Class 14 Vaccination Rate Mini Project

Cindy Tran

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Getting Started

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

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction         co
unty
## 1 2021-01-05                    94129             San Francisco  San Franc
isco
## 2 2021-01-05                    92562                 Riverside      River
side
## 3 2021-01-05                    92805                    Orange         Or
ange
## 4 2021-01-05                    92322            San Bernardino San Bernar
dino
## 5 2021-01-05                    94972                    Sonoma         So
noma
## 6 2021-01-05                    94107             San Francisco  San Franc
isco
##   vaccine_equity_metric_quartile                 vem_source
## 1                              4 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                              1 Healthy Places Index Score
## 4                             NA            No VEM Assigned
## 5                             NA            No VEM Assigned
## 6                              4 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1                3574.3                 3900                       NA
## 2               53431.1                60184                       12
## 3               61414.4                69071                       25
## 4                 581.0                  632                       NA
## 5                  25.0                   25                       NA
## 6               28946.1                30103                       12
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                          868                               0.000199
## 3                          977                               0.000362
## 4                           NA                                     NA
## 5                           NA                                     NA
## 6                          836                               0.000399
```

```
##   percent_of_population_partially_vaccinated
## 1                                         NA
## 2                                   0.014422
## 3                                   0.014145
## 4                                         NA
## 5                                         NA
## 6                                   0.027771
##   percent_of_population_with_1_plus_dose booster_recip_count
## 1                                     NA                  NA
## 2                               0.014621                  NA
## 3                               0.014507                  NA
## 4                                     NA                  NA
## 5                                     NA                  NA
## 6                               0.028170                  NA
##                                                                  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?

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?

2022-02-08

```
#install.packages("skimr")
library(skimr)
skimr::skim(vax)
```

Data summary

Name	vax
Number of rows	102312
Number of columns	15
_____	
Column type frequency:	
character	5

numeric	10
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	58	0
local_health_jurisdiction	0	1	0	15	290	62	0
county	0	1	0	15	290	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	9000 1	92257.75	93658.50	95380.50	97635.0	
vaccine_equity_metric_quartile	5046	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.92	0	1346.95	13685.10	31756.12	88556.7	
age5_plus_population	0	1.00	20875.24	21106.02	0	1460.50	15364.00	34877.00	101902.0	
persons_fully_vaccinated	9640	0.91	10890.58	12771.81	11	623.00	5313.00	18338.00	85970.0	
persons_partially_vaccinated	9640	0.91	1845.39	2062.93	11	189.00	1251.00	2790.00	29153.0	
percent_of_population_fully_vaccinated	9640	0.91	0.48	0.27	0	0.27	0.51	0.69	1.0	
percent_of_population_partially_vaccinated	9640	0.91	0.09	0.11	0	0.06	0.07	0.10	1.0	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
percent_of_population_with_1_plus_dose	9640	0.91	0.56	0.27	0	0.37	0.59	0.76	1.0	▅▃▅▇▆▅
booster_recip_count	63642	0.38	3516.20	5246.71	11	150.00	908.00	5069.75	48283.0	▇▂▁▁▁▁▁

Q5. How many numeric columns are in this dataset?

15

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] 9640
```

9640

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

```
9640 / (sum(!is.na(vax$persons_fully_vaccinated))) * 100

## [1] 10.40228
```

10%

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

This data is posisbly missing because some counties did not have collect this information.

Working with Dates

```
library(lubridate)

##
## Attaching package: 'lubridate'

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

today()

## [1] "2022-02-14"

# 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 405 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 399 days
```

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

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

## Time difference of 6 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] 58
```

Working with ZIP Codes

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

Find the centroid of the La Jolla 92037 (i.e. UC San Diego) ZIP code area.

```
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

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

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

We can pull census data about ZIP code areas (including median household income etc.

```
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>
```

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

Focus on the San Diego Area

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

```
## [1] 6206
```

```
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] 6206
```

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)
```

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] 56

sd[56,]

##    as_of_date zip_code_tabulation_area local_health_jurisdiction    county
## 56 2021-01-05                    92154                 San Diego San Diego
##    vaccine_equity_metric_quartile                 vem_source
## 56                              2 Healthy Places Index Score
##    age12_plus_population age5_plus_population persons_fully_vaccinated
## 56               76365.2                82971                       33
##    persons_partially_vaccinated percent_of_population_fully_vaccinated
## 56                         1357                                0.000398
##    percent_of_population_partially_vaccinated
## 56                                   0.016355
##    percent_of_population_with_1_plus_dose booster_recip_count
## 56                              0.016753                  NA
##                                                                   redacted
## 56 Information redacted in accordance with CA state privacy requirements
```

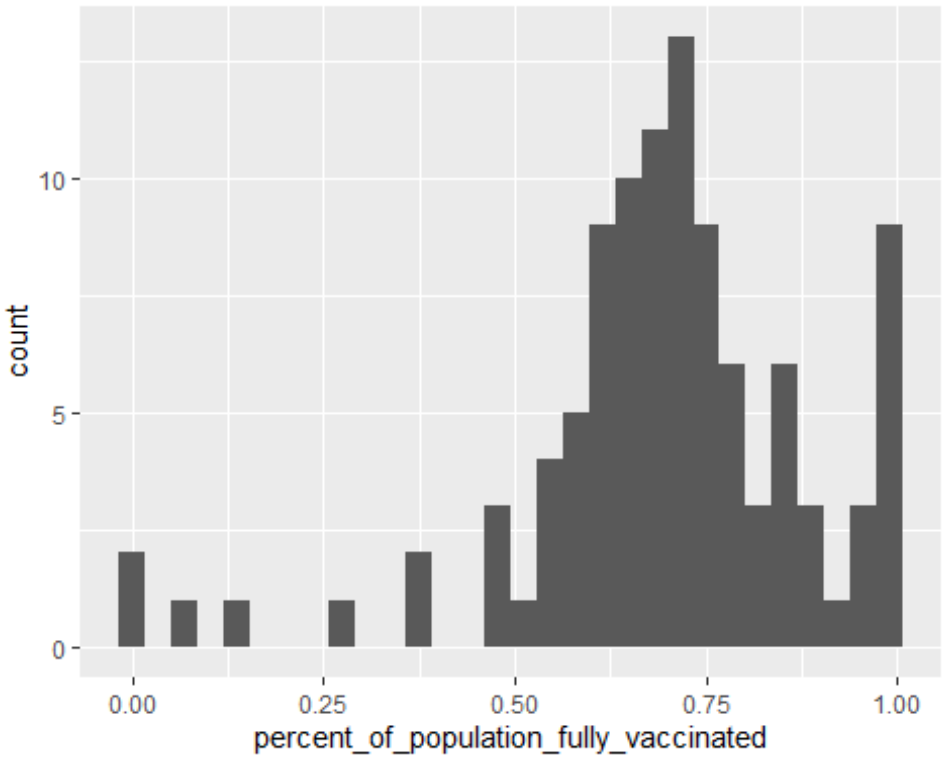
92154

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

```
q13 <- filter (sd, as_of_date == "2021-11-09")
mean(q13$percent_of_population_fully_vaccinated, na.rm = TRUE)

## [1] 0.6961169
```

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"?

```
library(ggplot2)
ggplot(q13) +
  aes(x = percent_of_population_fully_vaccinated) +
  geom_histogram()

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

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

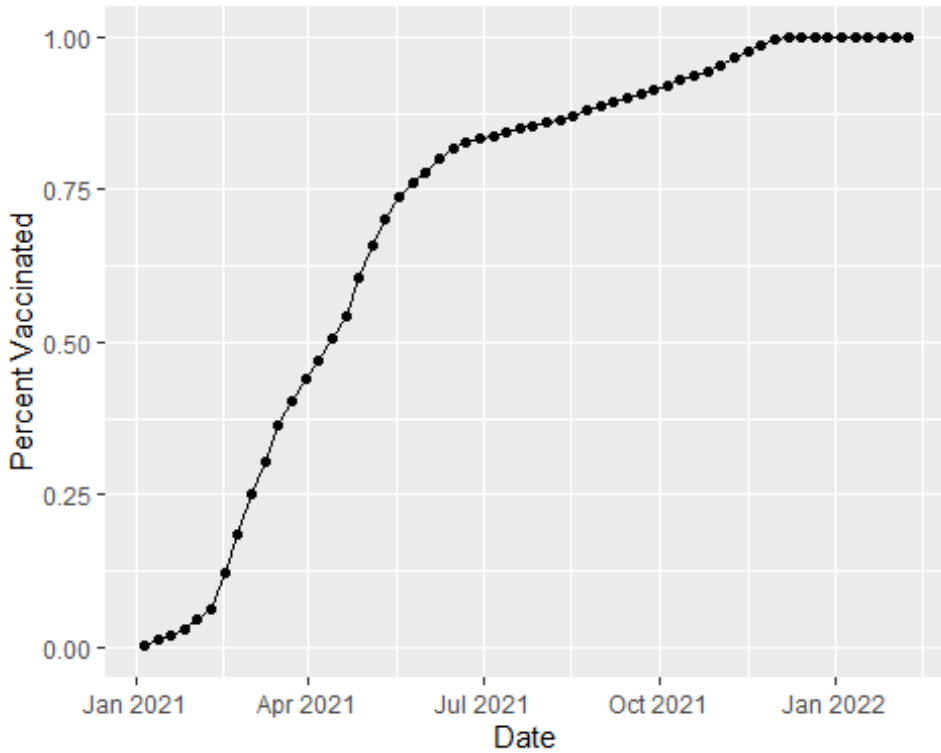


Focus on UCSD/La Jolla

```
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 SImilarly Sized Areas

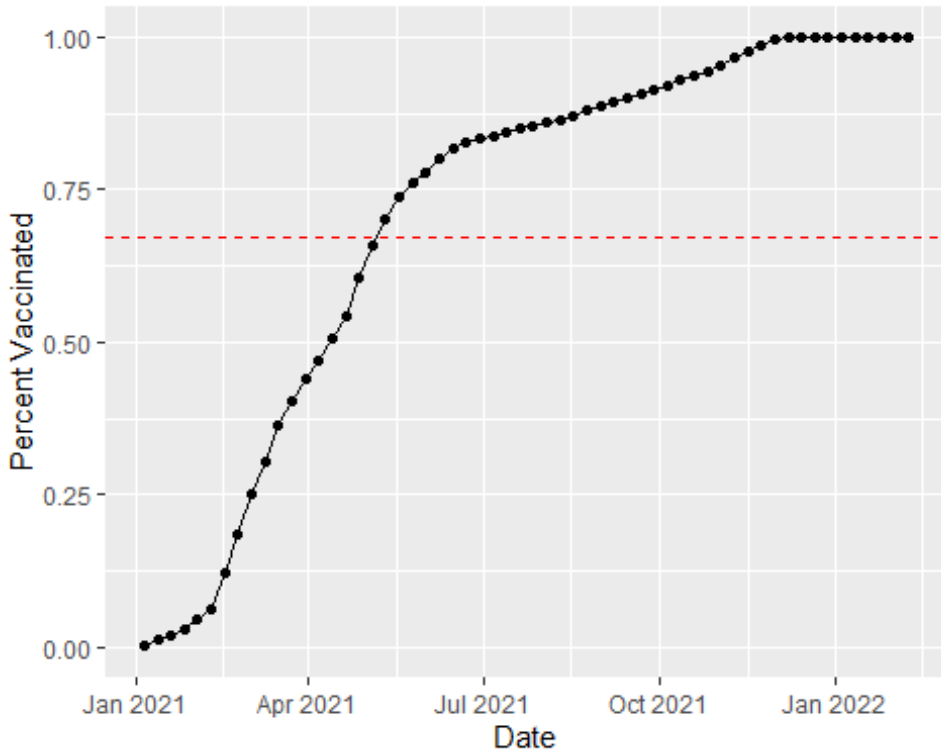
```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2021-11-16")

head(vax.36)
```

```
##   as_of_date zip_code_tabulation_area local_health_jurisdiction      count
y
## 1 2021-11-16                    93063                   Ventura     Ventur
a
## 2 2021-11-16                    92591                 Riverside   Riversid
e
## 3 2021-11-16                    91745               Los Angeles Los Angele
s
## 4 2021-11-16                    93311                      Kern        Ker
n
## 5 2021-11-16                    95240               San Joaquin San Joaqui
n
## 6 2021-11-16                    92505                 Riverside   Riversid
e
##   vaccine_equity_metric_quartile                vem_source
## 1                              4 Healthy Places Index Score
## 2                              3 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              3 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               49342.3                53192                     35688
## 2               34147.8                38439                     21584
## 3               48344.2                52318                     39646
## 4               37656.8                42439                     30104
## 5               39228.8                44646                     24225
## 6               44919.3                50178                     27181
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                         2933                                0.670928
## 2                         2516                                0.561513
## 3                         3265                                0.757789
## 4                         3286                                0.709348
## 5                         4228                                0.542602
## 6                         2947                                0.541692
##   percent_of_population_partially_vaccinated
## 1                                   0.055140
## 2                                   0.065454
## 3                                   0.062407
## 4                                   0.077429
## 5                                   0.094701
## 6                                   0.058731
##   percent_of_population_with_1_plus_dose booster_recip_count redacted
## 1                               0.726068                7001       No
## 2                               0.626967                3487       No
## 3                               0.820196                8195       No
## 4                               0.786777                5635       No
## 5                               0.637303                3069       No
## 6                               0.600423                3271       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, na.rm = TRUE)

## [1] 0.6716873

ggplot(ucsd) +
  aes(as_of_date, percent_of_population_fully_vaccinated) +
  geom_hline(yintercept = 0.6716873, linetype = "dashed", color = "red") +
  geom_point() +
  geom_line(group=1) +
  ylim(c(0,1)) +
  labs(x="Date", y="Percent Vaccinated")
```

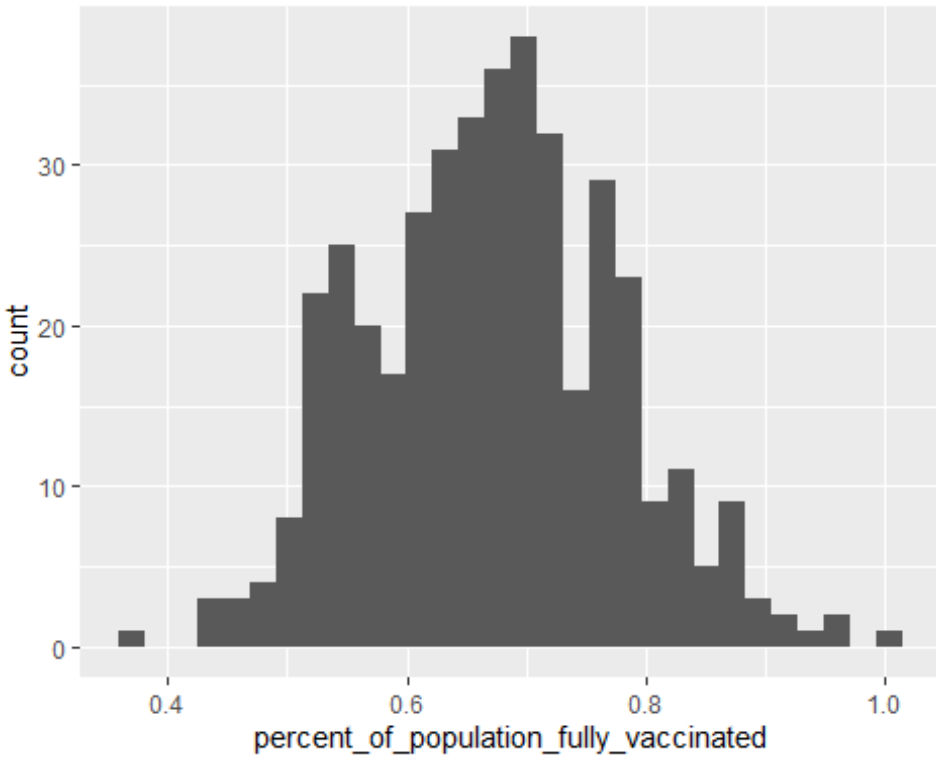


Q17. What is the 6 number summary (Min, 1st Qu., Median, Mean, 3rd Qu., and Max) of the "Percent of Population Fully Vaccinated" values for ZIP code areas with a population as large as 92037 (La Jolla) as_of_date "2021-11-16"?

```
summary(vax.36$percent_of_population_fully_vaccinated)

##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.3675  0.5992  0.6738  0.6717  0.7408  1.0000
```

Q18. Using ggplot generate a histogram of this data.

```
ggplot(vax.36) +
  aes(x = 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=="92109") %>%
  select(percent_of_population_fully_vaccinated)

##   percent_of_population_fully_vaccinated
## 1                               0.717349

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                               0.535312
```

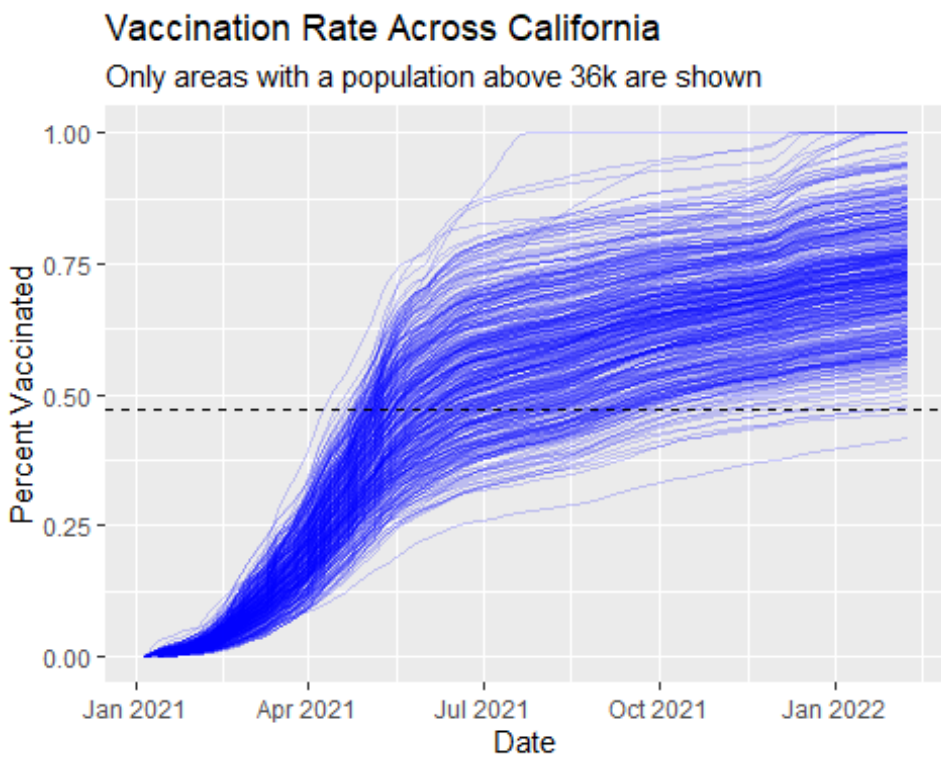
92109 is above the average while 92040 is below the average.

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)

mean(vax.36.all$percent_of_population_fully_vaccinated, na.rm = TRUE)

## [1] 0.472364
```

```
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="Percent Vaccinated",
       title="Vaccination Rate Across California",
       subtitle="Only areas with a population above 36k are shown") +
  geom_hline(yintercept = 0.472364, linetype="dashed")
```

```
## Warning: Removed 174 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 feel a bit uncomfortable going to in person classes, but am okay with going if necessary.

```
sessionInfo()
```

```
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 10 x64 (build 19043)
##
## Matrix products: default
##
## locale:
## [1] LC_COLLATE=English_United States.1252
```

```
## [2] LC_CTYPE=English_United States.1252
## [3] LC_MONETARY=English_United States.1252
## [4] LC_NUMERIC=C
## [5] LC_TIME=English_United States.1252
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
## [1] ggplot2_3.3.5   dplyr_1.0.7     zipcodeR_0.3.3  lubridate_1.8.0
## [5] skimr_2.1.3
##
## loaded via a namespace (and not attached):
##  [1] httr_1.4.2         tidyr_1.2.0        bit64_4.0.5        jsonlite_1.7
.3
##  [5] assertthat_0.2.1   sp_1.4-6           highr_0.9          blob_1.2.2
##  [9] yaml_2.2.1         tidycensus_1.1     pillar_1.7.0       RSQLite_2.2.
9
## [13] lattice_0.20-45    glue_1.6.0         uuid_1.0-3         digest_0.6.2
7
## [17] rvest_1.0.2        colorspace_2.0-2   htmltools_0.5.1.1  pkgconfig_2.
0.3
## [21] raster_3.5-15      purrr_0.3.4        scales_1.1.1       terra_1.5-17
## [25] tzdb_0.2.0         tigris_1.5.1       tibble_3.1.6       proxy_0.4-26
## [29] farver_2.1.0       generics_0.1.2     ellipsis_0.3.2     withr_2.4.3
## [33] cachem_1.0.6       repr_1.1.4         cli_3.1.1          magrittr_2.0
.1
## [37] crayon_1.4.2       memoise_2.0.1      maptools_1.1-2     evaluate_0.1
4
## [41] fansi_1.0.2        xml2_1.3.3         foreign_0.8-82     class_7.3-20
## [45] tools_4.1.2        hms_1.1.1          lifecycle_1.0.1    stringr_1.4.
0
## [49] munsell_0.5.0      compiler_4.1.2     e1071_1.7-9        rlang_0.4.11
## [53] classInt_0.4-3     units_0.8-0        grid_4.1.2         rstudioapi_0
.13
## [57] rappdirs_0.3.3     labeling_0.4.2     base64enc_0.1-3    rmarkdown_2.
11
## [61] gtable_0.3.0       codetools_0.2-18   DBI_1.1.2          curl_4.3.2
## [65] R6_2.5.1           knitr_1.37         rgdal_1.5-28       fastmap_1.1.
0
## [69] bit_4.0.4          utf8_1.2.2         KernSmooth_2.23-20 readr_2.1.2
## [73] stringi_1.7.6      Rcpp_1.0.8         vctrs_0.3.8        sf_1.0-6
## [77] tidyselect_1.1.1   xfun_0.29
```