ANALYZING NYPD SHOOTING INCIDENTS (2006–2024)

FINAL PROJECT

DTSA 5301: DATA SCIENCE AS A FIELD

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PROJECT GOALS & QUESTION

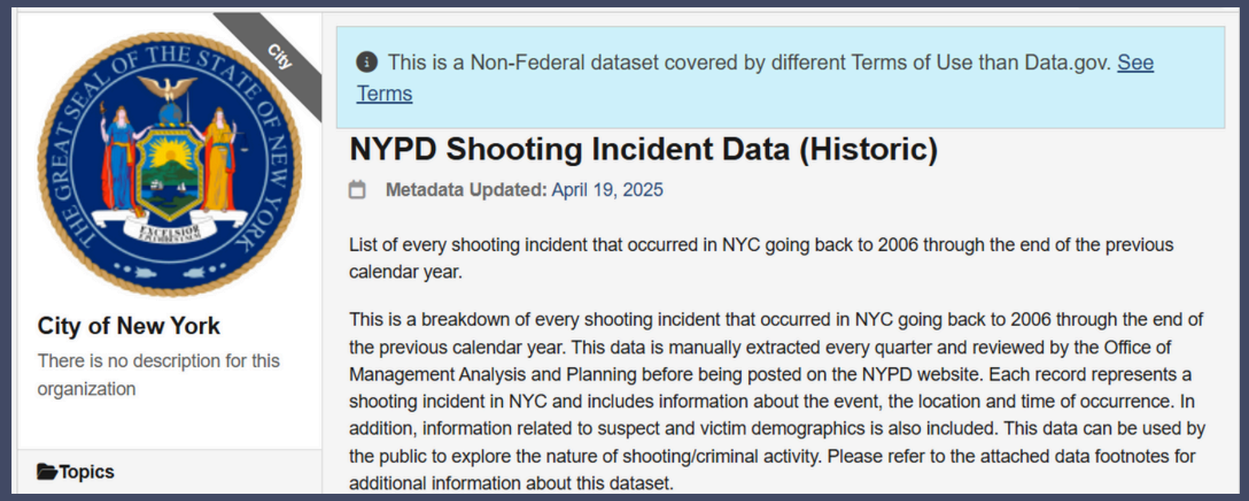
Project Goals: 🎯

- Demonstrate the end-to-end data science process
- Use real-world NYC data
- Predict risk factors for shootings

Key Question: ❓

- How can past data help us decide where and when to deploy police resources most effectively?

DATA OVERVIEW



Where Our Data Comes From:

- **Source**: NYPD Open Data Portal
- **Period**: 2006–2024
- ~30,000 records
- **Features**: Date, time, location, demographics (victim & perpetrator)

DATA CLEANING & PREPARATION

Step 2: Tidy and Transform Data

Remove Unnecessary Columns

The following columns are not needed for this assignment:
PRECINCT, JURISDICTION_CODE, LOCATION_DESC, X_COORD_CD, Y_COORD_CD, Lon_Lat

```
nypd_shooting <- nypd_shooting %>%
  select(-c(PRECINCT, JURISDICTION_CODE, LOCATION_DESC, X_COORD_CD, Y_COORD_CD, Lon_Lat)) %>%
  mutate(OCCUR_DATE = mdy(OCCUR_DATE),
         OCCUR_TIME = hms(OCCUR_TIME),
         Shootings = 1,
         OCCUR_YEAR = year(OCCUR_DATE),
         OCCUR_MONTH = month(OCCUR_DATE, label = TRUE, abbr = TRUE),
         OCCUR_WDAY = weekdays(OCCUR_DATE),
         OCCUR_HOUR = hour(hms(OCCUR_TIME)))
```

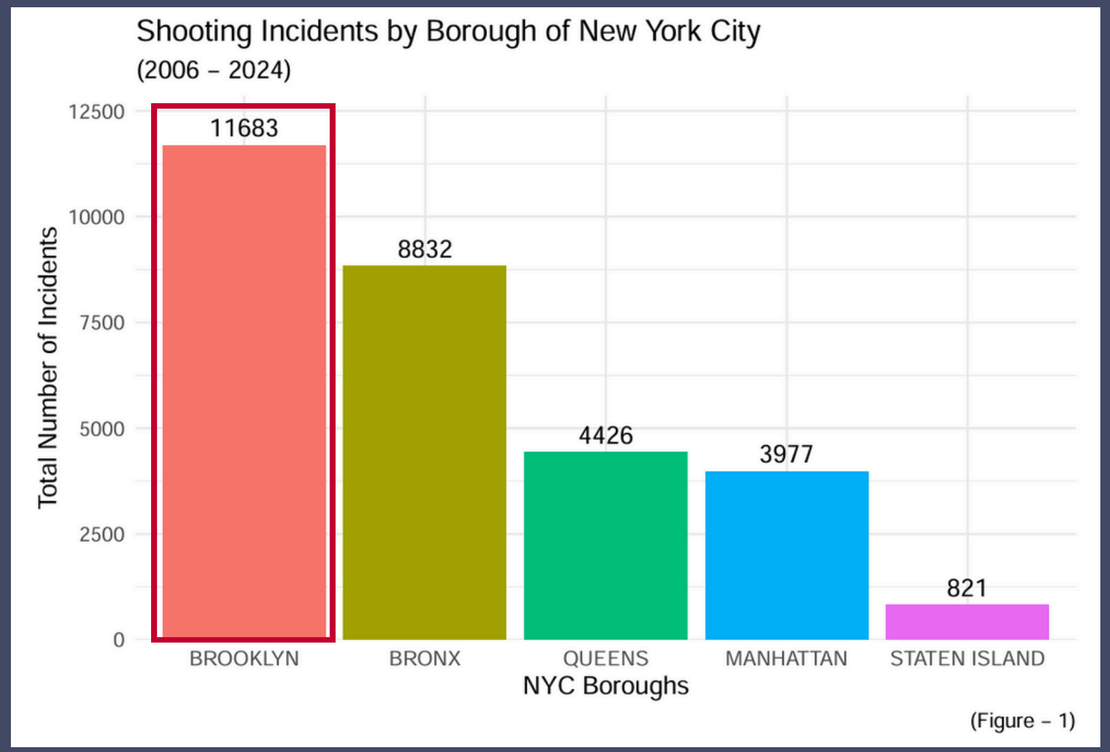
Making Raw Data Useful:

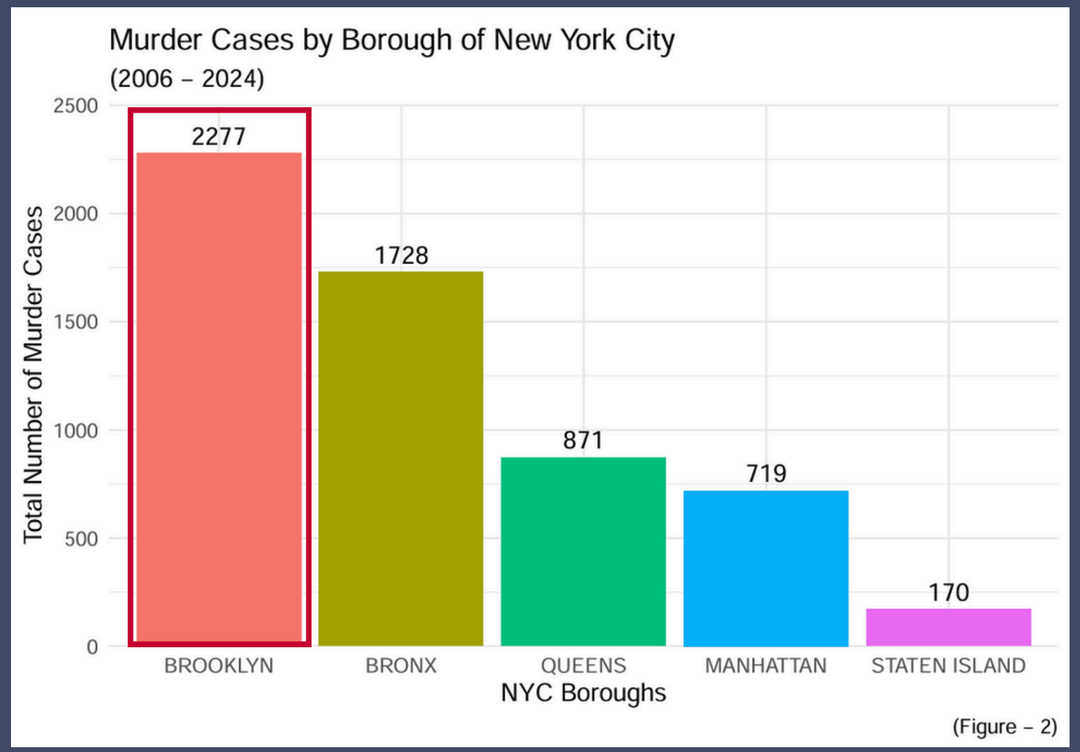
- Remove unnecessary columns
  - PRECINCT,JURISDICTION_CODE,LOCATION_DESC,X_COORD_CD,Y_COORD_CD,Lon_Lat
- Replace missing values and remove extreme values in the data
- Converted time/date formats
- Descriptive statistics

GEOGRAPHIC HOTSPOTS OF VIOLENCE

Where Shootings Happen Most

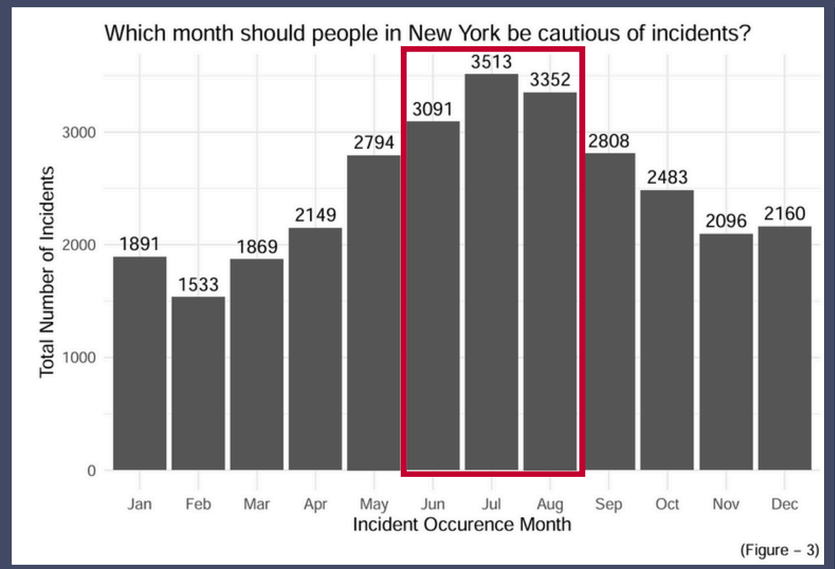
- **Brooklyn** recorded the highest number of shooting incidents
- The pattern is similar when looking specifically at murder cases



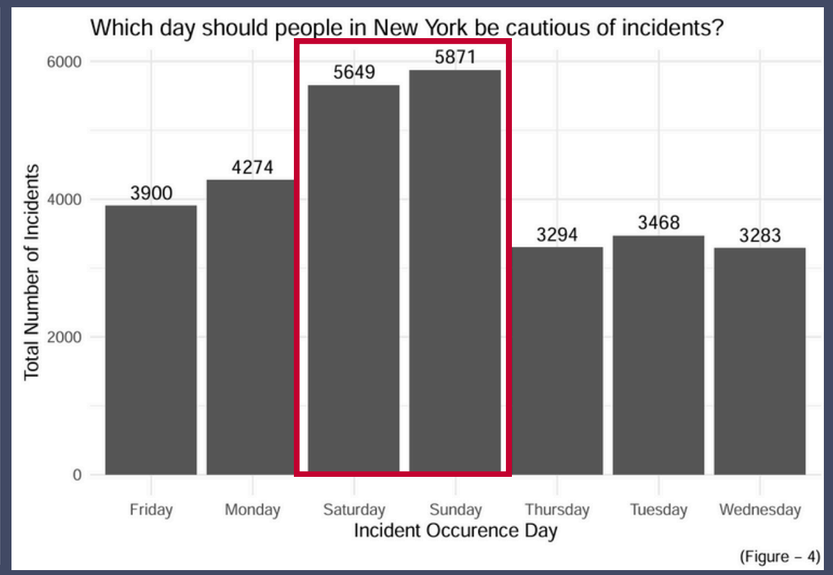


WHEN CRIME HAPPENS

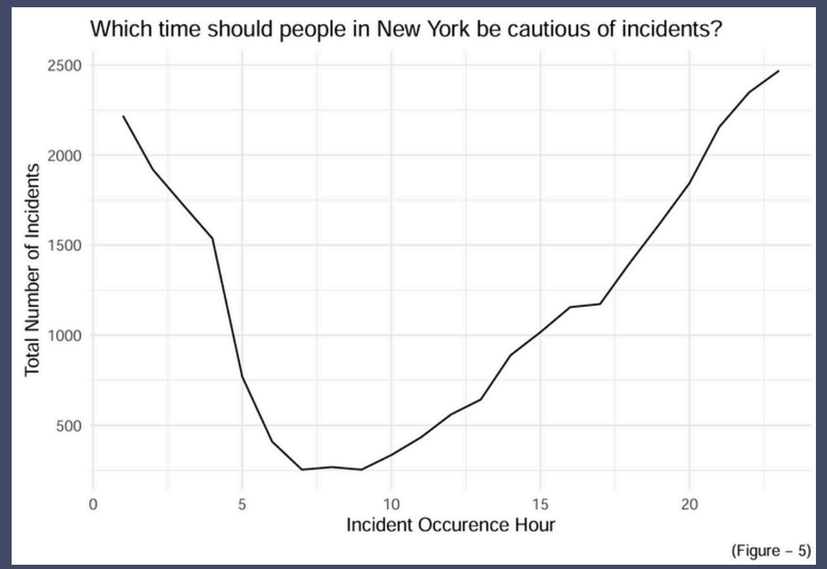
- **Summer** months—particularly June, July, and August
- **Weekends** tend to have more criminal activity
- **Evenings** and **nighttime** are the riskiest hours.



(Figure – 3)



(Figure – 4)



(Figure – 5)

THE PROFILE OF PERPETRATORS AND VICTIMS

Who's Involved?

- A significant number of incidents involve individuals aged **18–24** and **25–44**
- **Black** and **White Hispanic** individuals appear most frequently in incident records.
- The vast majority of incidents involve **male** individuals

```r
table(nypd_shooting$PERP_AGE_GROUP, nypd_shooting$VIC_AGE_GROUP)
```

```
##
##              <18  1022  18-24  25-44  45-64   65+  UNKNOWN
##              812     0   3568   4342    573    44        5
##    (null)    156     0    457    859    135    21        0
##    <18       566     0    669    455     90    23        2
##    18-24     825     1   2903   2483    355    49       14
##    25-44     284     0   1622   3773    571    52       40
##    45-64      22     0     90    419    221    18        5
##    65+         0     0      2     27     25    13        0
##    Unknown   416     0   1364   1202    148    16        2
```

```r
table(nypd_shooting$PERP_SEX, nypd_shooting$VIC_SEX)
```

```
##
##                F      M  Unknown
##              693   8614        3
##    (null)    176   1452        0
##    F          80    380        1
##    M        1830  15003        7
##    Unknown   112   1387        1
```

PREDICTING MURDER CASES

- Use logistic regression to estimate the probability that a shooting incident
- The **victim's age group** and the **perpetrator's race** were statistically significant predictors of whether the victim survived

```r
# Logistics Regression
glm_model <- glm(STATISTICAL_MURDER_FLAG ~ PERP_RACE + PERP_SEX + PERP_AGE_GROUP + VIC_RACE + VIC_SEX +
summary(glm_model)
```

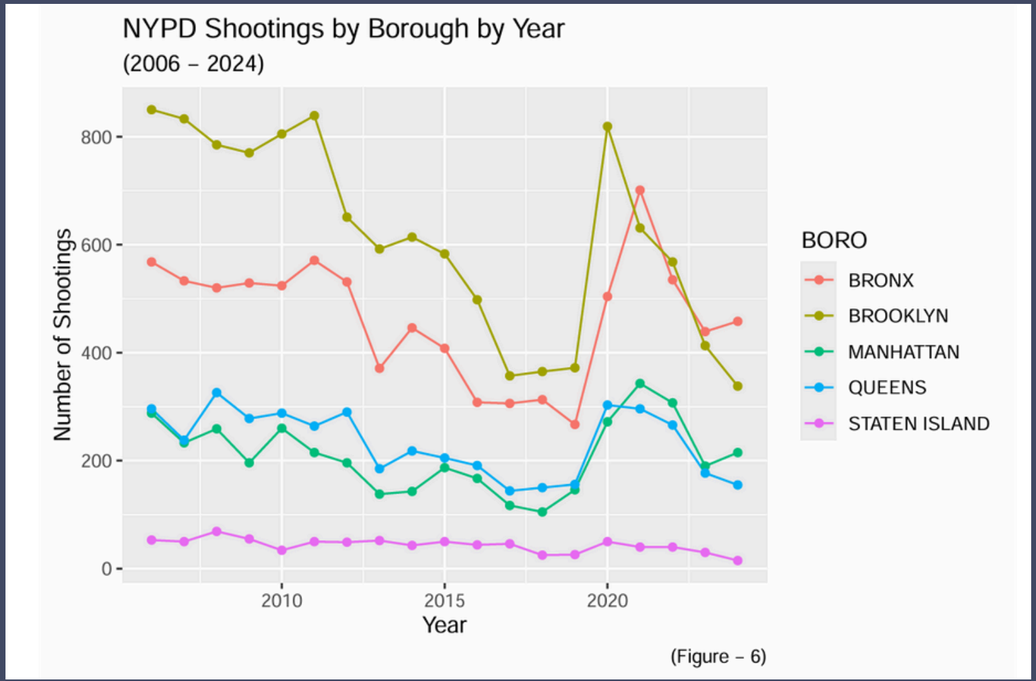
```
##
## Call:
## glm(formula = STATISTICAL_MURDER_FLAG ~ PERP_RACE + PERP_SEX +
##     PERP_AGE_GROUP + VIC_RACE + VIC_SEX + VIC_AGE_GROUP + OCCUR_HOUR +
##     OCCUR_WDAY + OCCUR_MONTH + Latitude + Longitude + BORO, family = binomial,
##     data = nypd_shooting)
##
## Coefficients: (3 not defined because of singularities)
##                                        Estimate Std. Error z value Pr(>|z|)
## (Intercept)                           67.926327 144.547278   0.470 0.638409
```

```
## (Intercept)
## PERP_RACE(null)                                    ***
## PERP_RACEAMERICAN INDIAN/ALASKAN NATIVE
## PERP_RACEASIAN / PACIFIC ISLANDER                  ***
## PERP_RACEBLACK                                     ***
## PERP_RACEBLACK HISPANIC                            ***
## PERP_RACEUnknown                                   ***
## PERP_RACEWHITE                                     ***
## PERP_RACEWHITE HISPANIC                            ***
## PERP_SEX(null)
## PERP_SEXF                                          ***
## PERP_SEXM                                          ***
```

```
## VIC_AGE_GROUP1022
## VIC_AGE_GROUP18-24                                 ***
## VIC_AGE_GROUP25-44                                 ***
## VIC_AGE_GROUP45-64                                 ***
## VIC_AGE_GROUP65+                                   ***
## VIC_AGE_GROUPUNKNOWN
```

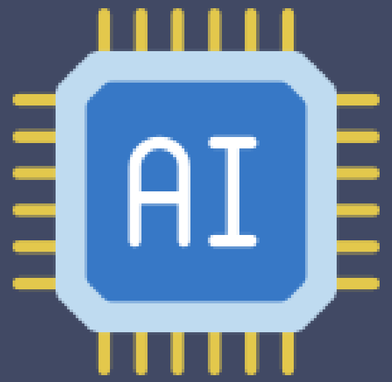

```
## PERP_SEX(null)
## PERP_SEXF                                          ***
## PERP_SEXM                                          ***
```

WHAT I LEARNED



- **My assumptions were challenged** — I initially expected the Bronx to lead in incidents
- Shows the risk of relying on media-driven **stereotypes**
- Supports CNN reporting: NYC shootings rose 73% in May 2021 vs. May 2020

FINAL THOUGHTS



- Data helps fight crime more effectively
- Summer & weekends are high-risk
- Young men are most involved
- Predictive modeling has real-world value


THANK YOU FOR LISTENING
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