NYPD COVID Shooting

OB

2024-10-08

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

1. Importing Data

First we install one of R's most important libraries (tidyverse)

```
library(tidyverse)
```

Next, we obtain the url that we will be downloading our NYPD shooting data from and extract it into a df using read_csv from the tidyverse library

```
url_in <- "https://data.cityofnewyork.us/api/views/833y-fsy8/rows.csv?accessType=DOWNLOAD"
nypd_shoot <- read_csv(url_in)
```

We have now imported and stored our data in a variable.

2. Tidying and Transforming Data

Let's call on our data to see what it looks like to have a general understanding of variables we would need to change or affect in our tidying and transformation process.

```
nypd_shoot
```

```
## # A tibble: 28,562 x 21
##    INCIDENT_KEY OCCUR_DATE OCCUR_TIME BORO      LOC_OF_OCCUR_DESC PRECINCT
##           <dbl> <chr>      <time>     <chr>     <chr>                <dbl>
##  1    244608249 05/05/2022 00:10      MANHATTAN INSIDE                  14
##  2    247542571 07/04/2022 22:20      BRONX     OUTSIDE                 48
##  3     84967535 05/27/2012 19:35      QUEENS    <NA>                   103
##  4    202853370 09/24/2019 21:00      BRONX     <NA>                    42
##  5     27078636 02/25/2007 21:00      BROOKLYN  <NA>                    83
##  6    230311078 07/01/2021 23:07      MANHATTAN <NA>                    23
##  7    229224142 06/07/2021 19:55      QUEENS    <NA>                   113
##  8    231246224 07/22/2021 01:47      BROOKLYN  <NA>                    77
##  9    228559720 05/22/2021 18:39      BRONX     <NA>                    48
```

```
## 10    238210279 12/22/2021 23:17      BRONX     <NA>                    49
## # i 28,552 more rows
## # i 15 more variables: JURISDICTION_CODE <dbl>, LOC_CLASSFCTN_DESC <chr>,
## #   LOCATION_DESC <chr>, STATISTICAL_MURDER_FLAG <lgl>, PERP_AGE_GROUP <chr>,
## #   PERP_SEX <chr>, PERP_RACE <chr>, VIC_AGE_GROUP <chr>, VIC_SEX <chr>,
## #   VIC_RACE <chr>, X_COORD_CD <dbl>, Y_COORD_CD <dbl>, Latitude <dbl>,
## #   Longitude <dbl>, Lon_Lat <chr>
```

I have decided to remove all the location based columns. Analysis will be done by borough/precinct. Then, load the lubridate library and change the occur_date column to type date.

```
nypd_shoot <- nypd_shoot %>% select(-c(Latitude, Longitude, X_COORD_CD, Y_COORD_CD, Lon_Lat))
library(lubridate)
nypd_shoot$OCCUR_DATE <- mdy(nypd_shoot$OCCUR_DATE)
summary(nypd_shoot)
```

```
##   INCIDENT_KEY         OCCUR_DATE          OCCUR_TIME           BORO
##  Min.   :  9953245   Min.   :2006-01-01   Length:28562      Length:28562
##  1st Qu.: 65439914   1st Qu.:2009-09-04   Class1:hms        Class :character
##  Median : 92711254   Median :2013-09-20   Class2:difftime   Mode  :character
##  Mean   :127405824   Mean   :2014-06-07   Mode  :numeric
##  3rd Qu.:203131993   3rd Qu.:2019-09-29
##  Max.   :279758069   Max.   :2023-12-29
##
##  LOC_OF_OCCUR_DESC     PRECINCT     JURISDICTION_CODE LOC_CLASSFCTN_DESC
##  Length:28562       Min.   :  1.0   Min.   :0.0000    Length:28562
##  Class :character   1st Qu.: 44.0   1st Qu.:0.0000    Class :character
##  Mode  :character   Median : 67.0   Median :0.0000    Mode  :character
##                     Mean   : 65.5   Mean   :0.3219
##                     3rd Qu.: 81.0   3rd Qu.:0.0000
##                     Max.   :123.0   Max.   :2.0000
##                                     NA's   :2
##  LOCATION_DESC      STATISTICAL_MURDER_FLAG PERP_AGE_GROUP
##  Length:28562       Mode :logical           Length:28562
##  Class :character   FALSE:23036             Class :character
##  Mode  :character   TRUE :5526              Mode  :character
##
##
##
##
##    PERP_SEX          PERP_RACE         VIC_AGE_GROUP        VIC_SEX
##  Length:28562       Length:28562       Length:28562       Length:28562
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##    VIC_RACE
##  Length:28562
##  Class :character
##  Mode  :character
##
```

```
##
##
##
```

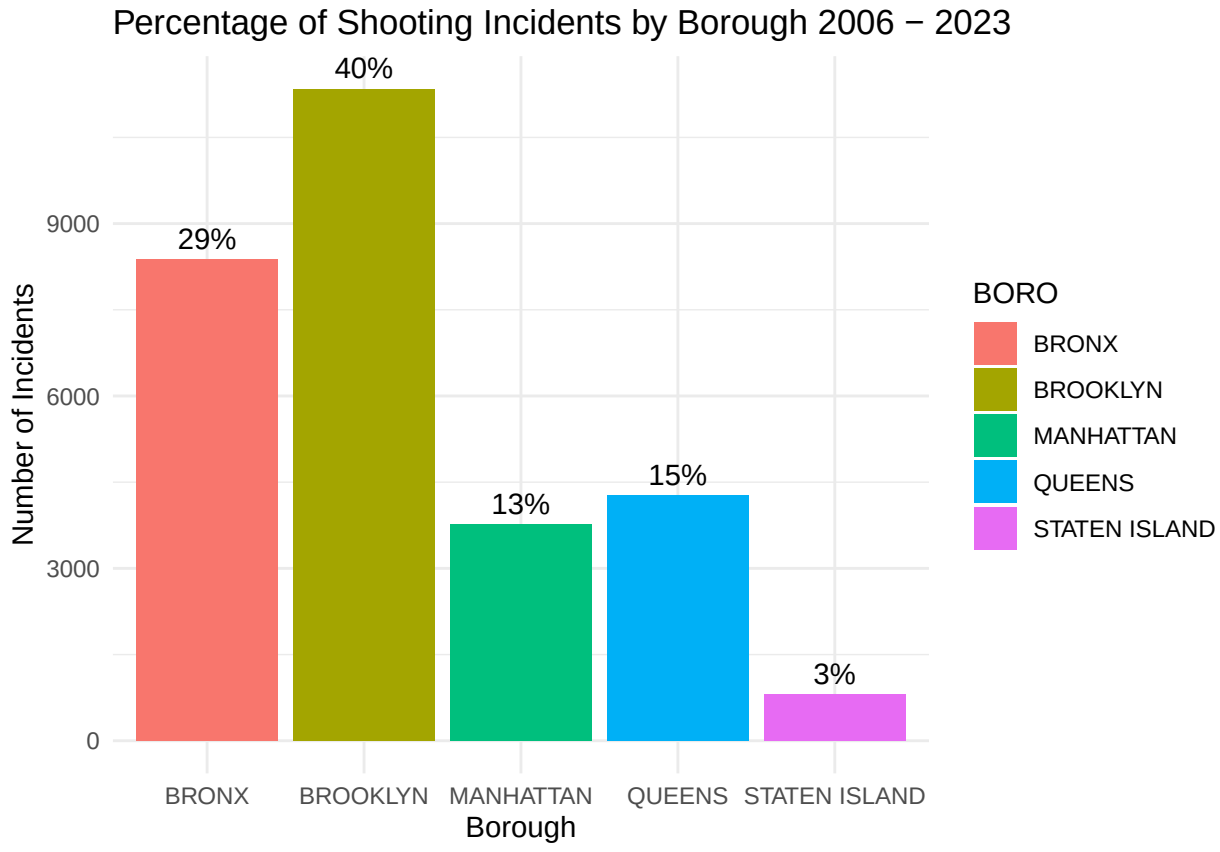
3. Visualization and Model(s)

The first visualization I am making is what percentage of shootings take place by Borough.

```
 borough_counts <- nypd_shoot %>%
     group_by(BORO) %>%
     summarize(count = n())

borough_counts <- borough_counts %>%
      mutate(percentage = count / sum(count) * 100)

ggplot(borough_counts, aes(x = BORO, y = count, fill = BORO)) +
      geom_bar(stat = "identity") +
      geom_text(aes(label = paste0(round(percentage, 0), "%")), vjust = -0.5) +
      labs(title = "Percentage of Shooting Incidents by Borough 2006 - 2023",
           x = "Borough",
           y = "Number of Incidents") +
      theme_minimal()
```



The next visualization I make is one that shows what time these shootings occur.

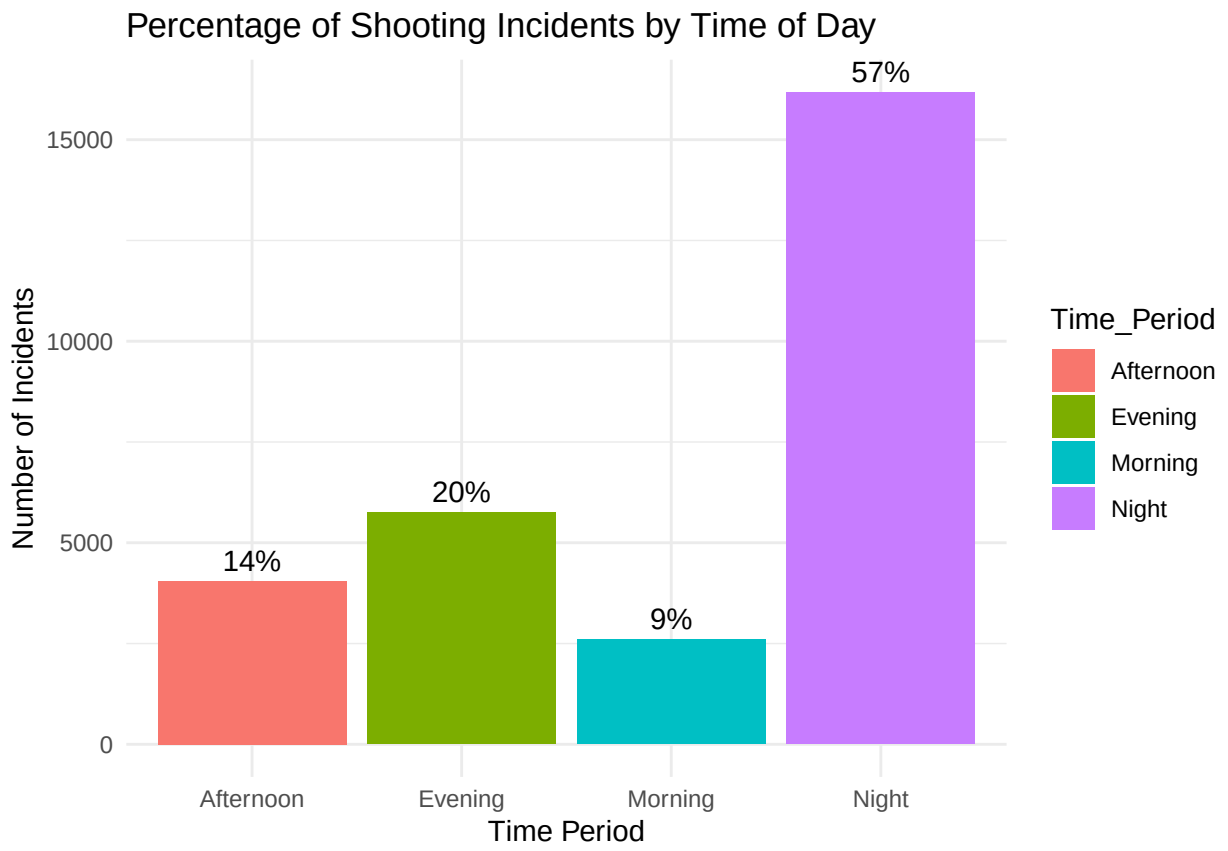
```r
classify_time <- function(time) {
      hour <- as.numeric(format(time, "%H"))  # Extract hour as numeric

      if (hour >= 5 & hour < 12) {
          return("Morning")
      } else if (hour >= 12 & hour < 17) {
          return("Afternoon")
      } else if (hour >= 17 & hour < 21) {
          return("Evening")
      } else {
          return("Night")
      }
}

nypd_shoot <- nypd_shoot %>%
     mutate(OCCUR_TIME = as.POSIXct(OCCUR_TIME, format = "%H:%M:%S", tz = "UTC"))
nypd_shoot <- nypd_shoot %>%
     mutate(Time_Period = sapply(OCCUR_TIME, classify_time))

time_counts <- nypd_shoot %>%
           group_by(Time_Period) %>%
           summarize(count = n())
time_counts <- time_counts %>%
           mutate(percentage = count / sum(count) * 100)

ggplot(time_counts, aes(x = Time_Period, y = count, fill = Time_Period)) +
     geom_bar(stat = "identity") +
     geom_text(aes(label = paste0(round(percentage, 0), "%")), vjust = -0.5) +
     labs(
         title = "Percentage of Shooting Incidents by Time of Day",
         x = "Time Period",
         y = "Number of Incidents"
     ) +
     theme_minimal()
```



Using a linear regression model to showcase relationships between boroughs and the times of night that shootings occur.

```
incident_counts <- nypd_shoot %>%
      group_by(OCCUR_DATE, BORO, Time_Period) %>%
      summarize(incident_count = n())
```

```
lm_model <- lm(incident_count ~ BORO + OCCUR_DATE + Time_Period, data = incident_counts)

summary(lm_model)
```

```
##
## Call:
## lm(formula = incident_count ~ BORO + OCCUR_DATE + Time_Period,
##     data = incident_counts)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.9808 -0.6194 -0.4142  0.1801 17.1564
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)          1.871e+00  8.172e-02  22.900  < 2e-16 ***
## BOROBROOKLYN         1.816e-02  2.277e-02   0.797 0.425257
## BOROMANHATTAN       -2.390e-01  2.955e-02  -8.088 6.47e-16 ***
## BOROQUEENS          -2.367e-01  2.837e-02  -8.346  < 2e-16 ***
```

```
## BOROSTATEN ISLAND  -4.166e-01  5.159e-02  -8.076 7.10e-16 ***
## OCCUR_DATE         -2.714e-05  4.662e-06  -5.821 5.94e-09 ***
## Time_PeriodEvening  9.873e-02  2.957e-02   3.339 0.000844 ***
## Time_PeriodMorning -2.798e-02  3.547e-02  -0.789 0.430187
## Time_PeriodNight    4.481e-01  2.582e-02  17.353  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.219 on 17926 degrees of freedom
## Multiple R-squared:  0.03927,    Adjusted R-squared:  0.03884
## F-statistic: 91.59 on 8 and 17926 DF,  p-value: < 2.2e-16
```

Three Key Insights that can be drawn from the data:

1. Shootings are statistically more likely to occur at night
2. Shootings are decreasing over time, a possible decline in gun violence
3. Manhattan, Queens, and Staten Island are less likely to havve shooting incidents

4. Ethics/Bias Analysis

An analysis that I decided not to do was to look into a relationship for ethnicity. As data scientists we must ensure that the insights we produce and share isn't harmful.