Class 17 Mini project

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Class 17 Mini Project

Getting Started

```
# 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                    94579                   Alameda     Alameda
2 2021-01-05                    93726                    Fresno      Fresno
3 2021-01-05                    94305               Santa Clara Santa Clara
4 2021-01-05                    93704                    Fresno      Fresno
5 2021-01-05                    94403                 San Mateo   San Mateo
6 2021-01-05                    93668                    Fresno      Fresno
  vaccine_equity_metric_quartile                 vem_source
1                              3 Healthy Places Index Score
2                              1 Healthy Places Index Score
3                              4 Healthy Places Index Score
4                              1 Healthy Places Index Score
5                              4 Healthy Places Index Score
6                              1    CDPH-Derived ZCTA Score
  age12_plus_population age5_plus_population tot_population
1               19192.7                20872          21883
2               33707.7                39067          42824
3               15716.9                16015          16397
4               24803.5                27701          29740
5               37967.5                41530          44408
```

```
6                1013.4                 1199           1219
  persons_fully_vaccinated persons_partially_vaccinated
1                       NA                           NA
2                       NA                           NA
3                       NA                           NA
4                       NA                           NA
5                       NA                           NA
6                       NA                           NA
  percent_of_population_fully_vaccinated
1                                     NA
2                                     NA
3                                     NA
4                                     NA
5                                     NA
6                                     NA
  percent_of_population_partially_vaccinated
1                                         NA
2                                         NA
3                                         NA
4                                         NA
5                                         NA
6                                         NA
  percent_of_population_with_1_plus_dose booster_recip_count
1                                     NA                  NA
2                                     NA                  NA
3                                     NA                  NA
4                                     NA                  NA
5                                     NA                  NA
6                                     NA                  NA
  bivalent_dose_recip_count eligible_recipient_count
1                        NA                        4
2                        NA                        2
3                        NA                        8
4                        NA                        5
5                        NA                        7
6                        NA                        0
  eligible_bivalent_recipient_count
1                                 4
2                                 2
3                                 8
4                                 5
5                                 7
6                                 0
```

```
                                                               redacted
1 Information redacted in accordance with CA state privacy requirements
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?

The “persons_fully_vaccinated” column

Q2 What column details the Zip code tabulation area?

The “**zip_code_tabulation_area**” column.

Q3 What is the earliest date in this dataset?

```
min(vax$as_of_date)
```

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

Q4 What is the latest date in this dataset?

```
max(vax$as_of_date)
```

```
[1] "2023-05-23"
```

```
skimr::skim_without_charts(vax)
```

Table 1: Data summary

Name	vax
Number of rows	220500
Number of columns	19
Column type frequency:	
character	5
numeric	14
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	125	0
local_health_jurisdiction	0	1	0	15	625	62	0
county	0	1	0	15	625	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
zip_code_tabulation_area	0	1.00	93665.11	1817.38	90001	92257.75	93658.50	95380.50	97635.0
vaccine_equity_metric_quartile	10875	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0
age12_plus_population	0	1.00	18895.04	18993.87	0	1346.95	13685.10	31756.12	88556.7
age5_plus_population	0	1.00	20875.24	21105.97	0	1460.50	15364.00	34877.00	101902.0
tot_population	10750	0.95	23372.77	22628.50	12	2126.00	18714.00	38168.00	111165.0
persons_fully_vaccinated	17711	0.92	14272.72	15264.17	11	954.00	8990.00	23782.00	87724.0
persons_partially_vaccinated	17711	0.92	1711.05	2071.56	11	164.00	1203.00	2550.00	42259.0
percent_of_population_fully_vaccinated	22579	0.90	0.58	0.25	0	0.44	0.62	0.75	1.0
percent_of_population_partially_vaccinated	22579	0.90	0.08	0.09	0	0.05	0.06	0.08	1.0
percent_of_population_with_1_plus_dose	23732	0.89	0.64	0.24	0	0.50	0.68	0.82	1.0
booster_recip_count	74388	0.66	6373.43	7751.70	11	328.00	3097.00	10274.00	60022.0
bivalent_dose_recip_count	159956	0.27	3407.91	4010.38	11	222.00	1832.00	5482.00	29484.0
eligible_recipient_count	0	1.00	13120.40	15126.17	0	534.00	6663.00	22517.25	87437.0
eligible_bivalent_recipient_count	0	1.00	13016.51	15199.08	0	266.00	6562.00	22513.00	87437.0

Q5 How many numeric columns are in this dataset?

There are 14 numeric columns

Q6 Note that there are "missing values" in the dataset. How many `NA` values there in the `persons_fully_vaccinated` column?

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

```
[1] 17711
```

There are 17711 NA values

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] 8.0322
```

8.03 percent of `persons_fully_vaccinated` values are missing.

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

Working with dates

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

```

Attaching package: 'lubridate'

The following objects are masked from 'package:base':

    date, intersect, setdiff, union
```

What is today's date:

```
today()
```

```
[1] "2023-05-31"
```

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

How many days have passed since the first vaccination reported in this dataset?How many days have passed since the first vaccination reported in this dataset?

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

```
Time difference of 876 days
```

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

```r
today() - vax$as_of_date[220500]
```

```
Time difference of 8 days
```

There have been 8 days.

Q10 How many unique dates are in the dataset (i.e. how many different dates are detailed)?

```r
length(unique(vax$as_of_date))
```

```
[1] 125
```

There are 125 unique dates.

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.

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

```r
library(zipcodeR)
```

```
The legacy packages maptools, rgdal, and rgeos, underpinning this package
will retire shortly. Please refer to R-spatial evolution reports on
https://r-spatial.org/r/2023/05/15/evolution4.html for details.
This package is now running under evolution status 0
```

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

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

Calculate the distance between the centroids of any two ZIP codes in miles, e.g.

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

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

More usefully, we can pull census data about ZIP code areas (including median household income etc.). For example:

```
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
# i 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 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:

```
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
```

```r
 sd <- vax[ vax$county == "San Diego" , ]
```

```r
nrow(sd)
```

```
[1] 13375
```

Using **dplyr** the code would look like this:

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

nrow(sd)
```

```
[1] 13375
```

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.

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

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

```r
length(unique(sd$zip_code_tabulation_area))
```

```
[1] 107
```

There are 107 distinct zip codes.

Q12 What San Diego County Zip code area has the largest population in this dataset?

```
lapop<- filter(sd, age5_plus_population ==max(sd$age5_plus_population))
```

```
lapop$zip_code_tabulation_area
```

```
  [1] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [13] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [25] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [37] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [49] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [61] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [73] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [85] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
 [97] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
[109] 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154 92154
[121] 92154 92154 92154 92154 92154
```

```
#Base R
lapop<-sd[sd$age5_plus_population==max(sd$age5_plus_population),]
unique(lapop$zip_code_tabulation_area)
```

```
[1] 92154
```

code 92154 area has the largest population in this dataset.

Q13 What is the overall average (with 2 decimal numbers) "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2023-05-23"?

```
bb<-sd[sd$as_of_date=="2023-05-23",]
(mean(bb$percent_of_population_fully_vaccinated,na.rm=TRUE))*100
```

```
[1] 74.19654
```

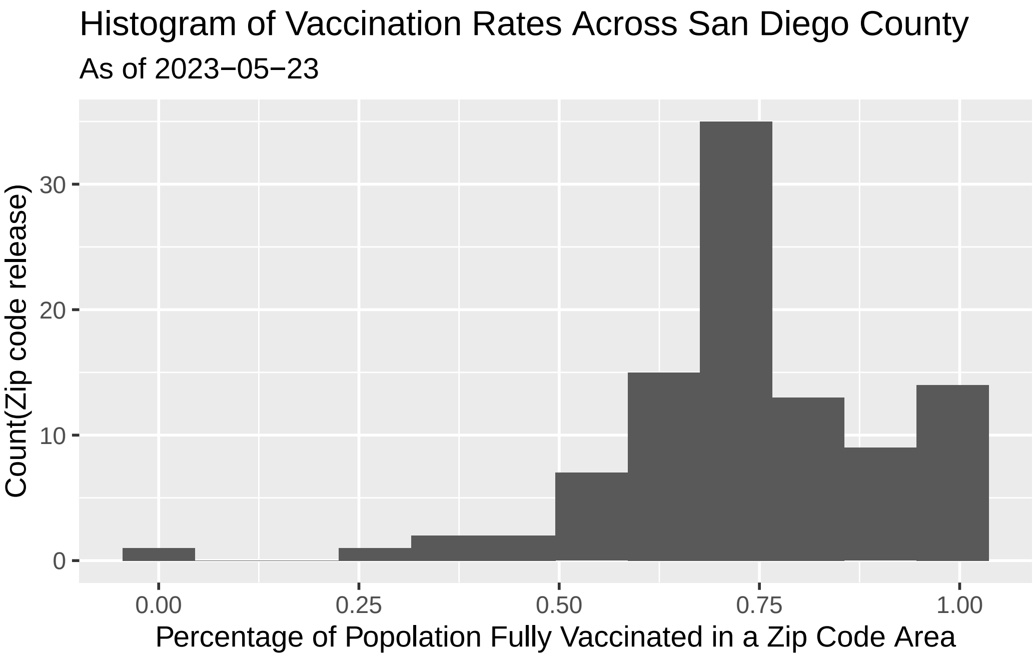
The value is 74%

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 "2023-05-23"?

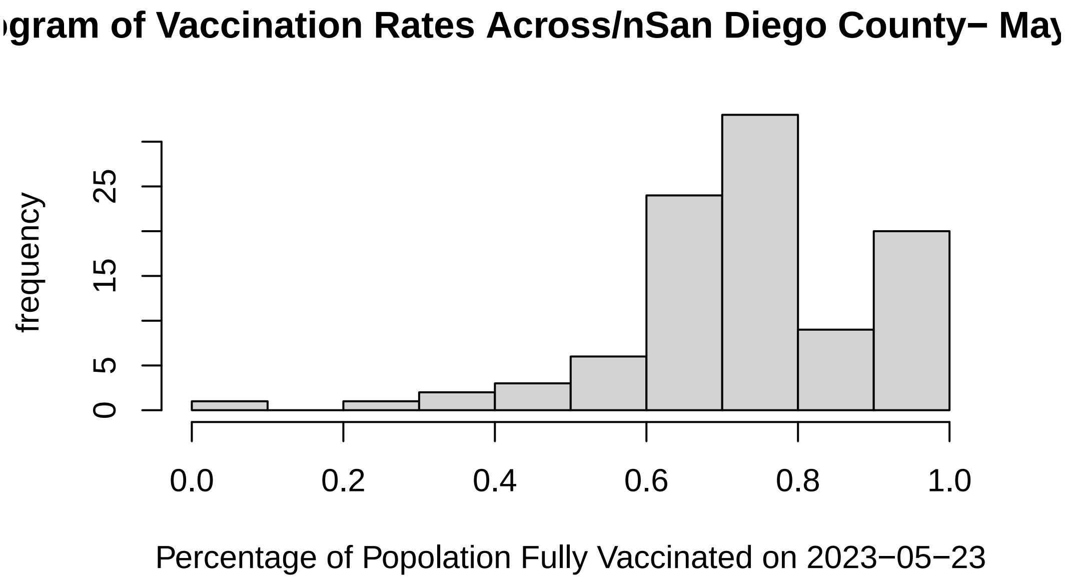
```
library(ggplot2)
```

```r
ggplot(bb,aes(bb$percent_of_population_fully_vaccinated))+
  geom_histogram(bins=12)+
  ggtitle("Histogram of Vaccination Rates Across San Diego County")+
  labs(subtitle="As of 2023-05-23",
       x="Percentage of Popolation Fully Vaccinated in a Zip Code Area",
       y="Count(Zip code release)")
```

```
Warning: Removed 8 rows containing non-finite values (`stat_bin()`).
```



```r
hist(bb$percent_of_population_fully_vaccinated,
     xlab="Percentage of Popolation Fully Vaccinated on 2023-05-23",
     ylab="frequency",
     main="Histogram of Vaccination Rates Across/nSan Diego County- May 23, 2023")
```



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:

```
plt_uscd_vaccination_rate<-ggplot(ucsd) +
  aes(ucsd$as_of_date,
      ucsd$percent_of_population_fully_vaccinated) +
  geom_point() +
  geom_line(group=1) +
  ylim(c(0,1)) +
  labs(title="Vaccination rate for La Jolla CA 92037", x="Date", y="Percent Vaccinated")
```

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* "2023-05-23".

```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                as_of_date == "2023-05-23")

#head(vax.36)
```

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* "2023-05-23". Add this as a straight horizontal line to your plot from above with the `geom_hline()` function

```
meanppop<- mean(vax.36$percent_of_population_fully_vaccinated)
```

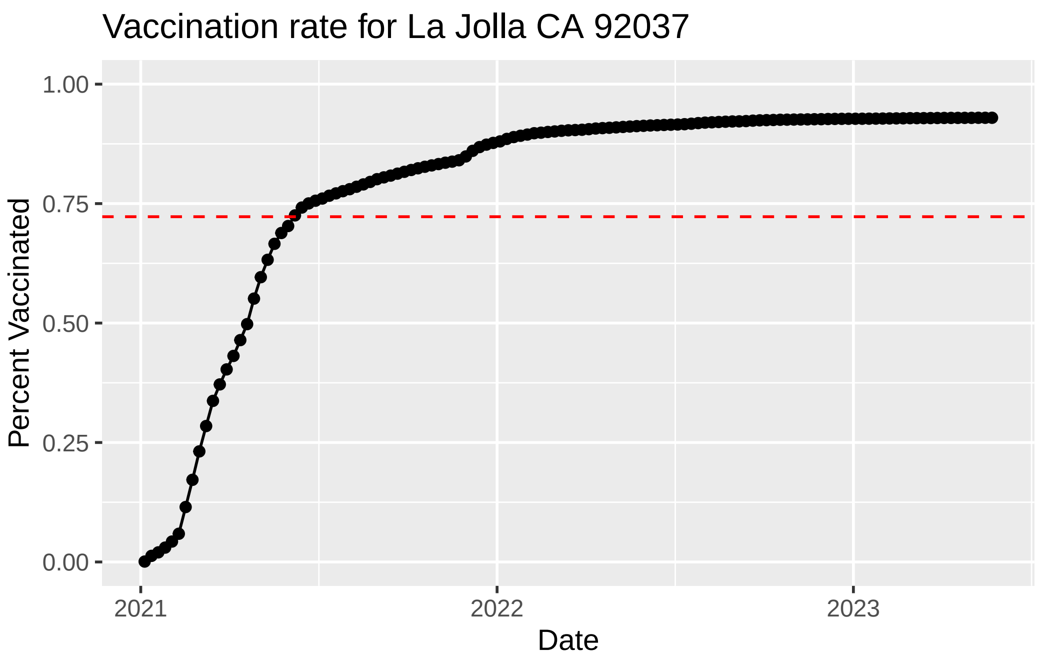
```
plt_uscd_vaccination_rate+
  geom_hline(yintercept=meanppop,color="red",linetype="dashed")
```

```
Warning: Use of `ucsd$as_of_date` is discouraged.
i Use `as_of_date` instead.

Warning: Use of `ucsd$percent_of_population_fully_vaccinated` is discouraged.
i Use `percent_of_population_fully_vaccinated` instead.

Warning: Use of `ucsd$as_of_date` is discouraged.
i Use `as_of_date` instead.

Warning: Use of `ucsd$percent_of_population_fully_vaccinated` is discouraged.
i Use `percent_of_population_fully_vaccinated` instead.
```



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* "2023-05-23"?

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

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
 0.3816  0.6469  0.7207  0.7226  0.7924  1.0000 
```

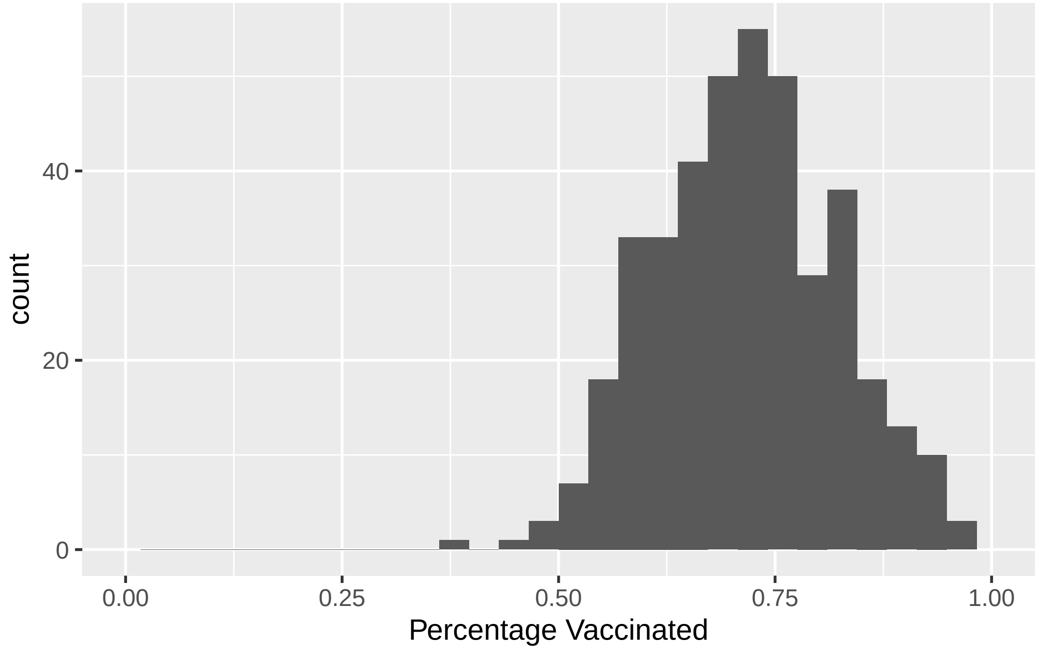
Q18. Using ggplot generate a histogram of this data

```
ggplot(vax.36)+
  aes(vax.36$percent_of_population_fully_vaccinated,na.rm=TRUE)+
  geom_histogram()+
  xlim(0,1)+
  labs(x="Percentage Vaccinated")
```

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

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

```
Warning: Removed 2 rows containing missing values (`geom_bar()`).
```



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 == "2023-05-23") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)
```

```
  percent_of_population_fully_vaccinated
1                               0.552434
```

Area 92049 is lower than average.

```
vax %>% filter(as_of_date == "2023-05-23") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)
```

```
  percent_of_population_fully_vaccinated
1                                0.69487
```

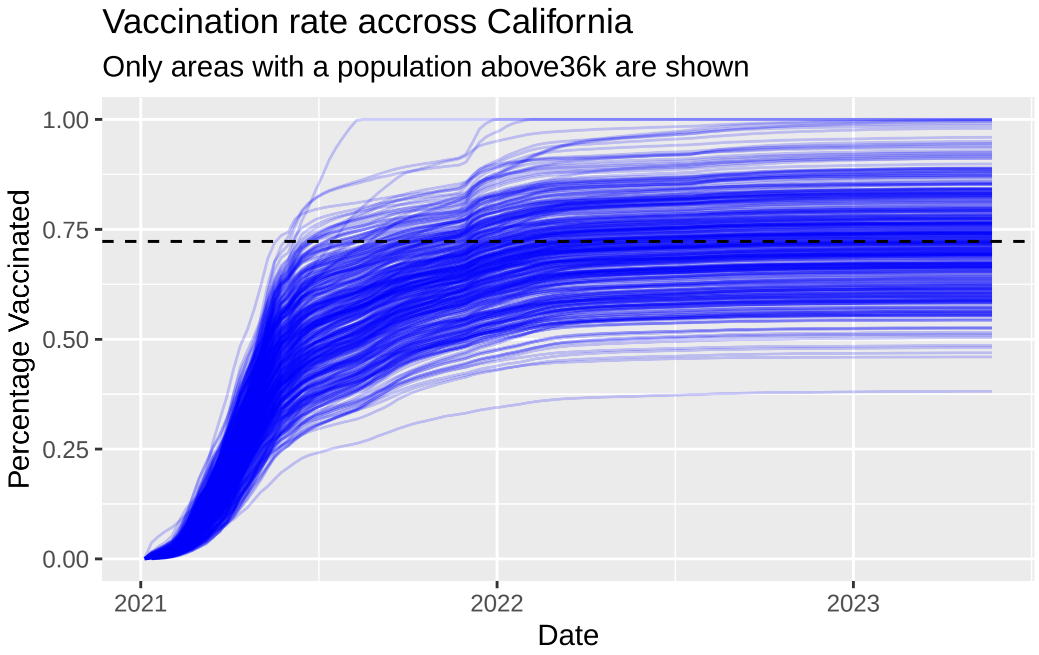
Area 92109 is lower than average

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="blue") +
  ylim(0,1) +
  labs(x="Date", y="Percentage Vaccinated",
       title="Vaccination rate accross California",
       subtitle="Only areas with a population above36k are shown") +
  geom_hline(yintercept =meanppop, linetype="dashed")
```

```
Warning: Removed 185 rows containing missing values (`geom_line()`).
```



About this document

```r
sessionInfo()
```

```
R version 4.2.3 (2023-03-15)
Platform: x86_64-apple-darwin17.0 (64-bit)
Running under: macOS Big Sur ... 10.16

Matrix products: default
BLAS:   /Library/Frameworks/R.framework/Versions/4.2/Resources/lib/libRblas.0.dylib
LAPACK: /Library/Frameworks/R.framework/Versions/4.2/Resources/lib/libRlapack.dylib

locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
[1] ggplot2_3.4.2   dplyr_1.1.2     zipcodeR_0.3.5  lubridate_1.9.2

loaded via a namespace (and not attached):
 [1] Rcpp_1.0.10        lattice_0.21-8     tidyr_1.3.0        class_7.3-22
 [5] digest_0.6.31      utf8_1.2.3         R6_2.5.1           repr_1.1.6
 [9] RSQLite_2.3.1      evaluate_0.21      e1071_1.7-13       httr_1.4.6
[13] pillar_1.9.0       rlang_1.1.1        curl_5.0.0         uuid_1.1-0
[17] rstudioapi_0.14    raster_3.6-20      blob_1.2.4         rmarkdown_2.21
[21] labeling_0.4.2     readr_2.1.4        stringr_1.5.0      munsell_0.5.0
[25] bit_4.0.5          proxy_0.4-27       compiler_4.2.3     xfun_0.39
[29] pkgconfig_2.0.3    tigris_2.0.3       base64enc_0.1-3    htmltools_0.5.5
[33] tidyselect_1.2.0   tibble_3.2.1       codetools_0.2-19   fansi_1.0.4
[37] crayon_1.5.2       tzdb_0.4.0         withr_2.5.0        sf_1.0-13
[41] tidycensus_1.4     rappdirs_0.3.3     grid_4.2.3         gtable_0.3.3
[45] jsonlite_1.8.4     lifecycle_1.0.3    DBI_1.1.3          magrittr_2.0.3
[49] scales_1.2.1       units_0.8-2        KernSmooth_2.23-21 cli_3.6.1
[53] stringi_1.7.12     cachem_1.0.8       farver_2.1.1       sp_1.6-1
[57] skimr_2.1.5        xml2_1.3.4         generics_0.1.3     vctrs_0.6.2
[61] tools_4.2.3        bit64_4.0.5        glue_1.6.2         purrr_1.0.1
[65] hms_1.1.3          fastmap_1.1.1      yaml_2.3.7         colorspace_2.1-0
[69] timechange_0.2.0   terra_1.7-29       classInt_0.4-9     rvest_1.0.3
[73] memoise_2.0.1      knitr_1.42
```