Class 17

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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                   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
```

```
colnames(vax)
```

```
 [1] "as_of_date"
 [2] "zip_code_tabulation_area"
 [3] "local_health_jurisdiction"
 [4] "county"
 [5] "vaccine_equity_metric_quartile"
 [6] "vem_source"
 [7] "age12_plus_population"
 [8] "age5_plus_population"
 [9] "tot_population"
[10] "persons_fully_vaccinated"
[11] "persons_partially_vaccinated"
[12] "percent_of_population_fully_vaccinated"
[13] "percent_of_population_partially_vaccinated"
[14] "percent_of_population_with_1_plus_dose"
[15] "booster_recip_count"
[16] "bivalent_dose_recip_count"
[17] "eligible_recipient_count"
[18] "eligible_bivalent_recipient_count"
[19] "redacted"
```

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? 2023-05-23

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

Table 1: Data summary

Name	vax
Number of rows	220500

Table 1: Data summary

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	817.38	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	20875.22	21105.97	0	1460.50	15364.00	34877.00	101902.0
tot_population	10750	0.95	23372.72	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	0.91	0.58	0.25	0	0.44	0.62	0.75	1.0
percent_of_population_partially_vaccinated	22579	0.91	0.08	0.09	0	0.05	0.06	0.08	1.0
percent_of_population_with_1_plus_dose	23732	0.90	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?

```
num_numeric_columns <- sum(sapply(vax, is.numeric))
num_numeric_columns
```

```
[1] 14
```

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

```
num_missing <- sum(is.na(vax$persons_fully_vaccinated))
num_missing
```

```
[1] 17711
```

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

```
percent_missing <- round((num_missing / length(vax$persons_fully_vaccinated)) * 100, 2)
percent_missing
```

```
[1] 8.03
```

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

We don't have as much information about the military vaccinations,

Working with dates

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

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

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

    date, intersect, setdiff, union
```

```
today()
```

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

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

```
Time difference of 876 days
```

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

```
Time difference of 868 days
```

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

```
days_since_first_vaccination <- as.integer(today() - vax$as_of_date[1])

days_since_last_update <- as.integer(today() - vax$as_of_date[nrow(vax)])
days_since_last_update
```

```
[1] 8
```

8 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] 125
```

Working with ZIP codes

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

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

```
# A tibble: 1 x 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 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

```
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] 13375
```

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

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

```
distinct_zip_codes <- distinct(sd, zip_code_tabulation_area)

num_distinct_zip_codes <- nrow(distinct_zip_codes)
num_distinct_zip_codes
```

```
[1] 107
```

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

```
largest_population_zip <- sd %>%
  slice_max(age5_plus_population)

largest_population_zip_code <- largest_population_zip$zip_code_tabulation_area
mean(largest_population_zip_code)
```

```
[1] 92154
```

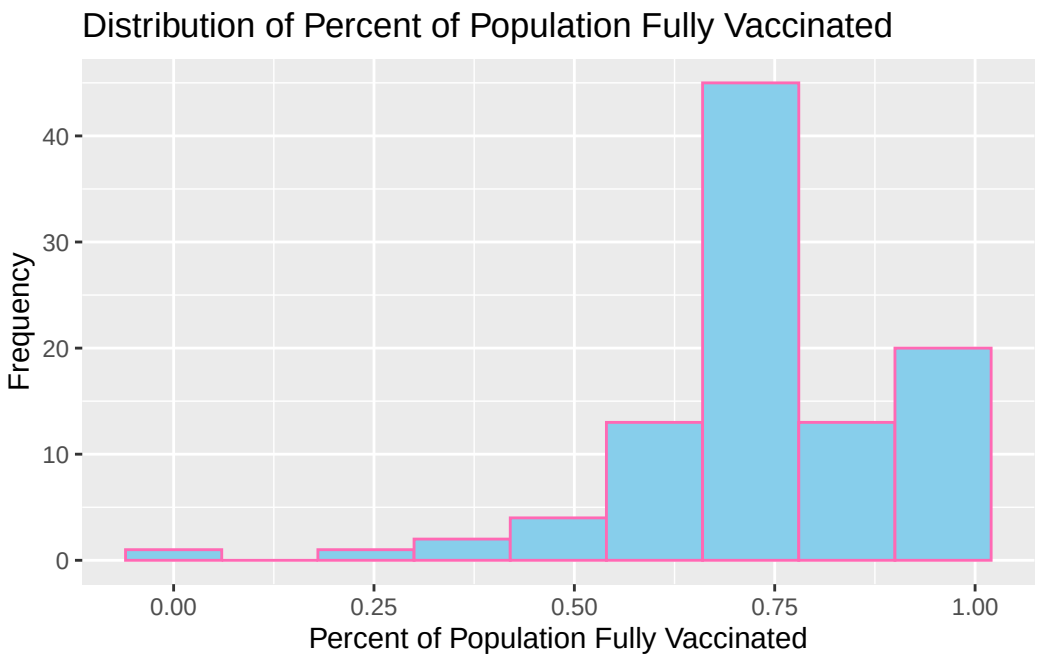
```
sd_2023_05_23 <- filter(vax, county == "San Diego" & as_of_date == "2023-05-23")

average_percent_fully_vaccinated <- mean(sd_2023_05_23$percent_of_population_fully_vaccina
average_percent_fully_vaccinated <- round(average_percent_fully_vaccinated, 2)
average_percent_fully_vaccinated
```

```
[1] 0.74
```

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)

ggplot(sd_2023_05_23, aes(x = percent_of_population_fully_vaccinated)) +
  geom_histogram(binwidth = 0.12, fill = "skyblue", color = "hotpink") +
  labs(x = "Percent of Population Fully Vaccinated", y = "Frequency") +
  ggtitle("Distribution of Percent of Population Fully Vaccinated")
```

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



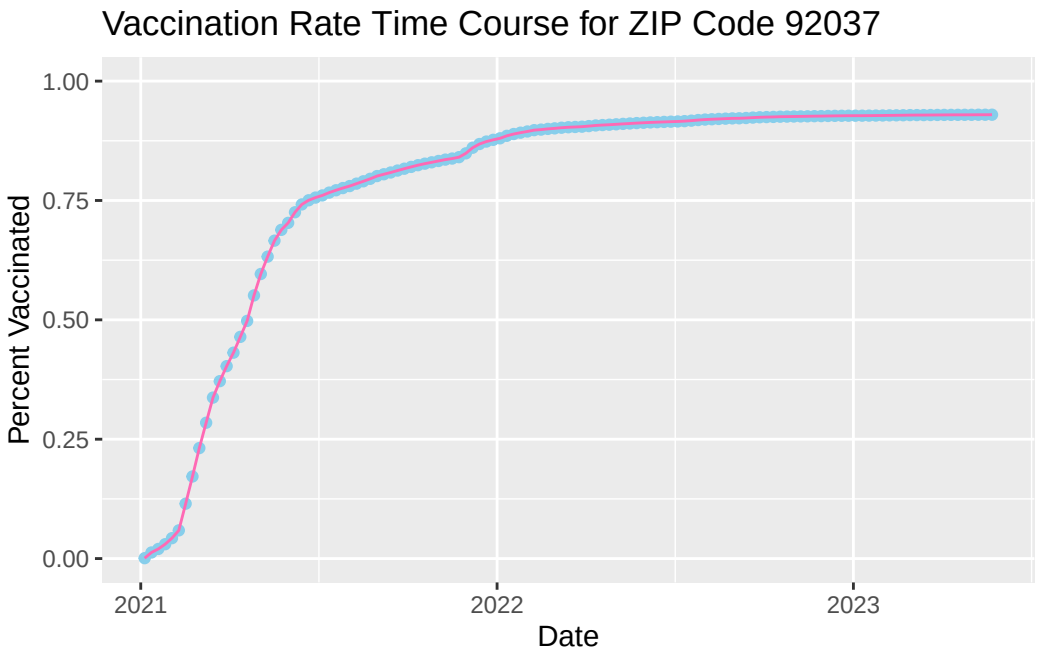
Focus on UCSD/La Jolla

```
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(color = "skyblue", fill = "skyblue") +
  geom_line(group = 1, color = "hotpink") +
  ylim(c(0, 1)) +
  labs(title = "Vaccination Rate Time Course for ZIP Code 92037", x = "Date", y = "Percent
```




```
# 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)
```

```
  as_of_date zip_code_tabulation_area local_health_jurisdiction       county
1 2023-05-23                   93720                     Fresno       Fresno
2 2023-05-23                   95670                 Sacramento   Sacramento
3 2023-05-23                   91405                Los Angeles  Los Angeles
4 2023-05-23                   94582               Contra Costa Contra Costa
5 2023-05-23                   95687                     Solano       Solano
6 2023-05-23                   92627                     Orange       Orange
  vaccine_equity_metric_quartile                vem_source
1                              3 Healthy Places Index Score
2                              2 Healthy Places Index Score
3                              1 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 tot_population
1               40357.3                44412          47081
2               46783.6                52133          55558
3               46561.6                51961          55506
4               34809.5                40433          42576
5               59036.1                65398          69060
6               54060.2                59229          63161
  persons_fully_vaccinated persons_partially_vaccinated
1                    33810                         3122
2                    35674                         3418
3                    37040                         4832
4                    44338                         3214
5                    40549                         4178
6                    40189                         3798
  percent_of_population_fully_vaccinated
1                               0.718124
2                               0.642104
3                               0.667315
4                               1.000000
5                               0.587156
6                               0.636295
  percent_of_population_partially_vaccinated
1                                   0.066311
2                                   0.061521
3                                   0.087054
4                                   0.075489
5                                   0.060498
6                                   0.060132
  percent_of_population_with_1_plus_dose booster_recip_count
```

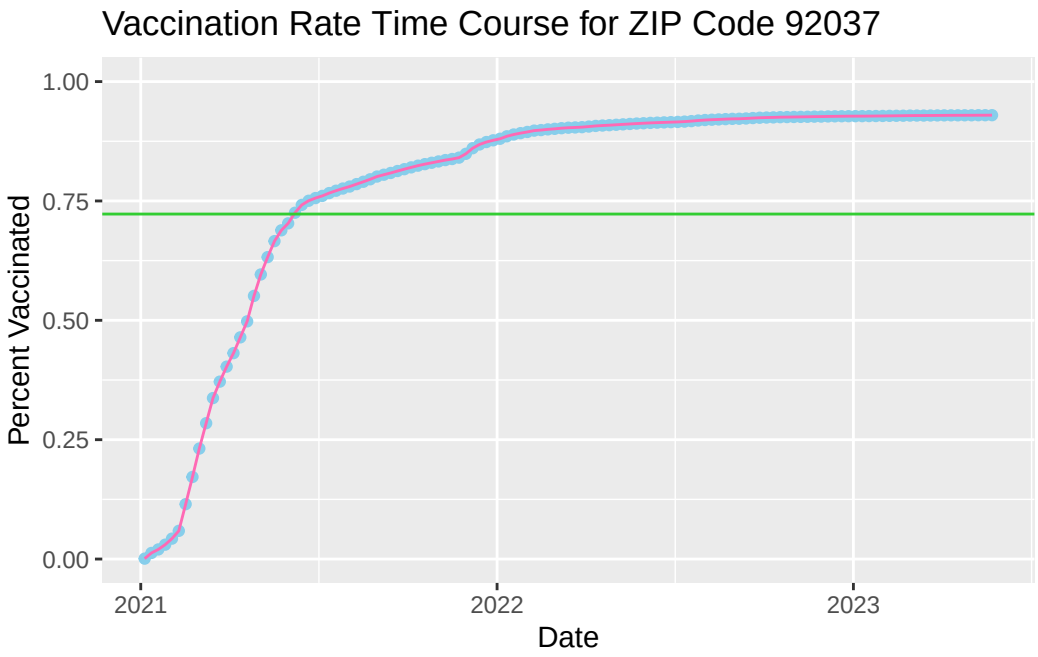
```
1                                0.784435                21186
2                                0.703625                21712
3                                0.754369                18988
4                                1.000000                33971
5                                0.647654                24494
6                                0.696427                21494
  bivalent_dose_recip_count eligible_recipient_count
1                      8056                    33740
2                     10016                    35587
3                      6688                    36977
4                     16642                    44050
5                     10308                    40460
6                      7819                    40104
  eligible_bivalent_recipient_count redacted
1                             33740       No
2                             35587       No
3                             36977       No
4                             44050       No
5                             40460       No
6                             40104       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* "2023-05-23". Add this as a straight horizontal line to your plot from above with the `geom_hline()` function?

```
mean_percent_vaccinated <- mean(vax.36$percent_of_population_fully_vaccinated, na.rm = TRU

mean_percent_vaccinated
```

```
[1] 0.7225892
```

```
ggplot(ucsd) +
  aes(as_of_date, percent_of_population_fully_vaccinated) +
  geom_point(color = "skyblue", fill = "skyblue") +
  geom_line(group = 1, color = "hotpink") + geom_hline(yintercept = 0.7225892, color= 'lim
  ylim(c(0, 1)) +
  labs(title = "Vaccination Rate Time Course for ZIP Code 92037", x = "Date", y = "Percent
```



- **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"?

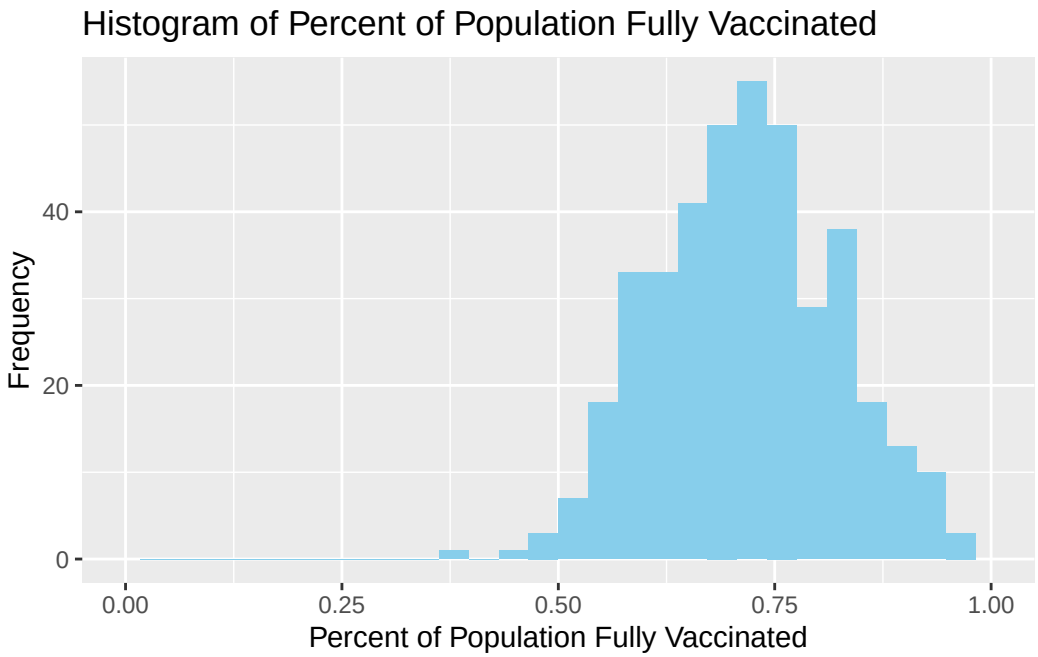
```
percent_vaccinated_summary <- summary(vax.36$percent_of_population_fully_vaccinated)

percent_vaccinated_summary
```

```
   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(x = percent_of_population_fully_vaccinated)) +
  geom_histogram(fill = "skyblue", bins = 30) +
  labs(title = "Histogram of Percent of Population Fully Vaccinated",
       x = "Percent of Population Fully Vaccinated",
       y = "Frequency") +
  xlim(c(0,1))
```

```
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
```

```
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
```

- **Q19**. Is the 92109 and 92040 ZIP code areas above or below the average value you calculated for all these above?

  92040 would be below the average at 0.552 and so is 92109 with a value of 0.695.

- **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 <- vax %>%
  filter(age5_plus_population > 36144)

ggplot(vax.36.all) +
  aes(x = as_of_date, y = percent_of_population_fully_vaccinated, group = zip_code_tabulat
  geom_line(alpha = 0.2, color = "skyblue") +
  ylim(0, 1) +
  labs(x = "Date", y = "Percent of Population Fully Vaccinated",
       title = "Vaccination Progress for ZIP Code Areas",
       subtitle = "Age 5+ Population > 36144") +
  geom_hline(yintercept = mean_percent_vaccinated, linetype = "dashed", color = "hotpink")
```

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