Deliverable 2

Police Overtime

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Introduction:

With the Boston Police Department having a budget of over $400 million dollars, we are focusing on analyzing how this money is spent. We have looked at Police Overtime and the relationship between total time worked and overtime hours. However, overtime pay is just one category of BPD spending. Analyzing earnings, demographics, budget, campaign contributions, and field activity datasets we can further analyze how money is used within the BPD.

Data Collection and Processing:

Earnings Data:

This data was provided to us and contained information about the Boston City Employees Earnings. The datasets range from 2011-2022 and contain pay information for each employee, broken up into injury, overtime, regular, retro, quinn, and detail pay. Additionally the total pay for each employee is provided as well as their job title and department. To focus on the pay of the Boston Police Department we had to filter this data to only contain their employees. Additionally, we had to process the columns relating to pay to be floating point numbers so we could perform computations on the data.

Race/Sex of Officers:

This dataset was provided to us and contains limited information about the demographics of the BPD, split by rank into the intersections of race and gender. We only were able to use the data for 2022 and 2023 as the remaining years did not have csv files.

Court Overtime Data:

Each dataset has annual records of officers requesting overtime pay when they appear in court. We have analyzed the number of records for each year to get a better understanding of overtime court appearance for the last decade. This data has STARTTIME and ENDTIME which could be used to calculate hours worked by officers.

Overtime Data:

This dataset ranges from 2012 to 2022. It provides records of officers requesting overtime pay and the address where the overtime took place. We have analyzed the number of records for each year to get a better understanding of overtime for the last decade and the discrepancy between ‘Hours Worked’ and ‘Hours Paid’.

Boston City Operating Budget:

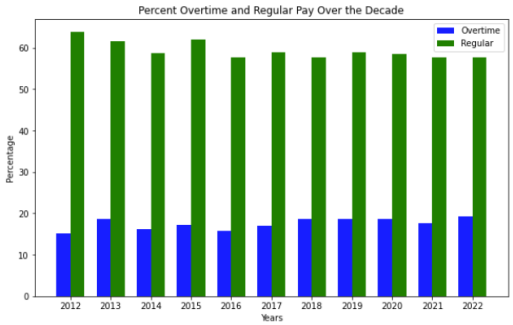
This dataset was not provided to us, and was found on the Boston.gov website. It provides information about the proposed budget for 2024 and the budgets for 2021-2023. This dataset can help us analyze how the budget has changed over time. We first had to replace any missing values with NaN. Additionally, the expense columns had to be formatted to floating point numbers so we could perform computations. Lastly, to look at the budget for the Boston Police Department, we filtered out other departments and only looked at the data relating to the BPD.

Watchlist, Discipline, and Complaint Data:

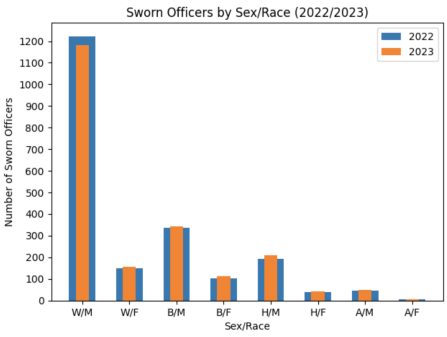
These datasets were not provided to us but required to answer the third question. They provided information about officers who are on the Suffolk County Watchlist, been disciplined for overtime abuse or misconduct, or have complaint records. To use these datasets we had to convert the format of the officer name in each dataset into the same format and remove duplicate values for complaints and salaries. Also calculating the number of years which an officer collected overtime during.

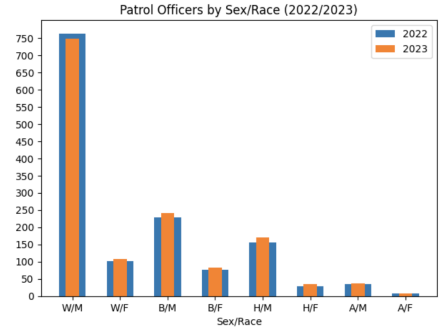
Exploratory Data Analysis:

We explored the Earnings Data by looking at trends between the different types of pay and how they made up the total pay. Most notable were the overtime and regular pay which followed the same general trend.

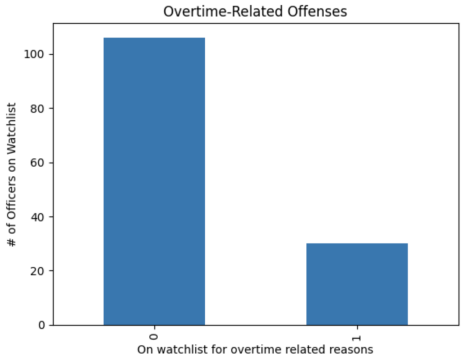


Looking at demographic data we were able to find that the BPD is composed largely of white men. This gives us background context into who will fill certain roles as a reflection of the overall composition of the BPD.

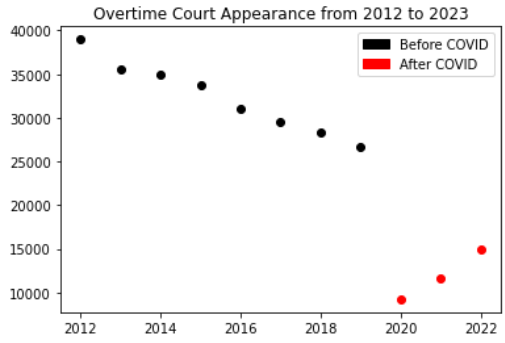




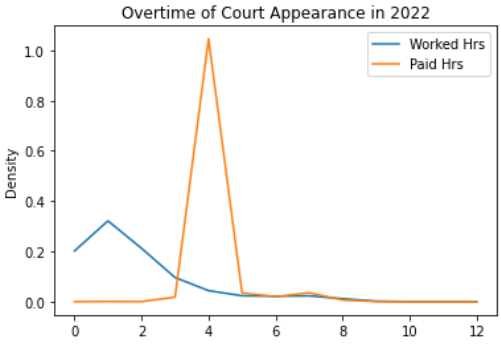
For our third question we wanted to look at the overlap between officers on the Suffolk County Police Watchlist and Officers who had overtime. Looking at the officers who were on the watchlist for overtime related offenses we were able to gain early insights into this overlap.



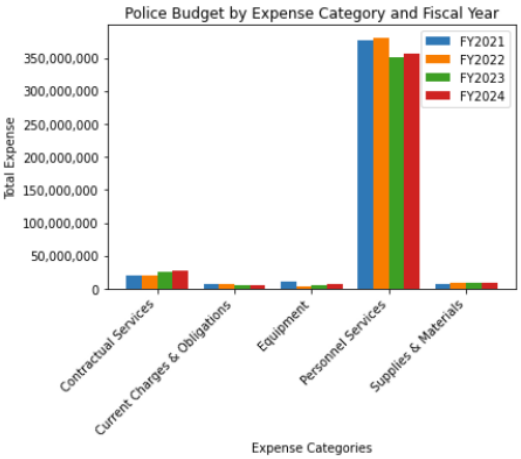
Yearly overtime court appearances (2012-2022) were declining from 2012 (40k) to 2019(27k). After hitting the all-time low of 10k in 2019 due to COVID-19, it is increasing by 3k each year. Also, court overtime data's ratio of paid to worked hours had outliers up to 16.



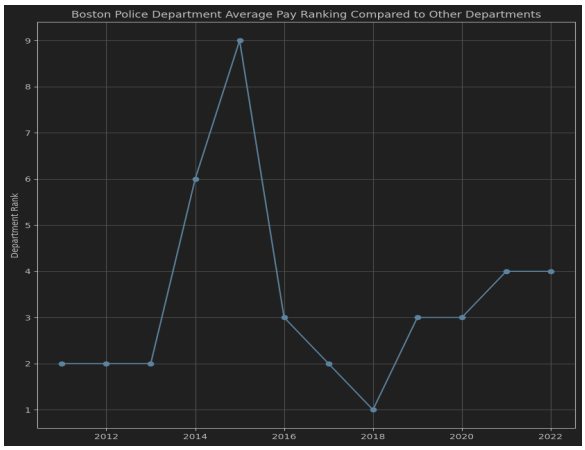
There was a clear discrepancy between hours worked and hours paid in overtime data for each year. 10 years of data all displayed the same pattern: when the hours worked are less than 4, officers tend to request for 4 hours of overtime and this is where the discrepancy was the greatest.



Visualizations, Methodology, and Insights:

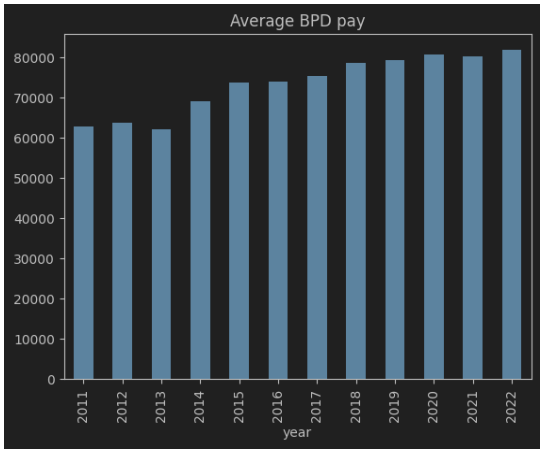


After exploring the data, we began to further analyze the trends we found. Our first key question was to identify financial excess in BPD Spending. We began answering this by looking at how the BPD Operating Budget has changed since 2021. We found that the overall budget had a 4.24% decrease since 2021. Additionally, the budget is broken up between five categories: Contractual Services, Current Charges & Obligation, Equipment, Personnel Services, and Supplies and Materials. Personnel Services has remained the top category for budget in all four years. This category deals with employee pay including overtime and regular pay.

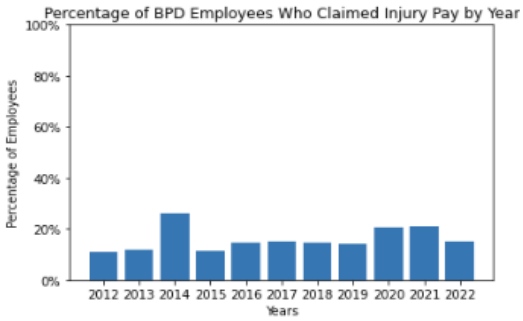


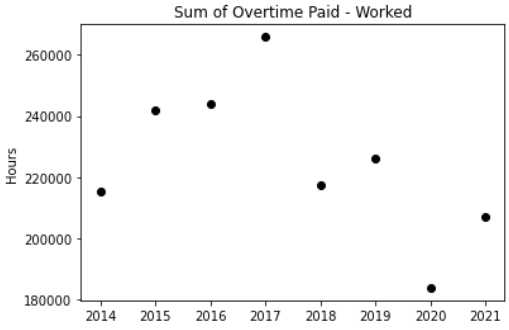
We then looked at the Earnings Data to further analyze how this budgeting money was being spent. From this we could look at how funds have changed intra-departmentally. We found that Officers are consistently the highest percentage of the combined pay for BPD employees, this makes sense given that there are more police officers than other roles. Surprisingly of the top 10 highest combined pay roles almost all had an uptick in combined pay in 2018 while many had a downtick in 2021. Police Detective is somewhat of an exception among the top 10 highest combined pay roles as it reached a peak in 2016 and after falling in 2017 has remained consistent. To compare to other departments, we looked at the average pay of BPD employees versus other department employees and determined the top 10 earning departments. From that we could determine how frequent departments appeared. The BFD was frequently ranked one, meaning they had the highest average pay for many years. BPD on the other hand, frequently ranked 2,3,4 and in 2018 ranked first.

Additionally we analyzed how BPD paychecks have changed throughout the years. We found that the average pay however has gone up from a little over 60,000 in 2011 to upwards of 80,000 in the past 3 years. Regular pay has gone up slightly in the past 10 years, while overtime pay has gone up significantly – it doubled from 15k in 2011 to 30k last year. Additionally we looked at the breakdown of this pay by looking at changes in overtime, quinn, retro, injury, detail, other , and regular pay have changed from 2012-2022. To do this, we looked at what percent each category made up of the total pay for each year. From this data we found that quinn, other, and injury pay had increased whereas detail and retro have decreased. Overtime and regular pay have remained consistent.



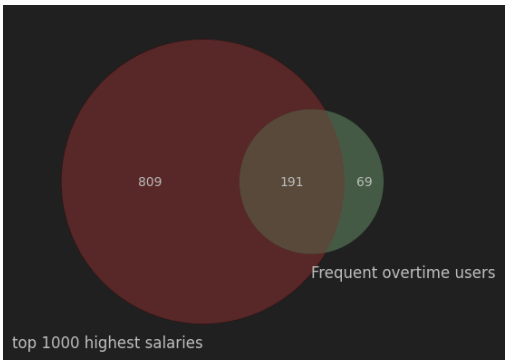
Lastly for this question, we looked at how much BPD Officer pay came from injury pay. Looking at BPD earnings from 2012-2022 we found that Injury pay has increased overall, with a slight decrease in 2022. Additionally we found that on average across the decade 15.9% of BPD employees claimed Injury pay.

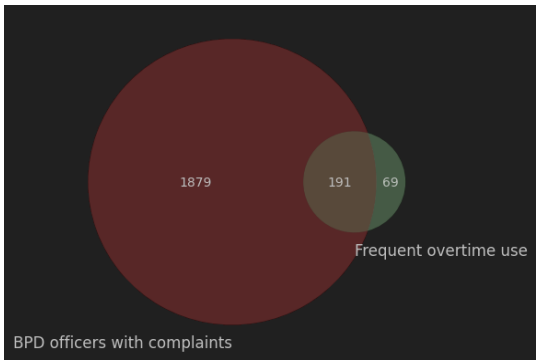




The next question we had to answer was to characterize wasteful BPD Overtime practices. To find the discrepancy between overtime hours paid compared to overtime hours worked, we analyzed overtime data from 2012 to 2022. The annual difference ranges from 180k hours to 260k hours but no pattern was found. The year of 2017 displayed maximum value and year of 2020 had minimum value. However, overtime data did not have hourly pay for each officer and having the same rank can't guarantee equal pay, we have not yet calculated the discrepancy financially. Distribution of ratios of overtime worked vs. overtime paid is skewing to the right as time goes by. As the data gets skewed, the number of outliers is increasing. Outliers have a ratio of 16.

Our final question was to look at the overlap between frequent overtime users and officers who have the highest salaries, are listed in suffolk county police watch list, have been previously decided for overtime abuse, or have internal affairs complaints. To do this we looked at the top 10% of officers who frequently claimed overtime (260 officers). We found that there was not a large overlap between frequent overtime users and the Suffolk County police watch list or officers who have a record of previous disciplinary action. We found that the vast majority of officers who were on the list had some form of internal complaints record, with 191 of the 260 checked. We found that 73% of the officers who were frequently using overtime had a salary in the top 1000 salaries in the Boston police. Overall there does appear to be some connection between the officers who took the largest amount of overtime per year and the officers with the highest pay, and with a record of internal and external complaints.





Extension Proposal:

Pitch:

Analyzing the impact of Boston Police Department presence and activity on Community Safety and Perception

Rationale:

This extension explores beyond the specific financial aspects and delves into the impact of police operations on community safety and public perceptions. Given the significant budget allocation to the BPD, it's important to understand how police presence and activities can correlate with crime rates, community safety, and public trust in Boston. This analysis can reveal insights into the effectiveness of police spending and strategies, and whether they align with community needs and perception.

Questions for Analysis:

- Are the crime rates lower in areas with higher police presence?
    - Are they higher in areas with lower police presence?
- Is there any relationship between police pay (specifically overtime) and improvements in community safety?
    - Are police officers with more overtime in places with higher/lower crime rates?
    - Is there any relationship between the police budget and crime rates in Boston?
    - Are there correlations in pay and crime for police officers?

Data Sets and Sources

To answer these questions we can look at the earnings and field data which were provided to us. We can also look at the datasets provided by the City of Boston as there are datasets for crime that we can look at.

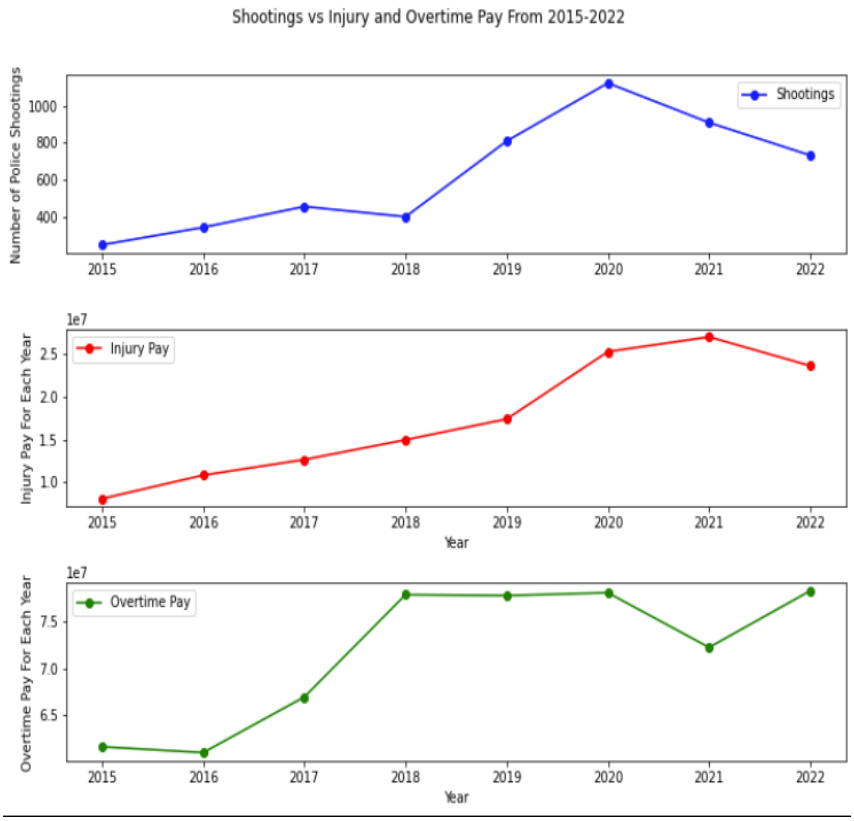
Data Visualizations

We can cluster the locations in the field data to show areas where higher crime occurs. Additionally we can create heat maps to display criminal activity in different years focusing on years with discrepancies in police presence. Bar charts can be used to compare crime reduction effectiveness across different types of police activities. We can use scatter plots to graph the relationship between police activity intensity with changes in crime rates.

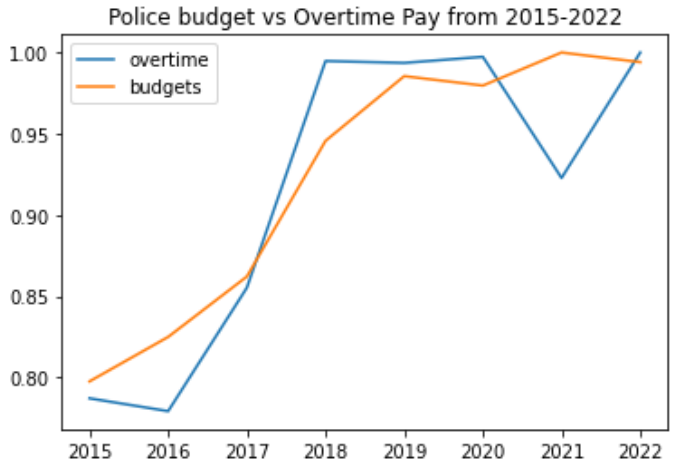
Additional Information:

It might be useful to look at police field activity, crime rates, and spending throughout the years to see how or if these relationships have persisted over time. We also plan to use statistical models for analyzing correlations between police activities and crime rates.

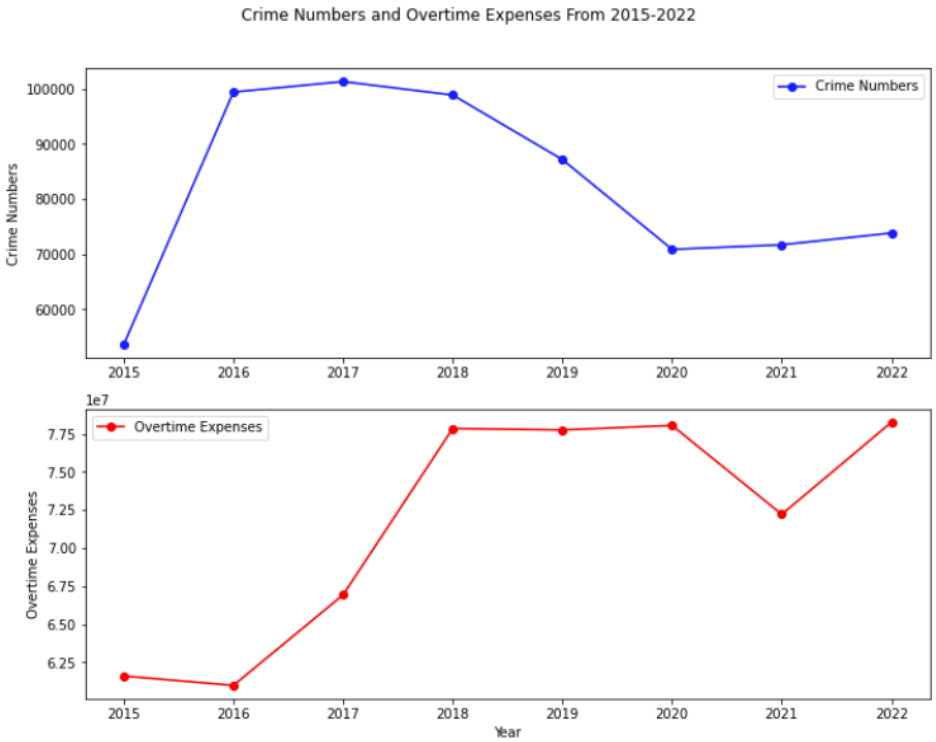
Extension Data Analysis:



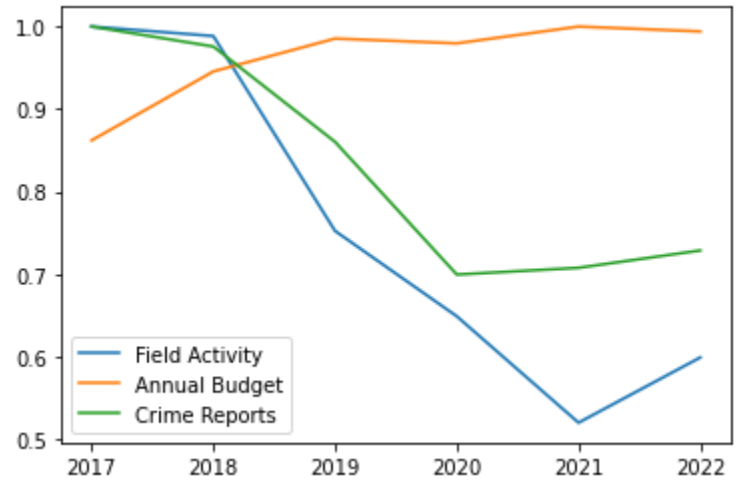
To see if there were any correlations between time and pay we looked at crime data provided by the city of boston which showed if a shooting was involved. Graphing the number of shootings in a given year, we can compare this number to the total injury pay and overtime pay claimed by BPD officers. From this graph there seems to be a trend in shootings and injury pay.



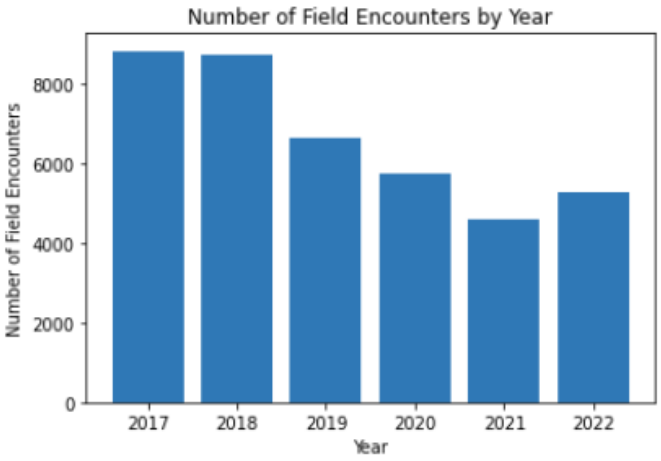
Analyzing the annual budget of the Boston Police Department and annual overtime pay, there is a strong correlation between the two variables. This tells us that from 2015 the ratio of overtime pay to annual budget has been relatively consistent.



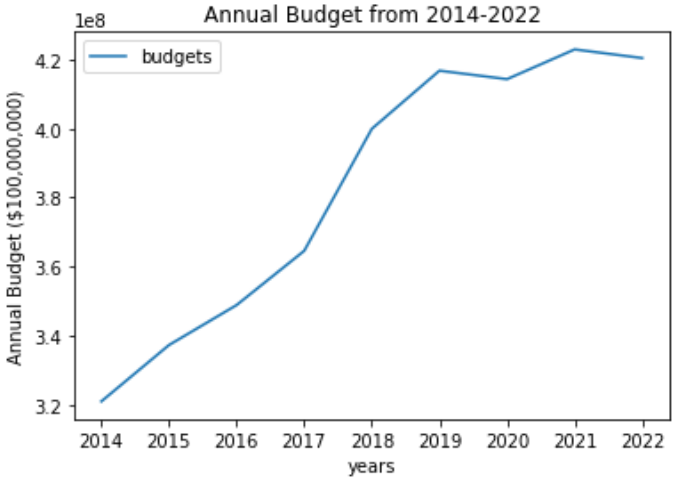
We were able to total the number of crime reports for each year from 2015-2022. In doing so we could compare this to police overtime expenses.There did not seem to be much of a correlation between the two, namely from 2020-2022.



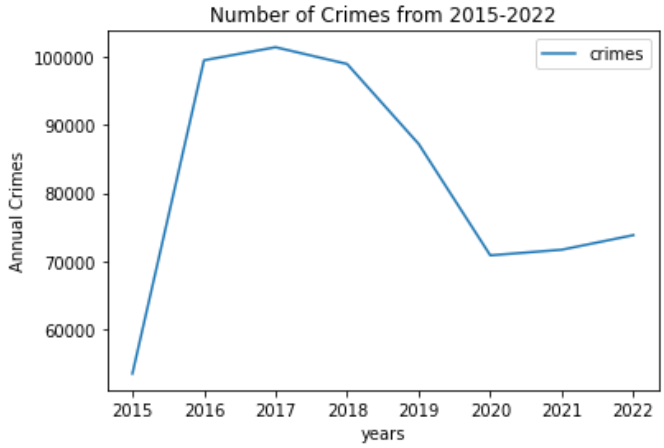
We analyzed the trend of budget, field activity and crime reports data to discover the relationship from 2017 and 2022. For better visualization, each data was divided by the maximum value of each data so the Y-value ranges from [0,1]. Number of field activity and Crime reports seem to have a positive correlation. However, while these variables were declining overtime, the annual budget was increasing and seems to have no relationship.



Number of field encounters from 2017 to 2022 is steadily decreasing. Encounters were most frequent in 2017 with 90k but decreased to 45k in 2021.



Annual budget is steadily increasing from 2014 to 2019. During the pandemic, the Boston Police Department budget was cut down and after 2019, increase of budget has slowed down.



Trends of number of crimes from 2015 to 2022 shows a unique pattern. Crime nearly doubled from 2015 to 2016 and reached 100k. However, after hitting a peak in 2017, it begins to decline until 2020 with 70k. In 2021 and 2022, the number of crimes in Boston is increasing by 5% each year.

Individual Contributions:

David White:

I Initially focused mainly on the field data. I combined a few datasets and did some preliminary analysis of a few of the years. I then worked on our first question which was about identifying trends in the BPD budget. Here I combined the data between 2011 and 2022 to look for trends in spending and the way that the budget and pay of officers changed year by year, and finally answered the third question by finding the percentage of officers who have the highest total overtime requests and how it overlaps with other categories.

Ashton Fox:

I spent a lot of time trying to figure out what a possible use of the field activity was, but ultimately couldn't see any immediate use we could have for it, so when the race/sex data among officers came out, I focused on that. I had a small sample to work with, but comparing the differences - or lack of - between years can hopefully give insight into where in the BPD these anomalous instances can lie. I also read into two other datasets, the BUPD watchlist dataset and civilian complaint dataset, to help answer the third question.

Seunghwan Hyun:

I answered Question 2 (Characterizing Wasteful BPD overtime practices) with a focus on overtime data and court overtime data. I visualized the relationship between worked hours and paid hours for overtime data and overtime court data from 2012 to 2022 and discovered the discrepancy between the two. I compared the annual distribution and sum of overtime and discovered that for overtime worked less than 4 hours is where the discrepancy was the greatest. Annual sum of difference had no particular pattern but ratios of worked vs paid overtime had significant outliers up to 16. Court appearances were steadily declining before COVID but have risen afterwards.

Ahmad Sadiq:

My primary goal was to identify instances of financial excess in BPD spending (so question 1). I meticulously compared the year-over-year changes in the BPD budget, pinpointing areas where funds had increased or decreased, both overall and within specific departments. By breaking down the data, I was able to discern how funding allocations shifted between departments over the two years. In my recent analysis, I expanded upon my initial examination of BPD financials, delving into the broader implication of police spending on community safety and perception. Utilizing the diverse range of data sets, being crime statistics, police activity logs, my contribution lies in correlating these factors to assess the effectiveness of police impact in the community safety and perception.

Emily Opresnick:

Initially I focused on processing and analyzing the Campaign Contribution data. After discussing this with the group, we found that this data did not help answer our main questions. Instead, I began working on answering the first question about financial excess in BPD spending. To do this, I looked at the data in the earnings datasets from 2012-2022. Additionally, I looked at the Boston City Budget Data set to further understand how the budget has changed over the past few years. Lastly, I began working on the extension question by exploring the data.