NYPDShooting

```
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.1.3
```

```
## Warning: package 'ggplot2' was built under R version 4.1.3
```

```
## Warning: package 'tibble' was built under R version 4.1.3
```

```
## Warning: package 'tidyr' was built under R version 4.1.3
```

```
## Warning: package 'readr' was built under R version 4.1.3
```

```
## Warning: package 'purrr' was built under R version 4.1.3
```

```
## Warning: package 'dplyr' was built under R version 4.1.3
```

```
## Warning: package 'stringr' was built under R version 4.1.3
```

```
## Warning: package 'forcats' was built under R version 4.1.3
```

```
## Warning: package 'lubridate' was built under R version 4.1.3
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.2     v readr     2.1.4
## v forcats   1.0.0     v stringr   1.5.0
## v ggplot2   3.4.2     v tibble    3.2.1
## v lubridate 1.9.2     v tidyr     1.3.0
## v purrr     1.0.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(lubridate)
library(zoo)
```

```
## Warning: package 'zoo' was built under R version 4.1.3
```

```
##
## Attaching package: 'zoo'
##
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
url_in <- "https://data.cityofnewyork.us/api/views/833y-fsy8/rows.csv"
NYPDShooting <- read_csv(url_in)
```

```
## Rows: 27312 Columns: 21
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (12): OCCUR_DATE, BORO, LOC_OF_OCCUR_DESC, LOC_CLASSFCTN_DESC, LOCATION...
## dbl   (7): INCIDENT_KEY, PRECINCT, JURISDICTION_CODE, X_COORD_CD, Y_COORD_CD...
## lgl   (1): STATISTICAL_MURDER_FLAG
## time  (1): OCCUR_TIME
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
shooting <- NYPDShooting %>%
  mutate(OCCUR_DATE = mdy(OCCUR_DATE)) %>%
  select(-c(JURISDICTION_CODE, LOCATION_DESC, X_COORD_CD, Y_COORD_CD, Latitude, Longitude, Lon_Lat))
summary(shooting)
```

```
##   INCIDENT_KEY         OCCUR_DATE          OCCUR_TIME           BORO
##  Min.   :  9953245   Min.   :2006-01-01   Length:27312      Length:27312
##  1st Qu.: 63860880   1st Qu.:2009-07-18   Class1:hms        Class :character
##  Median : 90372218   Median :2013-04-29   Class2:difftime   Mode  :character
##  Mean   :120860536   Mean   :2014-01-06   Mode  :numeric
##  3rd Qu.:188810230   3rd Qu.:2018-10-15
##  Max.   :261190187   Max.   :2022-12-31
##  LOC_OF_OCCUR_DESC     PRECINCT      LOC_CLASSFCTN_DESC STATISTICAL_MURDER_FLAG
##  Length:27312       Min.   :  1.00   Length:27312       Mode :logical
##  Class :character   1st Qu.: 44.00   Class :character   FALSE:22046
##  Mode  :character   Median : 68.00   Mode  :character   TRUE :5266
##                     Mean   : 65.64
##                     3rd Qu.: 81.00
##                     Max.   :123.00
##  PERP_AGE_GROUP       PERP_SEX           PERP_RACE         VIC_AGE_GROUP
##  Length:27312       Length:27312       Length:27312       Length:27312
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##    VIC_SEX            VIC_RACE
##  Length:27312       Length:27312
##  Class :character   Class :character
##  Mode  :character   Mode  :character
##
##
##
```

```
shooting$PERP_AGE_GROUP <- shooting$PERP_AGE_GROUP %>% replace_na("UNKNOWN")
shooting$PERP_SEX <- shooting$PERP_SEX %>% replace_na("U")
shooting$PERP_RACE <- shooting$PERP_RACE %>% replace_na("UNKNOWN")
```

Since there are missing data for the perpetrators, so I just replace them with unknown.

```
shooting_by_month_year <- shooting %>%
  group_by(PRECINCT, BORO, OCCUR_DATE) %>%
  summarize(INCIDENTS = n(), MONTH_YEAR = as.yearmon(paste(month(OCCUR_DATE, label = TRUE), year(OCCUR_
  select(MONTH_YEAR, PRECINCT, BORO, OCCUR_DATE, INCIDENTS) %>%
  ungroup()
```

```
## Warning: Returning more (or less) than 1 row per `summarise()` group was deprecated in
## dplyr 1.1.0.
## i Please use `reframe()` instead.
## i When switching from `summarise()` to `reframe()`, remember that `reframe()`
##   always returns an ungrouped data frame and adjust accordingly.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
## `summarise()` has grouped output by 'PRECINCT', 'BORO', 'OCCUR_DATE'. You can
## override using the `.groups` argument.
```

```
shooting_by_precinct <- shooting_by_month_year %>%
  group_by(PRECINCT, BORO, MONTH_YEAR) %>%
  summarize(INCIDENTS = n()) %>%
  select(MONTH_YEAR, PRECINCT, BORO, INCIDENTS) %>%
  ungroup()
```

```
## `summarise()` has grouped output by 'PRECINCT', 'BORO'. You can override using
## the `.groups` argument.
```

```
shooting_by_boro <- shooting_by_precinct %>%
  group_by(BORO, MONTH_YEAR) %>%
  summarize(INCIDENTS = sum(INCIDENTS)) %>%
  select(BORO, MONTH_YEAR, INCIDENTS) %>%
  ungroup()
```

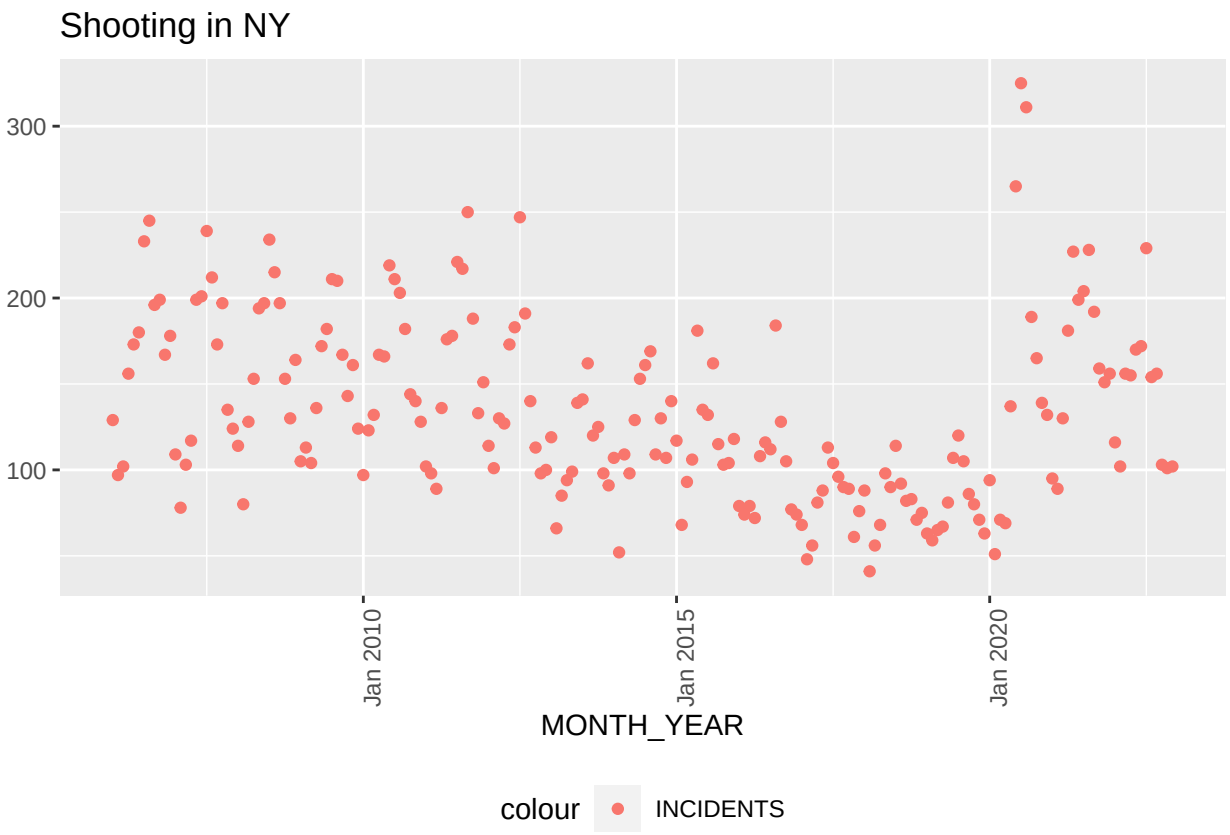
```
## `summarise()` has grouped output by 'BORO'. You can override using the
## `.groups` argument.
```

```
shooting_year_total <- shooting_by_boro %>%
  group_by(MONTH_YEAR) %>%
  summarize(INCIDENTS = sum(INCIDENTS)) %>%
  select(MONTH_YEAR, INCIDENTS) %>%
  ungroup()

summary(shooting_year_total)
```

```
##    MONTH_YEAR     INCIDENTS
##  Min.   :2006   Min.   : 41.00
##  1st Qu.:2010   1st Qu.: 96.75
##  Median :2014   Median :124.50
##  Mean   :2014   Mean   :133.88
##  3rd Qu.:2019   3rd Qu.:169.25
##  Max.   :2023   Max.   :325.00
```

```
shooting_year_total %>%
  filter(INCIDENTS > 0) %>%
  ggplot(aes(x = MONTH_YEAR, y = INCIDENTS)) +
  geom_point(aes(color = "INCIDENTS")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = "Shooting in NY", y = NULL)
```

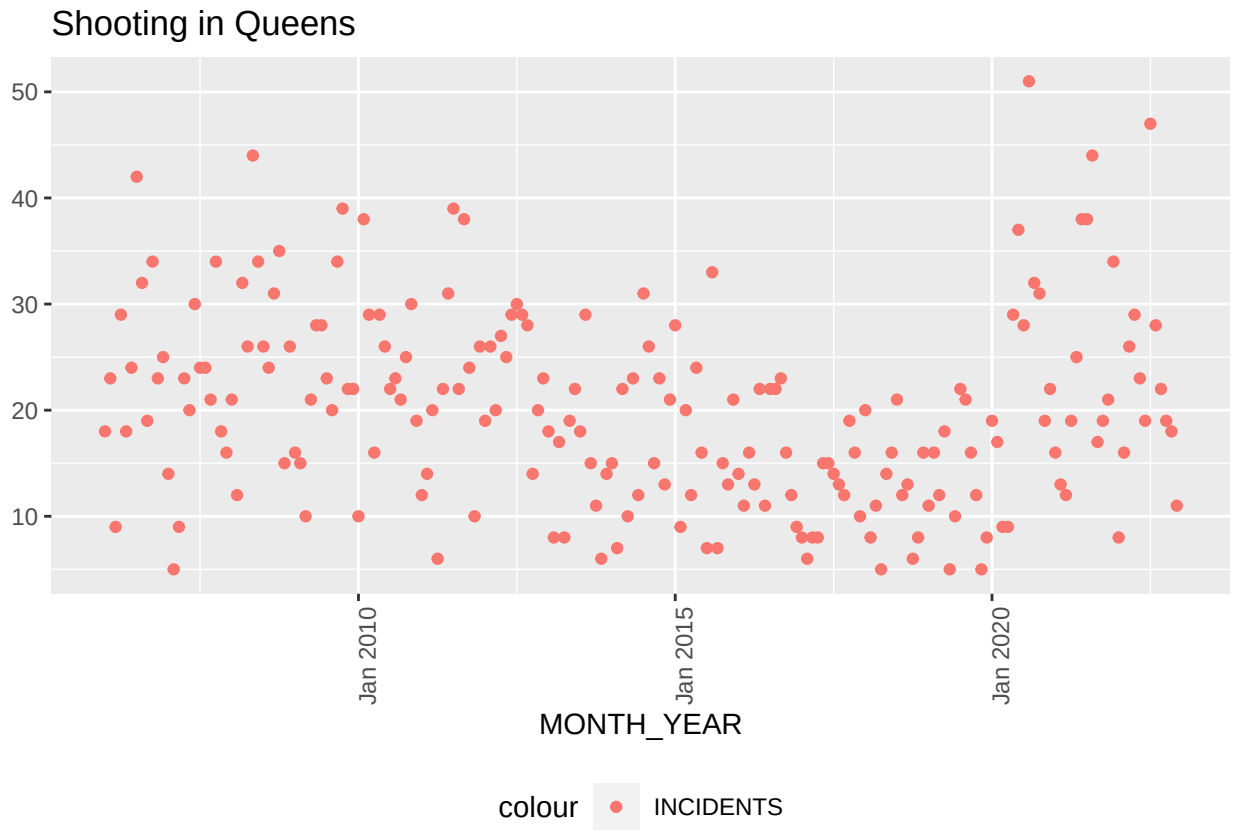


This plot illustrates shooting incidents across the entirety of New York. It demonstrates an initial gradual decline trend until around January 2020, followed by a sharp and significant upward trend thereafter.

```
shooting_queens_year_total <- shooting_by_boro %>%
  filter(BORO == "QUEENS") %>%
  group_by(MONTH_YEAR) %>%
  summarize(INCIDENTS = sum(INCIDENTS)) %>%
  select(MONTH_YEAR, INCIDENTS) %>%
  ungroup()
summary(shooting_queens_year_total)
```

```
##    MONTH_YEAR     INCIDENTS
##  Min.   :2006   Min.   : 5.00
##  1st Qu.:2010   1st Qu.:13.00
##  Median :2014   Median :19.00
##  Mean   :2014   Mean   :20.07
##  3rd Qu.:2019   3rd Qu.:26.00
##  Max.   :2023   Max.   :51.00
```

```
shooting_queens_year_total %>%
  filter(INCIDENTS > 0) %>%
  ggplot(aes(x = MONTH_YEAR, y = INCIDENTS)) +
  geom_point(aes(color = "INCIDENTS")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = "Shooting in Queens", y = NULL)
```

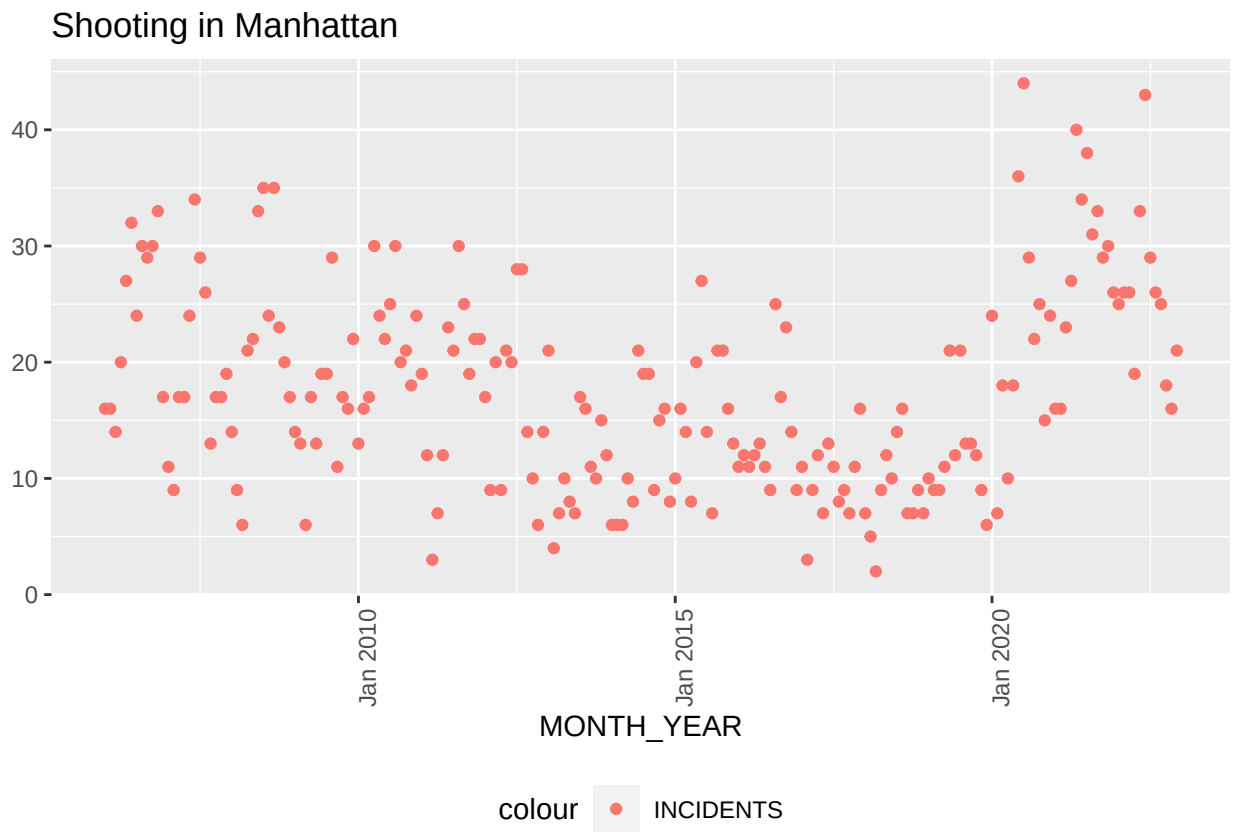


This plot depicts shooting incidents specifically within the Queens borough. It showcases a comparable trend to that of the entire New York, characterized by a decrease preceding January 2020, followed by a subsequent increase.

```
shooting_manhattan_year_total <- shooting_by_boro %>%
  filter(BORO == "MANHATTAN") %>%
  group_by(MONTH_YEAR) %>%
  summarize(INCIDENTS = sum(INCIDENTS)) %>%
  select(MONTH_YEAR, INCIDENTS) %>%
  ungroup()
summary(shooting_manhattan_year_total)
```

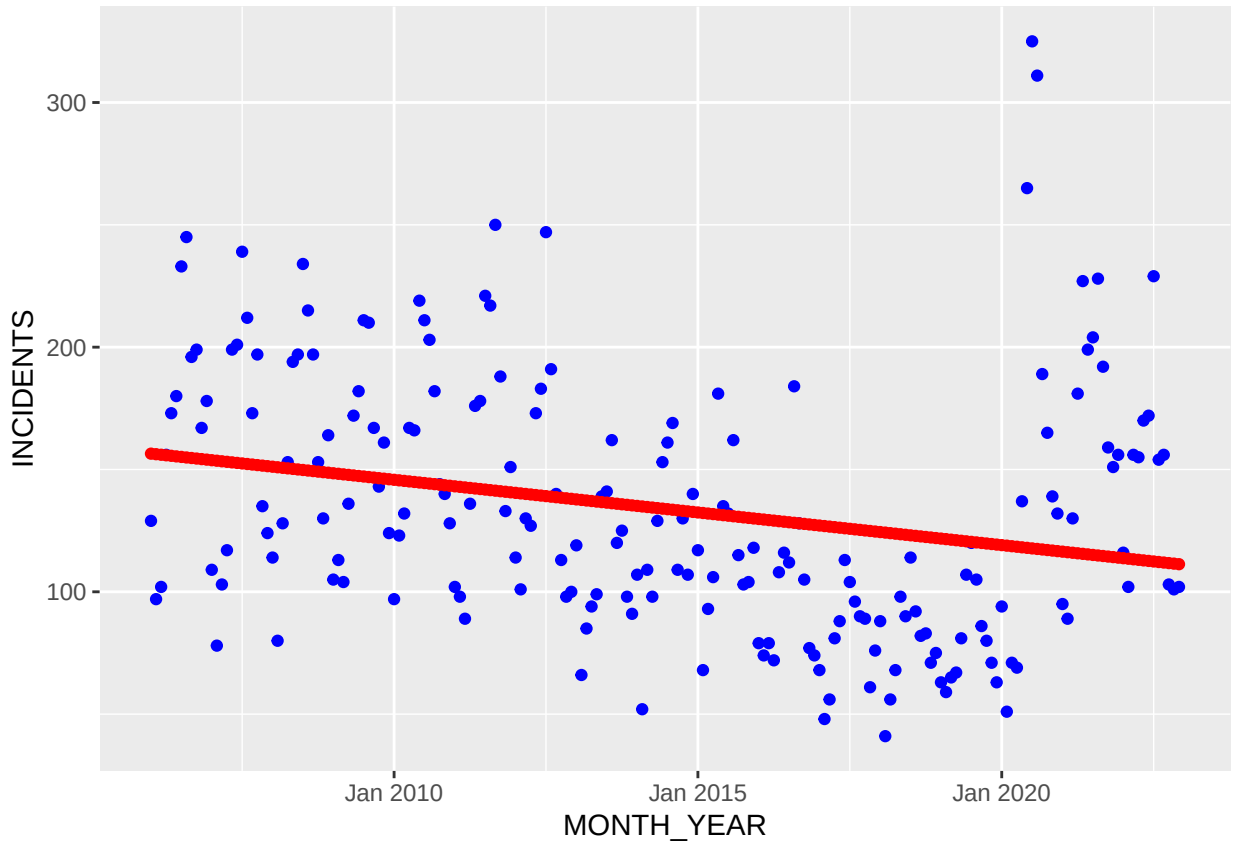
```
##    MONTH_YEAR     INCIDENTS
##  Min.   :2006   Min.   : 2.00
##  1st Qu.:2010   1st Qu.:11.00
##  Median :2014   Median :16.00
##  Mean   :2014   Mean   :17.51
##  3rd Qu.:2019   3rd Qu.:23.00
##  Max.   :2023   Max.   :44.00
```

```
shooting_manhattan_year_total %>%
  filter(INCIDENTS > 0) %>%
  ggplot(aes(x = MONTH_YEAR, y = INCIDENTS)) +
  geom_point(aes(color = "INCIDENTS")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = "Shooting in Manhattan", y = NULL)
```



This plot visualizes shooting incidents within the Manhattan borough. Its trend closely mirrors that of the Queens borough. However, the accompanying summary reveals a difference in incident count, indicating fewer occurrences in comparison to Queens.

```
mod <- lm(INCIDENTS ~ MONTH_YEAR, data = shooting_year_total)
x_grid <- seq(as.yearmon("JAN 2006"), as.yearmon("DEC 2023"))
new_df <- tibble(MONTH_YEAR = x_grid)
shooting_year_total_pred <- shooting_year_total %>% mutate(pred = predict(mod))
shooting_year_total_pred %>% ggplot() +
  geom_point(aes(x = MONTH_YEAR, y = INCIDENTS), color = "blue") +
  geom_point(aes(x = MONTH_YEAR, y = pred), color = "red")
```



When analyzing the data as a whole or by borough, a noticeable spike emerges around January 2020. However, predictions from a linear model indicate a declining trend due to the drops before this point. The presence of the pandemic might have influenced shooting incident numbers, introducing potential bias to the data.