Vaccination rate mini project

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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         county
## 1 2021-01-05                   92549                 Riverside      Riverside
## 2 2021-01-05                   92130                 San Diego      San Diego
## 3 2021-01-05                   92397           San Bernardino San Bernardino
## 4 2021-01-05                   94563             Contra Costa   Contra Costa
## 5 2021-01-05                   94519             Contra Costa   Contra Costa
## 6 2021-01-05                   91042              Los Angeles    Los Angeles
##   vaccine_equity_metric_quartile               vem_source
## 1                              3 Healthy Places Index Score
## 2                              4 Healthy Places Index Score
## 3                              3 Healthy Places Index Score
## 4                              4 Healthy Places Index Score
## 5                              3 Healthy Places Index Score
## 6                              2 Healthy Places Index Score
##   age12_plus_population age5_plus_population persons_fully_vaccinated
## 1                2348.4                 2461                       NA
## 2               46300.3                53102                       61
## 3                3695.6                 4225                       NA
## 4               17216.1                18896                       NA
## 5               16861.2                18678                       NA
## 6               23962.2                25741                       NA
##   persons_partially_vaccinated percent_of_population_fully_vaccinated
## 1                           NA                                     NA
## 2                           27                                0.001149
## 3                           NA                                     NA
## 4                           NA                                     NA
## 5                           NA                                     NA
## 6                           NA                                     NA
##   percent_of_population_partially_vaccinated
## 1                                         NA
## 2                                   0.000508
## 3                                         NA
## 4                                         NA
## 5                                         NA
```

```
## 6                                          NA
##   percent_of_population_with_1_plus_dose booster_recip_count
## 1                                     NA                  NA
## 2                                0.001657                 NA
## 3                                     NA                  NA
## 4                                     NA                  NA
## 5                                     NA                  NA
## 6                                     NA                  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? 2022-03-01

```
# As we have done previously, let's call the skim() function from the skimr package to get a quick over

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

Table 1: Data summary

Name	vax
Number of rows	107604
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	61	0
local_health_jurisdiction	0	1	0	15	305	62	0
county	0	1	0	15	305	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	1307	0.95	2.44	1.11	1	1.00	2.00	3.00	4.0	
age12_plus_population	0	1.00	18895.04	18993.91	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	18338	0.83	12155.61	13063.88	11	1066.25	7374.50	20005.00	77744.0	
persons_partially_vaccinated	18338	0.83	831.74	1348.68	11	76.00	372.00	1076.00	34219.0	
percent_of_population_fully_vaccinated	18338	0.83	0.51	0.26	0	0.33	0.54	0.70	1.0	
percent_of_population_partially_vaccinated	18338	0.83	0.05	0.09	0	0.01	0.03	0.05	1.0	
percent_of_population_with_12_plus_dose	18338	0.83	0.54	0.28	0	0.36	0.58	0.75	1.0	
booster_recip_count	64317	0.40	4100.55	5900.21	11	176.00	1136.00	6154.50	50602.0	

Q5. How many numeric columns are in this dataset? 10

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] 18338
```

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

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

```
## [1] 17.04
```

Working with dates

```
library(lubridate)
```

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

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

```
today()
```

```
## [1] "2022-03-06"
```

```
# 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 rep

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

```
## Time difference of 425 days
```

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

```
# 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 420 days
```

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

```
unique.dates <- (unique(vax$as_of_date))
num.unique.dates <- length(unique.dates)
num.unique.dates
```

```
## [1] 61
```

Working with ZIP codes

```
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
```

```
# 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", ]
```

```
# Using dplyr the code would look like this

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] 6527
```

```
# subsetting across multiple criteria - for example all San Diego county areas with a population of ove

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(vax$zip_code_tabulation_area))
```

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

Q12. What San Diego County Zip code area has the largest 12 + Population in this dataset?

```
largest_plus12_population <- which.max(vax$age12_plus_population)
vax$zip_code_tabulation_area[largest_plus12_population]
```

```
## [1] 91331
```

Q13. What is the overall average "Percent of Population Fully Vaccinated" value for all San Diego "County" as of "2022-02-22"?

```
sd_20220222 <- filter(vax, county == "San Diego" & as_of_date == "2022-02-22")
round(mean(na.omit(sd_20220222$percent_of_population_fully_vaccinated))*100,2)
```

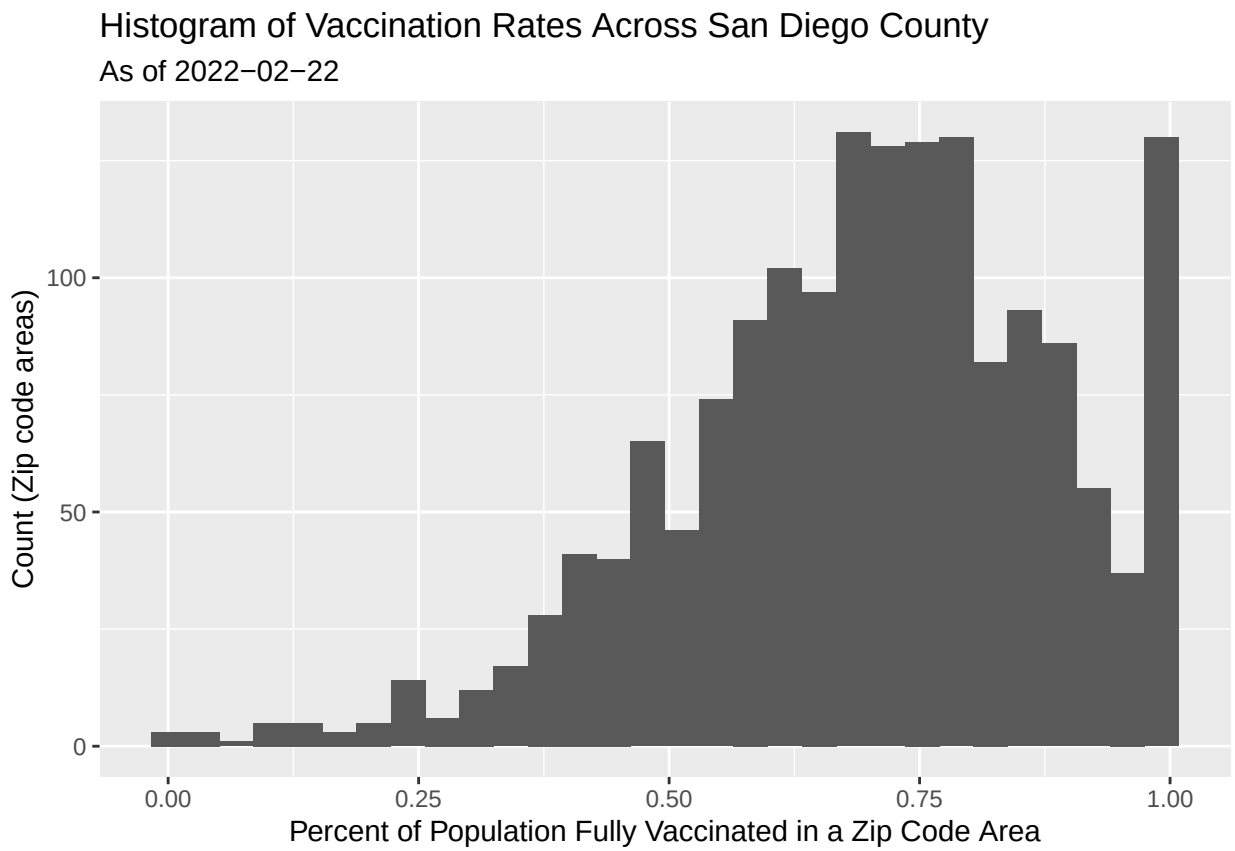
```
## [1] 70.42
```

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 "2022-02-22"?

```
pfv_20220222 <- filter(vax, as_of_date == "2022-02-22")
library(ggplot2)
ggplot(pfv_20220222, aes(percent_of_population_fully_vaccinated)) +
  geom_histogram() +
  labs(x="Percent of Population Fully Vaccinated in a Zip Code Area", y="Count (Zip code areas)", title
```

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

```
## Warning: Removed 105 rows containing non-finite values (stat_bin).
```



Focus on UCSD/La Jolla

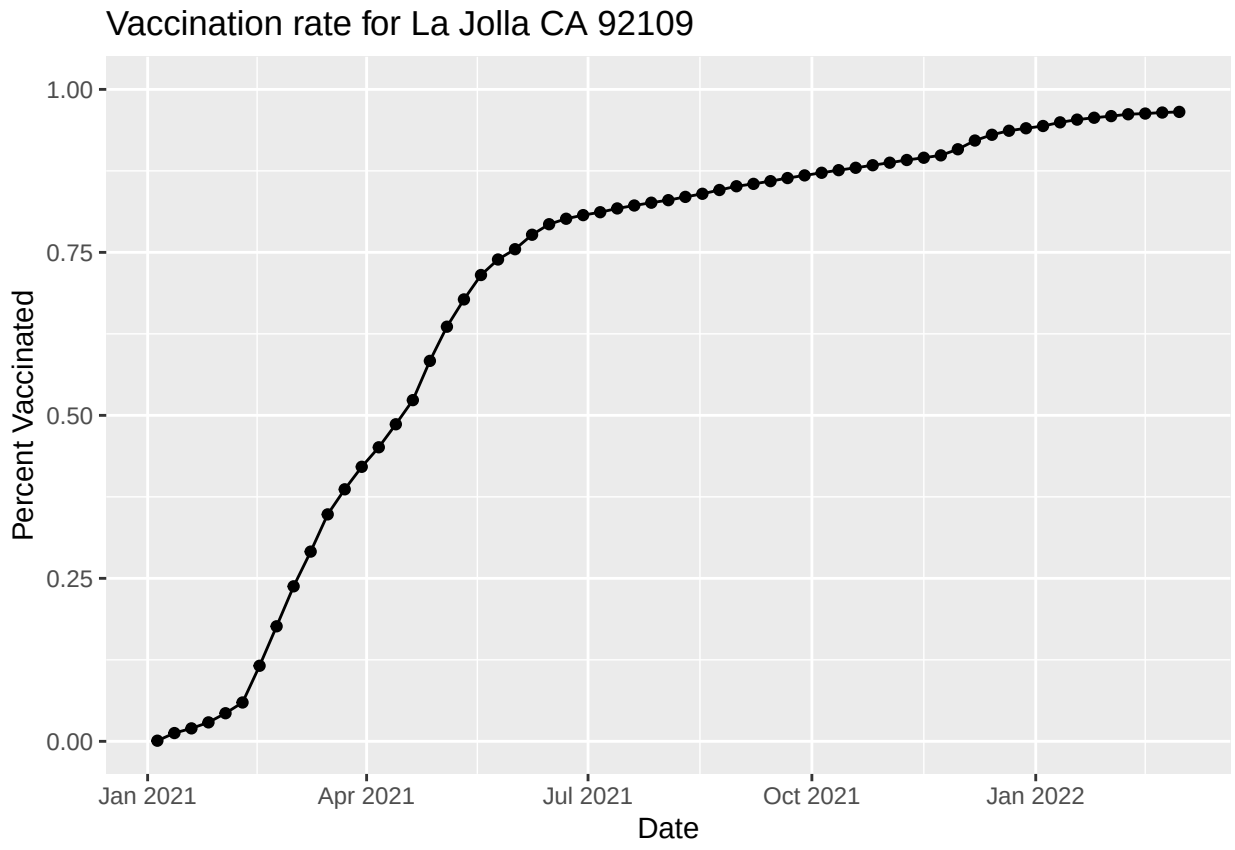
```
#UC San Diego resides in the 92037 ZIP code area and is listed with an age 5+ population size of 36,144

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:

```
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", title = "Vaccination rate for La Jolla CA 92109")
```



Comparing to similar sized areas

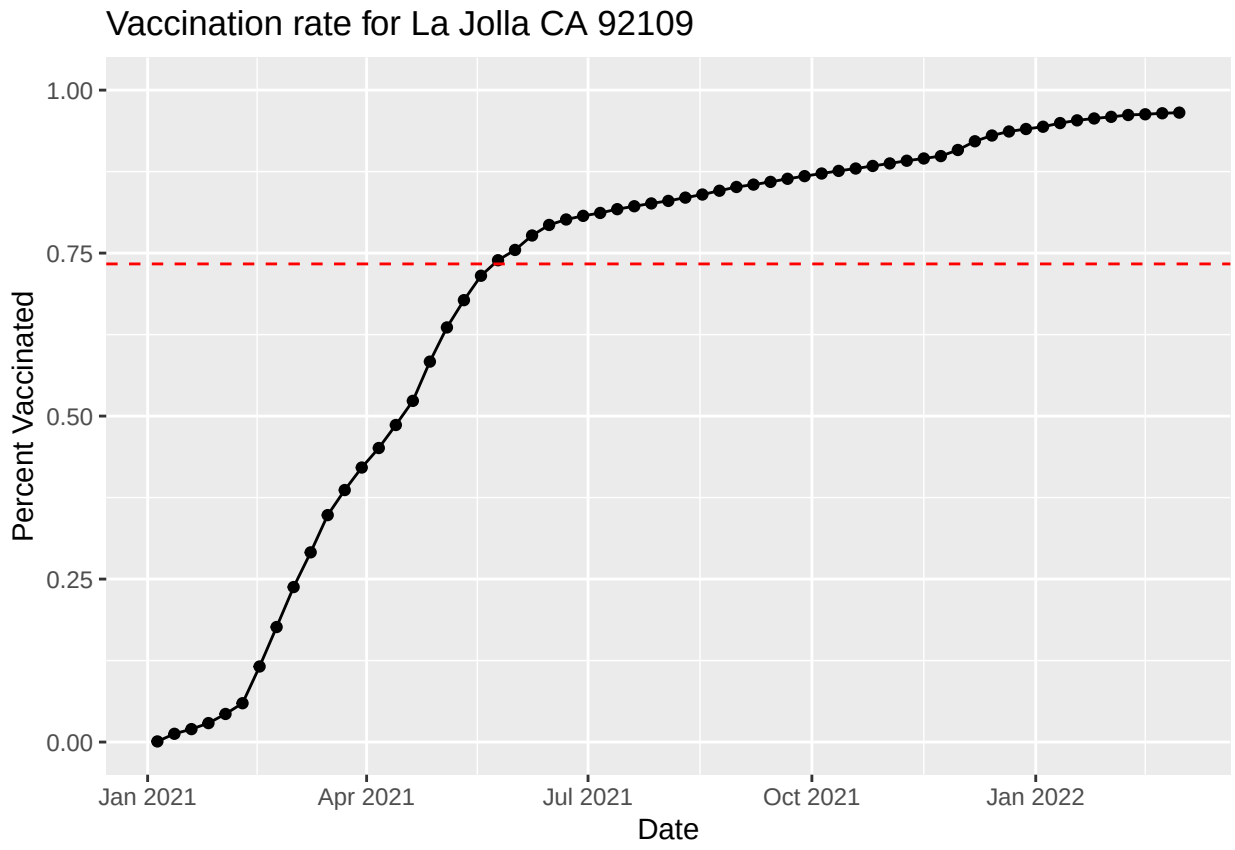
```
# Subset to all CA areas with a population as large as 92037
vax.36 <- filter(vax, age5_plus_population > 36144 &
                 as_of_date == "2022-02-22")

#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 "2022-02-22". Add this as a straight horizontal line to your plot from above with the geom_hline() function?

```
vax.mean.36 <- mean(na.omit(vax.36$percent_of_population_fully_vaccinated))

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", title = "Vaccination rate for La Jolla CA 92109") +
  geom_hline(aes(yintercept=vax.mean.36), linetype = "dashed", color = "red")
```



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 "2022-02-22"?

```
summary(vax.36)
```

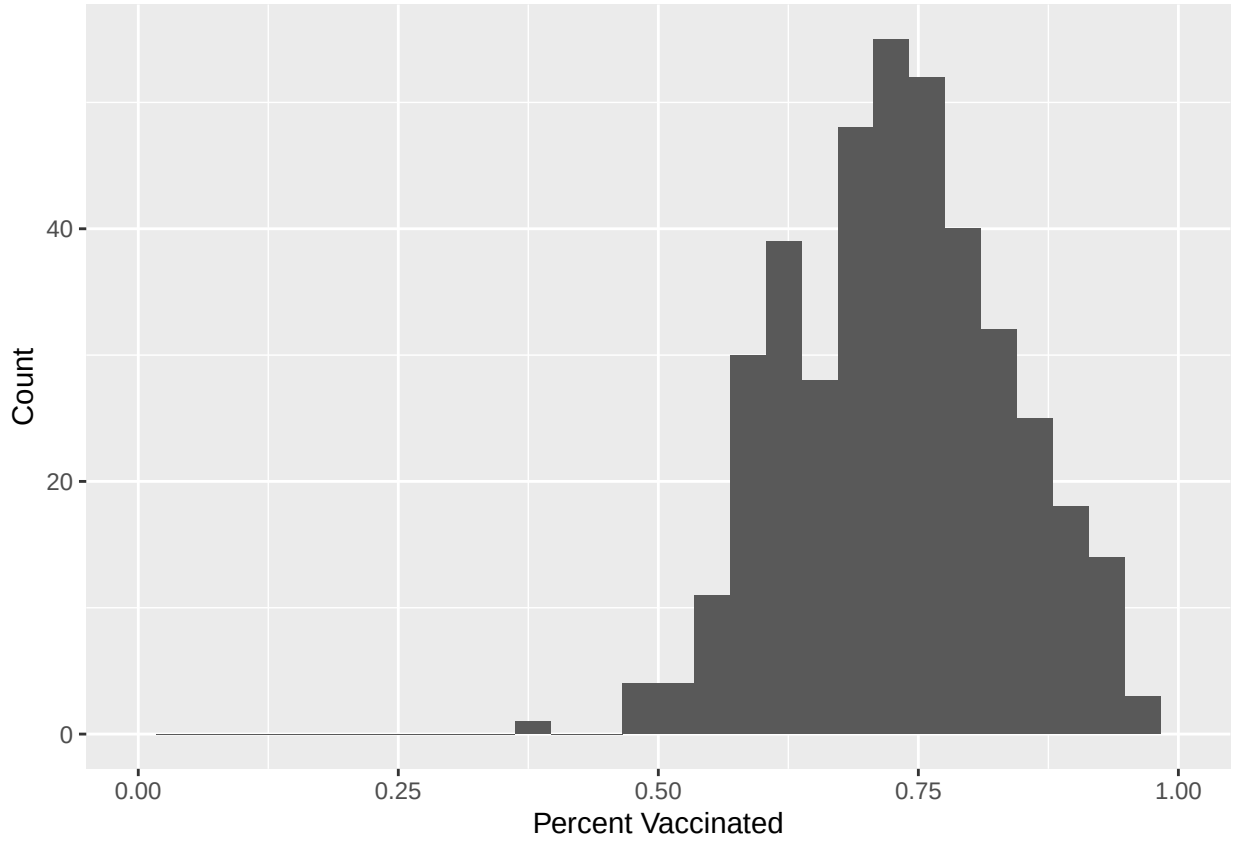
```
##    as_of_date         zip_code_tabulation_area local_health_jurisdiction
##  Min.   :2022-02-22   Min.   :90001            Length:411
##  1st Qu.:2022-02-22   1st Qu.:91762            Class :character
##  Median :2022-02-22   Median :92646            Mode  :character
##  Mean   :2022-02-22   Mean   :92862
##  3rd Qu.:2022-02-22   3rd Qu.:94517
##  Max.   :2022-02-22   Max.   :96003
##     county          vaccine_equity_metric_quartile  vem_source
##  Length:411         Min.   :1.000                   Length:411
##  Class :character   1st Qu.:1.000                   Class :character
##  Mode  :character   Median :2.000                   Mode  :character
##                     Mean   :2.353
##                     3rd Qu.:3.000
##                     Max.   :4.000
##  age12_plus_population age5_plus_population persons_fully_vaccinated
##  Min.   :31651         Min.   : 36181       Min.   :15406
##  1st Qu.:37694         1st Qu.: 41612       1st Qu.:30551
##  Median :43985         Median : 48573       Median :35305
##  Mean   :46847         Mean   : 52012       Mean   :38118
##  3rd Qu.:53932         3rd Qu.: 59168       3rd Qu.:43420
##  Max.   :88557         Max.   :101902       Max.   :77457
##  persons_partially_vaccinated percent_of_population_fully_vaccinated
##  Min.   : 1714                Min.   :0.3881
##  1st Qu.: 2774                1st Qu.:0.6539
##  Median : 3600                Median :0.7333
##  Mean   : 4480                Mean   :0.7334
##  3rd Qu.: 5064                3rd Qu.:0.8027
##  Max.   :33548                Max.   :1.0000
##  percent_of_population_partially_vaccinated
##  Min.   :0.03933
##  1st Qu.:0.05924
##  Median :0.06875
##  Mean   :0.08614
##  3rd Qu.:0.08706
##  Max.   :0.90997
##  percent_of_population_with_1_plus_dose booster_recip_count   redacted
##  Min.   :0.4980                         Min.   : 5011       Length:411
##  1st Qu.:0.7373                         1st Qu.:13356       Class :character
##  Median :0.8154                         Median :17437       Mode  :character
##  Mean   :0.8121                         Mean   :18545
##  3rd Qu.:0.8866                         3rd Qu.:22749
##  Max.   :1.0000                         Max.   :50031
```

Q18. Using ggplot generate a histogram of this data

```
ggplot(vax.36) +
  aes(percent_of_population_fully_vaccinated) +
  geom_histogram() +
  xlim(c(0,1)) +
  labs(x="Percent Vaccinated", y="Count")
```

```
## `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?

```
zip_92040 <- vax %>% filter(as_of_date == "2022-02-22") %>%
  filter(zip_code_tabulation_area=="92040") %>%
  select(percent_of_population_fully_vaccinated)

zip_92040 < vax.mean.36
```

```
##      percent_of_population_fully_vaccinated
## [1,]                                   TRUE
```

```
zip_92109 <- vax %>% filter(as_of_date == "2022-02-22") %>%
  filter(zip_code_tabulation_area=="92109") %>%
  select(percent_of_population_fully_vaccinated)

zip_92109 < vax.mean.36
```

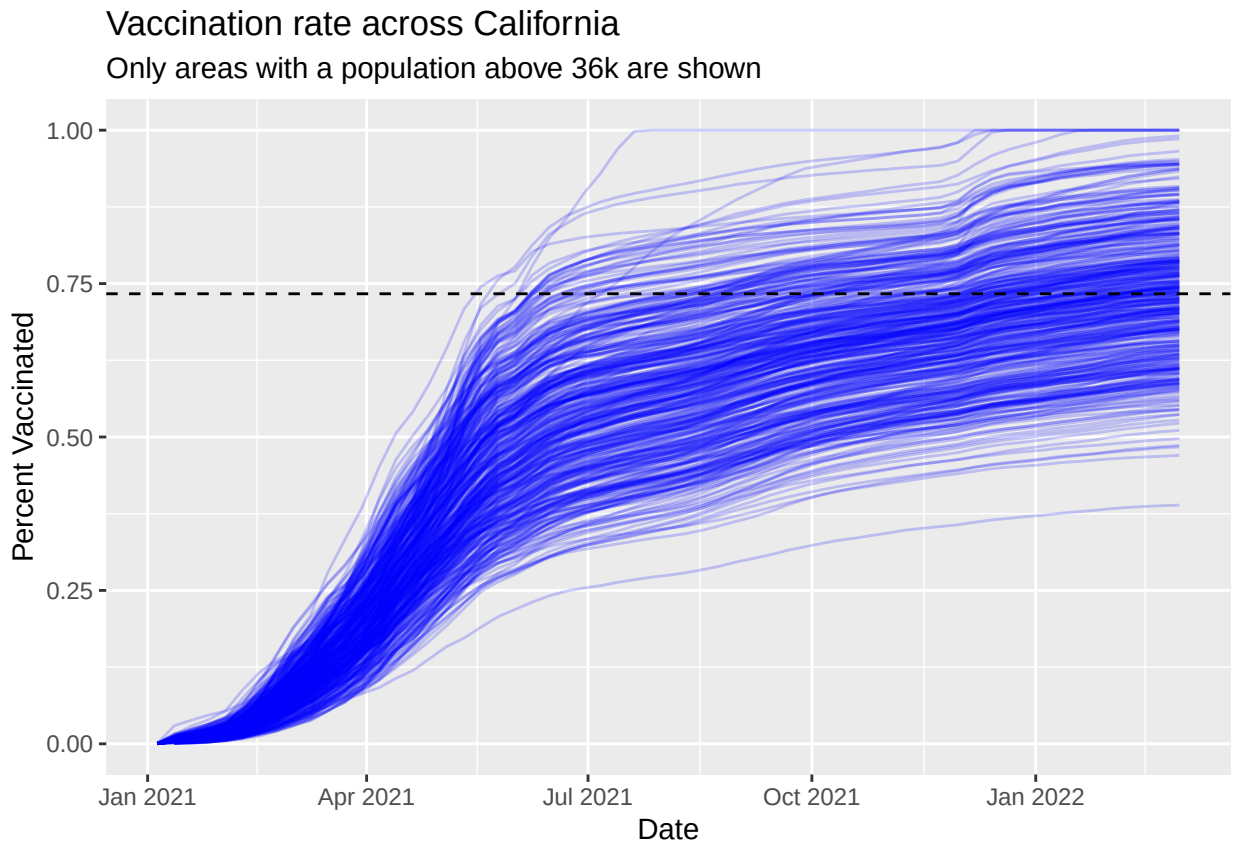
```
##      percent_of_population_fully_vaccinated
## [1,]                                   TRUE
```

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(c(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 = vax.mean.36, linetype= "dashed")
```

```
## Warning: Removed 311 row(s) containing missing values (geom_path).
```




```
sessionInfo()
```

```
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-apple-darwin17.0 (64-bit)
## Running under: macOS Big Sur 10.16
```

```
##
## Matrix products: default
## BLAS:   /Library/Frameworks/R.framework/Versions/4.1/Resources/lib/libRblas.0.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/4.1/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_3.3.5   dplyr_1.0.8     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_1.8.0
##  [5] sp_1.4-6           highr_0.9          blob_1.2.2         yaml_2.3.5
##  [9] tidycensus_1.1     pillar_1.7.0       RSQLite_2.2.10     lattice_0.20-45
## [13] glue_1.6.2         uuid_1.0-3         digest_0.6.29      rvest_1.0.2
## [17] colorspace_2.0-3   htmltools_0.5.2    pkgconfig_2.0.3    raster_3.5-15
## [21] purrr_0.3.4        scales_1.1.1       terra_1.5-21       tzdb_0.2.0
## [25] tigris_1.6         tibble_3.1.6       proxy_0.4-26       farver_2.1.0
## [29] generics_0.1.2     ellipsis_0.3.2     cachem_1.0.6       withr_2.5.0
## [33] repr_1.1.4         cli_3.2.0          magrittr_2.0.2     crayon_1.5.0
## [37] memoise_2.0.1      maptools_1.1-2     evaluate_0.15      fansi_1.0.2
## [41] xml2_1.3.3         foreign_0.8-82     class_7.3-20       tools_4.1.2
## [45] hms_1.1.1          lifecycle_1.0.1    stringr_1.4.0      munsell_0.5.0
## [49] compiler_4.1.2     e1071_1.7-9        rlang_1.0.2        classInt_0.4-3
## [53] units_0.8-0        grid_4.1.2         rstudioapi_0.13    rappdirs_0.3.3
## [57] labeling_0.4.2     base64enc_0.1-3    rmarkdown_2.12     gtable_0.3.0
## [61] codetools_0.2-18   DBI_1.1.2          curl_4.3.2         R6_2.5.1
## [65] knitr_1.37         rgdal_1.5-28       fastmap_1.1.0      bit_4.0.4
## [69] utf8_1.2.2         KernSmooth_2.23-20 readr_2.1.2        stringi_1.7.6
## [73] Rcpp_1.0.8         vctrs_0.3.8        sf_1.0-6           tidyselect_1.1.2
## [77] xfun_0.30
```