccinated,
      group=zip_code_tabulation_area) +
  geom_line(alpha=0.2) +
  labs(x="Date", y="Precent Vaccinated") +
  geom_hline(yintercept = 0.67, color="red")
```

```
## Warning: Removed 176 row(s) containing missing values (geom_path).
```



Q. What is the mean across the state for these 36k + population areas?

```
ca.now <- filter(ca, as_of_date=="2021-11-23")
summary( ca.now$percent_of_population_fully_vaccinated )
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.3552  0.5939  0.6696  0.6672  0.7338  1.0000
```