Vaccination Rate Mini-Project: class17

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11/26/2021

Getting started

We will start by downloading the most recently dated “Statewide COVID-19 Vaccines Administered by ZIP Code” CSV file from: https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code (https://data.ca.gov/dataset/covid-19-vaccine-progress-dashboard-data-by-zip-code)

Be sure to move your downloaded CSV file to your project directory and then read/import into an R object called vax. We will use this data to answer all the questions below.

```
# Import vaccination data
vax <- read.csv("vaxdata.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
```

```
test <- sort(vax$as_of_date, decreasing=TRUE)
head(test)
```

```
## [1] "2021-11-23" "2021-11-23" "2021-11-23" "2021-11-23" "2021-11-23"
## [6] "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?

–> 2021-11-23

As we have done previously, let's call the skim() function from the skimr package to get a quick overview of this dataset:

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

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	4089	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	▅▆▇▇

Q5. How many numeric columns are in this dataset?

–> 9 numeric columns

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] 8355
```

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

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

```
## [1] 10.07744
```

–> To 2 significant figures = 10.

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

–> These values may be missing if there are records of vaccines being given (doses administered), but no specifics on the data for the people that received them.

Working with dates

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

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

```
library(lubridate)
```

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

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

```
today()
```

```
## [1] "2021-11-26"
```

However, if we convert our date data into a lubridate format things like this will be much easier as well as plotting time series data later on.

```
# Specify that we are using the year-month-day format
vax$as_of_date <- ymd(vax$as_of_date)
```

Now we can do math with dates. For example: How many days have passed since the first vaccination reported in this dataset?

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

```
## Time difference of 325 days
```

Using the last and the first date value we can now determine how many days the dataset span?

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

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

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

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

```
## Time difference of 3 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] 47
```

Working with ZIP codes

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

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

```
## # A tibble: 1 × 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 × 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>
```

Optional: We can use this reverse_zipcode() to pull census data later on for any or all ZIP code areas we might be interested in.

```
# Pull data for all ZIP codes in the dataset
zipdata <- reverse_zipcode( vax$zip_code_tabulation_area )
head(zipdata)
```

```
## # A tibble: 6 × 24
##   zipcode zipcode_type major_city post_office_city common_city_list county state
##   <chr>   <chr>        <chr>      <chr>                     <blob> <chr>  <chr>
## 1 90001   Standard     Los Angel… Los Angeles, CA        <raw 44 B> Los A… CA
## 2 90002   Standard     Los Angel… Los Angeles, CA        <raw 47 B> Los A… CA
## 3 90003   Standard     Los Angel… Los Angeles, CA        <raw 23 B> Los A… CA
## 4 90004   Standard     Los Angel… Los Angeles, CA        <raw 34 B> Los A… CA
## 5 90005   Standard     Los Angel… Los Angeles, CA        <raw 34 B> Los A… CA
## 6 90006   Standard     Los Angel… Los Angeles, CA        <raw 23 B> Los A… 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>
```

We could also access socioeconomic data for different ZIP code areas in a similar way if we wanted to investigate factors that might be correlated with different vaccine uptake rates.

Another informative data exploration might be to plot the various values along with the ZIP codes latitude and longitude values on a map using a package like leafelet or using ggplot2 itself similar to this post. For now we will leave this as an optional extension exercise.

Focus on the San Diego area

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

```
# Subset to San Diego county only areas
sd1 <- vax[ vax$county == "San Diego" , ]
head(sd1)
```

```
##    as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 4  2021-01-05                   91901                San Diego San Diego
## 14 2021-01-05                   91902                San Diego San Diego
## 21 2021-01-05                   92011                San Diego San Diego
## 22 2021-01-05                   92055                San Diego San Diego
## 25 2021-01-05                   92067                San Diego San Diego
## 33 2021-01-05                   92081                San Diego San Diego
##    vaccine_equity_metric_quartile               vem_source
## 4                               3 Healthy Places Index Score
## 14                              4 Healthy Places Index Score
## 21                              4 Healthy Places Index Score
## 22                              3    CDPH-Derived ZCTA Score
## 25                              4 Healthy Places Index Score
## 33                              2 Healthy Places Index Score
##    age12_plus_population age5_plus_population persons_fully_vaccinated
## 4                15549.8                16905                       12
## 14               16620.7                18026                       22
## 21               20503.6                23247                       NA
## 22               11548.0                11654                       NA
## 25                6973.9                 7480                       11
## 33               25558.0                27632                       14
##    persons_partially_vaccinated percent_of_population_fully_vaccinated
## 4                           271                                0.000710
## 14                          374                                0.001220
## 21                           NA                                      NA
## 22                           NA                                      NA
## 25                          241                                0.001471
## 33                          346                                0.000507
##    percent_of_population_partially_vaccinated
## 4                                    0.016031
## 14                                   0.020748
## 21                                         NA
## 22                                         NA
## 25                                   0.032219
## 33                                   0.012522
##    percent_of_population_with_1_plus_dose
## 4                                0.016741
## 14                               0.021968
## 21                                     NA
## 22                                     NA
## 25                               0.033690
## 33                               0.013029
##                                                                  redacted
## 4                                                                      No
## 14                                                                     No
## 21 Information redacted in accordance with CA state privacy requirements
## 22 Information redacted in accordance with CA state privacy requirements
## 25                                                                     No
## 33                                                                     No
```

```
nrow(sd1)
```

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

```
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] 5029
```

Using dplyr is often more convenient when we are subsetting across multiple criteria - for example all San Diego county areas with a population of over 10,000.

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

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-01-05                   91901                San Diego San Diego
## 2 2021-01-05                   91902                San Diego San Diego
## 3 2021-01-05                   92011                San Diego San Diego
## 4 2021-01-05                   92055                San Diego San Diego
## 5 2021-01-05                   92081                San Diego San Diego
## 6 2021-01-05                   92124                San Diego San Diego
##   vaccine_equity_metric_quartile               vem_source
## 1                              3 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              4 Healthy Places Index Score
## 4                              3    CDPH-Derived ZCTA Score
## 5                              2 Healthy Places Index Score
## 6                              3 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               15549.8                16905                       12
## 2               16620.7                18026                       22
## 3               20503.6                23247                       NA
## 4               11548.0                11654                       NA
## 5               25558.0                27632                       14
## 6               25422.4                29040                       29
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                          271                                0.000710
## 2                          374                                0.001220
## 3                           NA                                      NA
## 4                           NA                                      NA
## 5                          346                                0.000507
## 6                          575                                0.000999
##   percent_of_population_partially_vaccinated
## 1                                   0.016031
## 2                                   0.020748
## 3                                         NA
## 4                                         NA
## 5                                   0.012522
## 6                                   0.019800
##   percent_of_population_with_1_plus_dose
## 1                                0.016741
## 2                                0.021968
## 3                                      NA
## 4                                      NA
## 5                                0.013029
## 6                                0.020799
##                                                                redacted
## 1                                                                    No
## 2                                                                    No
## 3 Information redacted in accordance with CA state privacy requirements
## 4 Information redacted in accordance with CA state privacy requirements
## 5                                                                    No
## 6                                                                    No
```

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?

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

```
## [1] 60
```

```
sd$zip_code_tabulation_area[23]
```

```
## [1] 92057
```

Using `dplyr` select all San Diego "county" entries on "as_of_date" "2021-11-16" and use this for the following questions.

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

```
sd_date <- filter(vax, county == "San Diego" & as_of_date == "2021-11-09")
head(sd_date)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 1 2021-11-09                   92081                San Diego San Diego
## 2 2021-11-09                   92058                San Diego San Diego
## 3 2021-11-09                   91902                San Diego San Diego
## 4 2021-11-09                   92140                San Diego San Diego
## 5 2021-11-09                   92124                San Diego San Diego
## 6 2021-11-09                   92135                San Diego San Diego
##   vaccine_equity_metric_quartile               vem_source
## 1                              2 Healthy Places Index Score
## 2                              1 Healthy Places Index Score
## 3                              4 Healthy Places Index Score
## 4                             NA            No VEM Assigned
## 5                              3 Healthy Places Index Score
## 6                             NA            No VEM Assigned
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1               25558.0                27632                    17333
## 2               34956.0                39695                    13892
## 3               16620.7                18026                    13101
## 4                3747.7                 3737                       38
## 5               25422.4                29040                    16121
## 6                 635.0                  635                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         2219                                0.627280
## 2                         2410                                0.349969
## 3                         1997                                0.726784
## 4                           14                                0.010169
## 5                         2060                                0.555131
## 6                           NA                                      NA
##   percent_of_population_partially_vaccinated
## 1                                   0.080305
## 2                                   0.060713
## 3                                   0.110784
## 4                                   0.003746
## 5                                   0.070937
## 6                                         NA
##   percent_of_population_with_1_plus_dose
## 1                               0.707585
## 2                               0.410682
## 3                               0.837568
## 4                               0.013915
## 5                               0.626068
## 6                                     NA
##                                                              redacted
## 1                                                                  No
## 2                                                                  No
## 3                                                                  No
## 4                                                                  No
## 5                                                                  No
## 6 Information redacted in accordance with CA state privacy requirements
```

```
summary(sd_date$percent_of_population_fully_vaccinated)
```

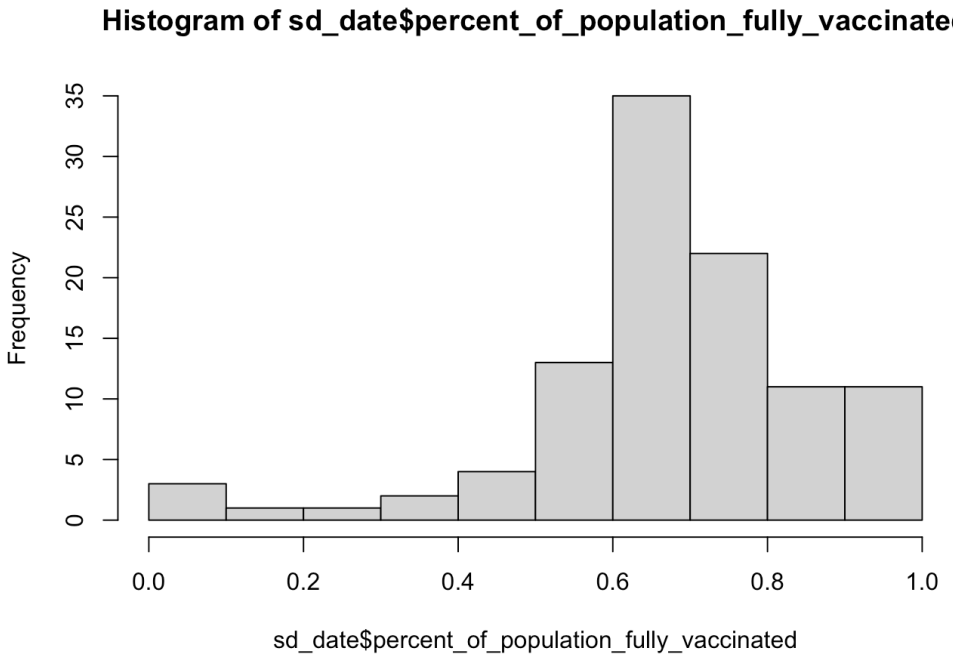
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
## 0.01017 0.60805 0.67711 0.67347 0.76257 1.00000       4
```

```
x <- sum(is.na(sd_date$percent_of_population_fully_vaccinated))
sum(na.omit(sd_date$percent_of_population_fully_vaccinated))/ (nrow(sd_date) - x) * 100
```

```
## [1] 67.34714
```

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)
```



Focus on UCSD/La Jolla

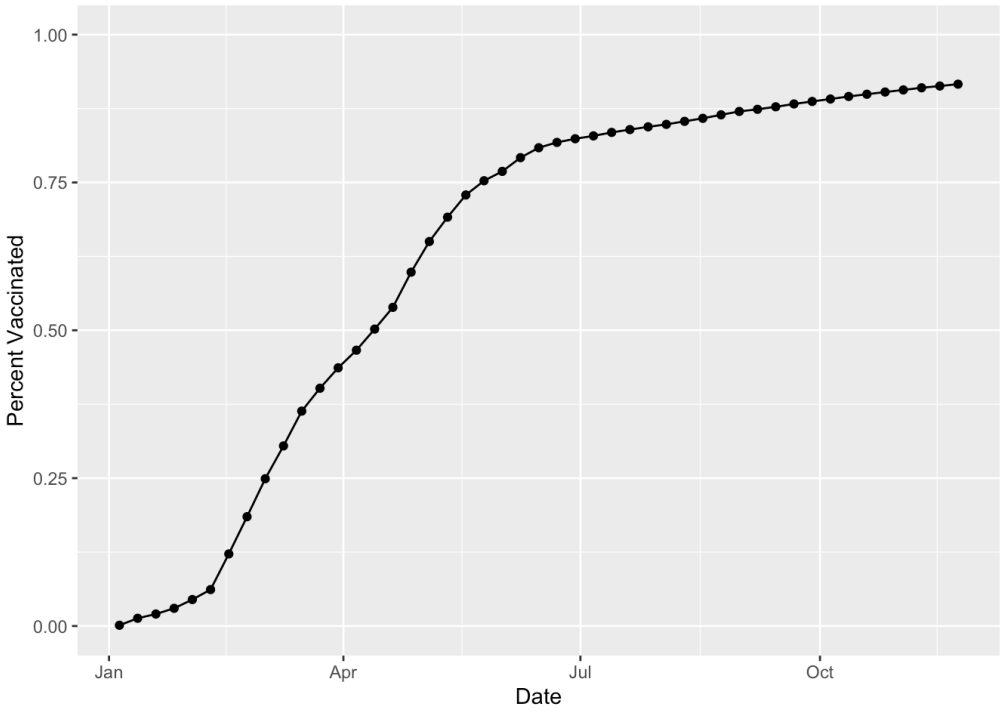
UC San Diego resides in the 92037 ZIP code area and is listed with an age 5+ population size of 36,144.

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

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

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

```
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")
```



This plot shows an initial slow roll out in January into Febuary (likely due to limited vaccine availability). This is followed with rapid ramp up until a clear slowing trend from June time onward. Interpertation beyond this requies context from other zip code areas to answer questions such as: is this trend representative of other areas? Are more people fully vaccinated in this area compared to others? Etc.

Comparing to similar sized areas

Let's return to the full dataset and look across every zip code area with a population at least as large as that of 92037 on as_of_date "2021-11-16".

```
# 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                   92020                 San Diego      San Diego
## 2 2021-11-16                   92563                 Riverside      Riverside
## 3 2021-11-16                   92806                    Orange         Orange
## 4 2021-11-16                   93291                    Tulare         Tulare
## 5 2021-11-16                   92335           San Bernardino San Bernardino
## 6 2021-11-16                   92618                    Orange         Orange
##   vaccine_equity_metric_quartile               vem_source
## 1                              2 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                              2 Healthy Places Index Score
## 4                              1 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               49284.5                54991                    35128
## 2               55897.8                63794                    36051
## 3               33050.9                36739                    24810
## 4               46879.7                54254                    27936
## 5               79670.3                91867                    49820
## 6               40348.0                44304                    39695
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         5161                                0.638795
## 2                         4224                                0.565116
## 3                         2355                                0.675304
## 4                         4012                                0.514911
## 5                         5970                                0.542306
## 6                         3936                                0.895969
##   percent_of_population_partially_vaccinated
## 1                                   0.093852
## 2                                   0.066213
## 3                                   0.064101
## 4                                   0.073948
## 5                                   0.064985
## 6                                   0.088841
##   percent_of_population_with_1_plus_dose redacted
## 1                               0.732647       No
## 2                               0.631329       No
## 3                               0.739405       No
## 4                               0.588859       No
## 5                               0.607291       No
## 6                               0.984810       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?

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

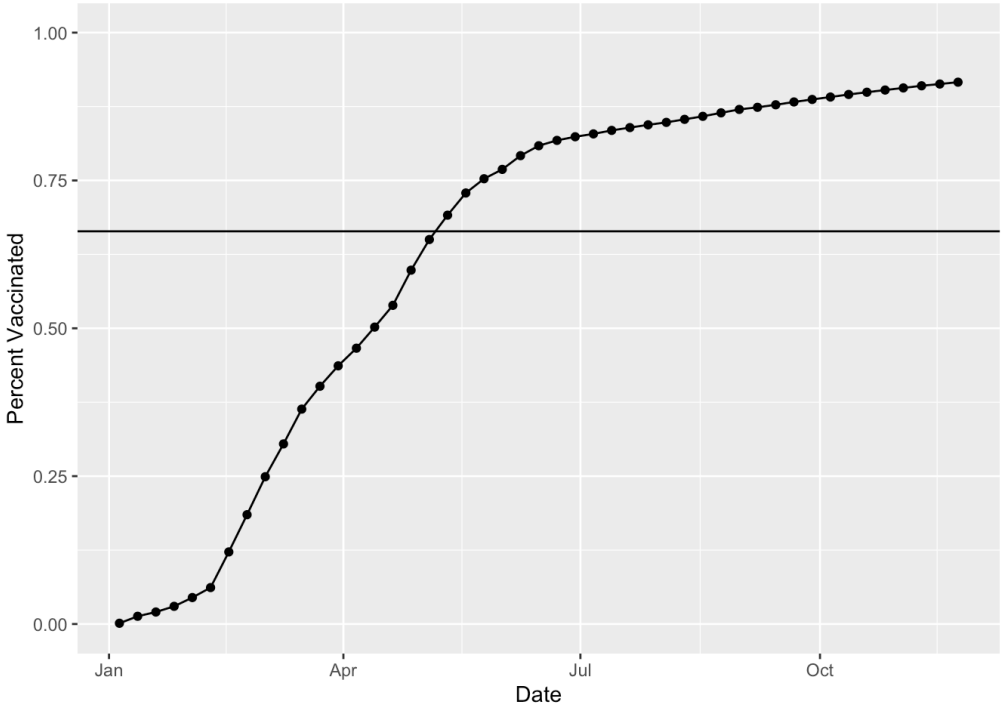
```
## [1] 0.6640413
```

Let’s make a new plot:

```
ucsd$as_of_date
```

```
##  [1] "2021-01-05" "2021-01-12" "2021-01-19" "2021-01-26" "2021-02-02"
##  [6] "2021-02-09" "2021-02-16" "2021-02-23" "2021-03-02" "2021-03-09"
## [11] "2021-03-16" "2021-03-23" "2021-03-30" "2021-04-06" "2021-04-13"
## [16] "2021-04-20" "2021-04-27" "2021-05-04" "2021-05-11" "2021-05-18"
## [21] "2021-05-25" "2021-06-01" "2021-06-08" "2021-06-15" "2021-06-22"
## [26] "2021-06-29" "2021-07-06" "2021-07-13" "2021-07-20" "2021-07-27"
## [31] "2021-08-03" "2021-08-10" "2021-08-17" "2021-08-24" "2021-08-31"
## [36] "2021-09-07" "2021-09-14" "2021-09-21" "2021-09-28" "2021-10-05"
## [41] "2021-10-12" "2021-10-19" "2021-10-26" "2021-11-02" "2021-11-09"
## [46] "2021-11-16" "2021-11-23"
```

```
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") +
  geom_hline(yintercept = 0.6640413)
```



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”?

```
dat <- summary(vax.36$percent_of_population_fully_vaccinated)
head(dat)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.3528910 0.5905170 0.6661630 0.6640413 0.7297545 1.0000000
```

Q18. Using `ggplot` , generate a histogram of this data.

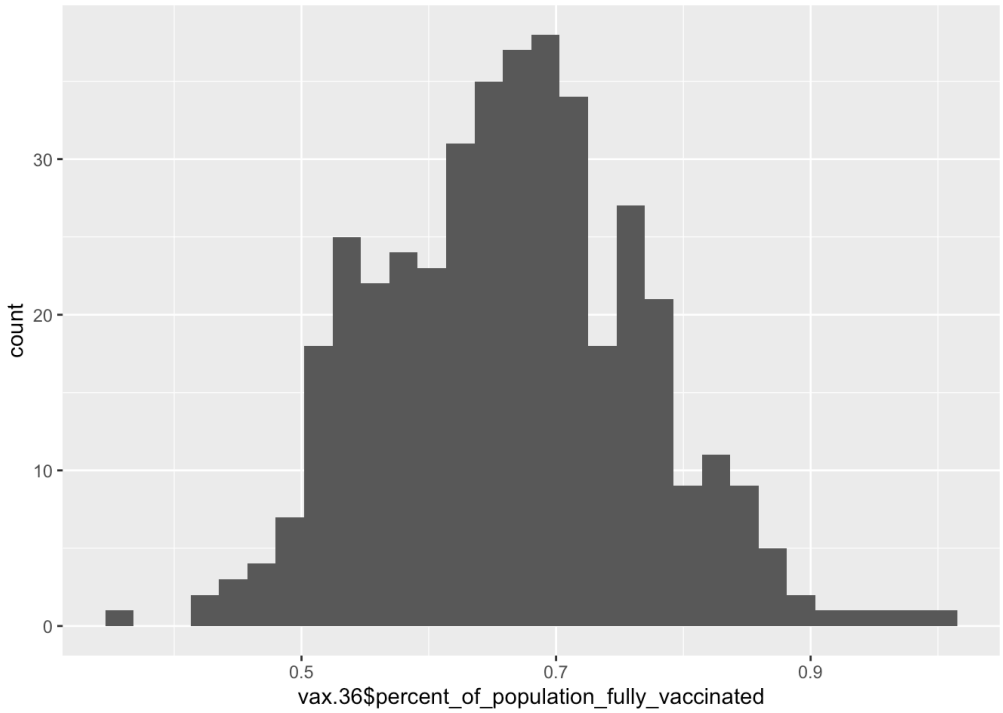
```
vax.36$percent_of_population_fully_vaccinated
```

```
##   [1] 0.638795 0.565116 0.675304 0.514911 0.542306 0.895969 0.610183 0.754831
##   [9] 0.671440 0.685062 0.571825 0.685009 0.789706 0.758088 0.758018 0.668217
##  [17] 0.533796 0.651510 0.687135 0.672017 0.705095 0.765967 0.544121 0.829537
##  [25] 0.637903 0.700493 0.613925 0.628329 0.642227 0.654824 0.631281 0.682419
##  [33] 0.819272 0.730465 0.573062 0.875929 0.659628 0.511820 0.706522 0.671575
##  [41] 0.709131 0.526173 0.721366 0.821927 0.556778 0.536308 0.512772 0.674613
##  [49] 0.690915 0.589145 0.661266 0.818517 0.703561 0.556520 0.756571 0.867086
##  [57] 0.556596 0.698836 0.636051 0.777597 0.625551 0.631382 0.716066 0.588702
##  [65] 0.539396 0.707375 0.718392 0.472181 0.528009 0.796706 0.644050 0.783687
##  [73] 0.631097 0.956078 0.753598 0.547531 0.597529 0.480697 0.618461 0.688234
##  [81] 0.610172 0.881642 0.836037 0.649573 0.565566 0.532163 0.795321 0.687544
##  [89] 0.671494 0.542527 0.548829 0.573898 0.687350 0.878852 0.666937 0.841436
##  [97] 0.637505 0.562748 0.677776 0.700007 0.572831 0.606870 0.553326 0.714489
## [105] 0.537228 0.750175 0.563423 0.745997 0.643037 0.749612 0.623749 0.680768
## [113] 0.767511 0.521701 0.522434 0.682254 0.523732 0.583474 0.653602 0.741917
## [121] 0.764800 0.855271 0.721193 0.701577 0.500653 0.433647 0.688582 0.631672
## [129] 0.662798 0.576452 0.601809 0.542173 0.619857 0.685675 0.716349 0.637176
## [137] 0.667082 0.780244 0.541241 0.741907 0.517657 0.685097 0.670161 0.707103
## [145] 0.767342 0.733755 0.638490 0.716598 0.759017 0.601673 0.702513 0.655895
## [153] 0.640323 0.768993 0.839498 0.684763 0.652456 0.517969 0.654527 0.654024
## [161] 0.530940 0.764964 0.742775 0.805337 0.651185 0.721270 0.614656 0.695125
## [169] 0.859553 0.728817 0.628313 0.670734 0.656297 0.764209 0.756293 0.948087
## [177] 0.690923 0.485393 0.574872 0.510786 0.610938 0.577006 0.549621 0.651296
## [185] 0.569071 0.788966 0.463319 0.623384 0.717695 0.784795 1.000000 0.658827
## [193] 0.574434 0.530863 0.654740 0.755299 0.586125 0.645119 0.436113 0.715121
## [201] 0.524522 0.657273 0.605903 0.665958 0.493331 0.771810 0.656647 0.526546
## [209] 0.603002 0.686999 0.476319 0.556440 0.668021 0.763976 0.632720 0.541915
## [217] 0.666057 0.714168 0.556318 0.743329 0.755339 0.811226 0.616480 0.813719
## [225] 0.595697 0.602320 0.653758 0.573314 0.758939 0.795904 0.620828 0.672871
## [233] 0.851894 0.584296 0.633778 0.521047 0.611774 0.784453 0.818396 0.557832
## [241] 0.549247 0.655007 0.776212 0.908691 0.842151 0.706651 0.522779 0.671247
## [249] 0.849087 0.661316 0.568585 0.552498 0.429913 0.741157 0.683580 0.518647
## [257] 0.778177 0.703912 0.530206 0.772152 0.584391 0.665908 0.820835 0.712352
## [265] 0.786689 0.704918 0.525192 0.591063 0.691787 0.775898 0.815766 0.634499
## [273] 0.686369 0.641569 0.620949 0.628331 0.749648 0.782176 0.674917 0.613536
## [281] 0.733390 0.662913 0.717260 0.708893 0.596023 0.703498 0.625933 0.750124
## [289] 0.634371 0.680762 0.669844 0.666881 0.702129 0.647831 0.844584 0.703221
## [297] 0.644819 0.602026 0.671617 0.778482 0.450352 0.696519 0.670376 0.566692
## [305] 0.666163 0.747186 0.504311 0.726094 0.798128 0.529317 0.742954 0.729044
## [313] 0.978329 0.695313 0.663354 0.603575 0.620572 0.632964 0.718851 0.611506
## [321] 0.564079 0.839156 0.821020 0.784338 0.789746 0.764371 0.546735 0.521949
## [329] 0.616061 0.667899 0.508542 0.781801 0.546277 0.628636 0.518007 0.786246
## [337] 0.676550 0.590092 0.707749 0.680295 0.590942 0.532132 0.747721 0.599918
## [345] 0.690365 0.352891 0.562106 0.468672 0.616078 0.541572 0.723034 0.591270
## [353] 0.727442 0.680905 0.653183 0.819011 0.692538 0.788603 0.454901 0.713177
## [361] 0.708313 0.489985 0.732898 0.640603 0.594066 0.619922 0.651024 0.860438
## [369] 0.671776 0.718488 0.496700 0.754363 0.589222 0.746015 0.668050 0.701483
## [377] 0.615606 0.609210 0.809691 0.544870 0.625113 0.610835 0.576914 0.694395
## [385] 0.763135 0.619944 0.649547 0.651101 0.613572 0.694361 0.839469 0.760372
## [393] 0.744376 0.680805 0.688630 0.604627 0.715254 0.524380 0.576548 0.668389
## [401] 0.818129 0.498205 0.544950 0.790066 0.524256 0.703243 0.708919 0.561631
## [409] 0.572598 0.692633 0.799640
```

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

```
## Warning: Use of `vax.36$percent_of_population_fully_vaccinated` is discouraged.
## Use `percent_of_population_fully_vaccinated` instead.
```

```
## `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                               0.521047
```

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

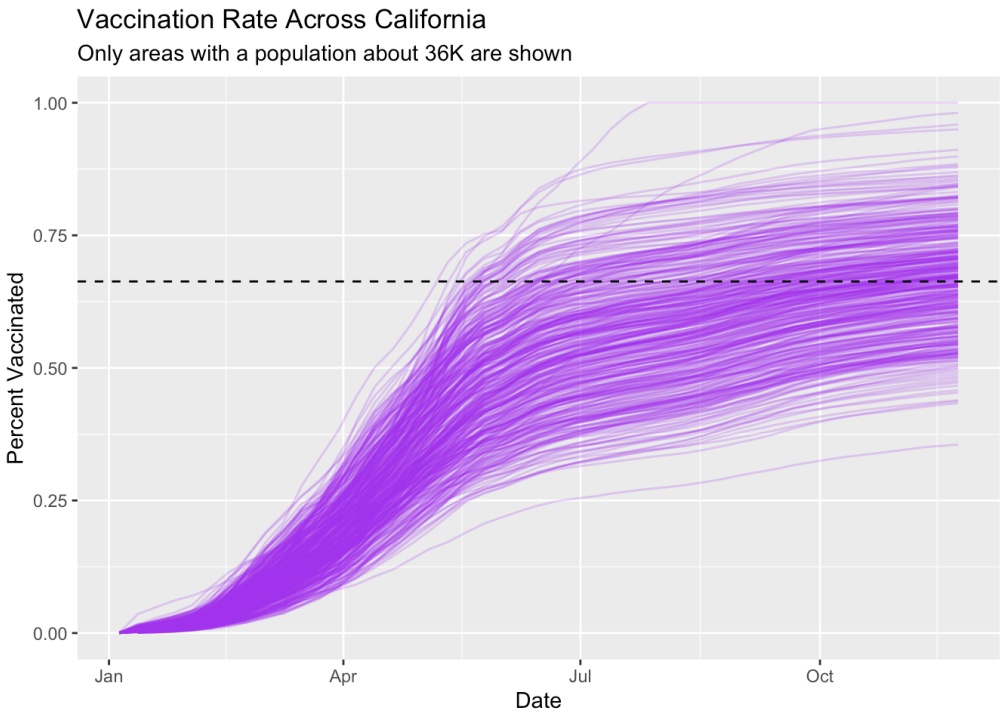
```
##   percent_of_population_fully_vaccinated
## 1                                0.68863
```

–> 92109 ZIP code = above, 92040 ZIP code = below

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

```
vax.36.all <- filter(vax, age5_plus_population > 36144)
ggplot(vax.36.all) +
  aes(as_of_date,
      percent_of_population_fully_vaccinated,
      group=zip_code_tabulation_area) +
  geom_line(alpha=0.2, color="purple") +
  ylim(c(0,1)) +
  labs(x="Date", y="Percent Vaccinated",
       title="Vaccination Rate Across California",
       subtitle="Only areas with a population about 36K are shown") +
  geom_hline(yintercept = 0.6629812, linetype = "dashed")
```

```
## Warning: Removed 176 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 missed our in-person class this week due to travel plans, but was able to work through the mini-project :)