CPDP Project - Checkpoint 02

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Data Science 339

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Q.1: Does this code compile and run without significant effort on the part of the reviewer?

Ans.1: Yes, please refer to Tableau file and README.

Q.2: Quantitative Analysis. Does the code answer the questions from the proposal?

Ans.2: Yes our code answers the questions from the protocol:
a) How are TRRs of different types of force distributed amongst officer seniorities?

The plots (Figure 01) show that the occurrence of TRRs are generally grouped to occur most frequently around the 5th year of an officer's career. Verbal Commands peak the earliest in the typical officer's career, reflecting the results we obtained for checkpoint 1. Firearm use is more skewed to slightly more senior officers, with a peak after officers have 5-years of experience. Meanwhile, taser use is most heavily distributed to more senior officers compared to all other force types.
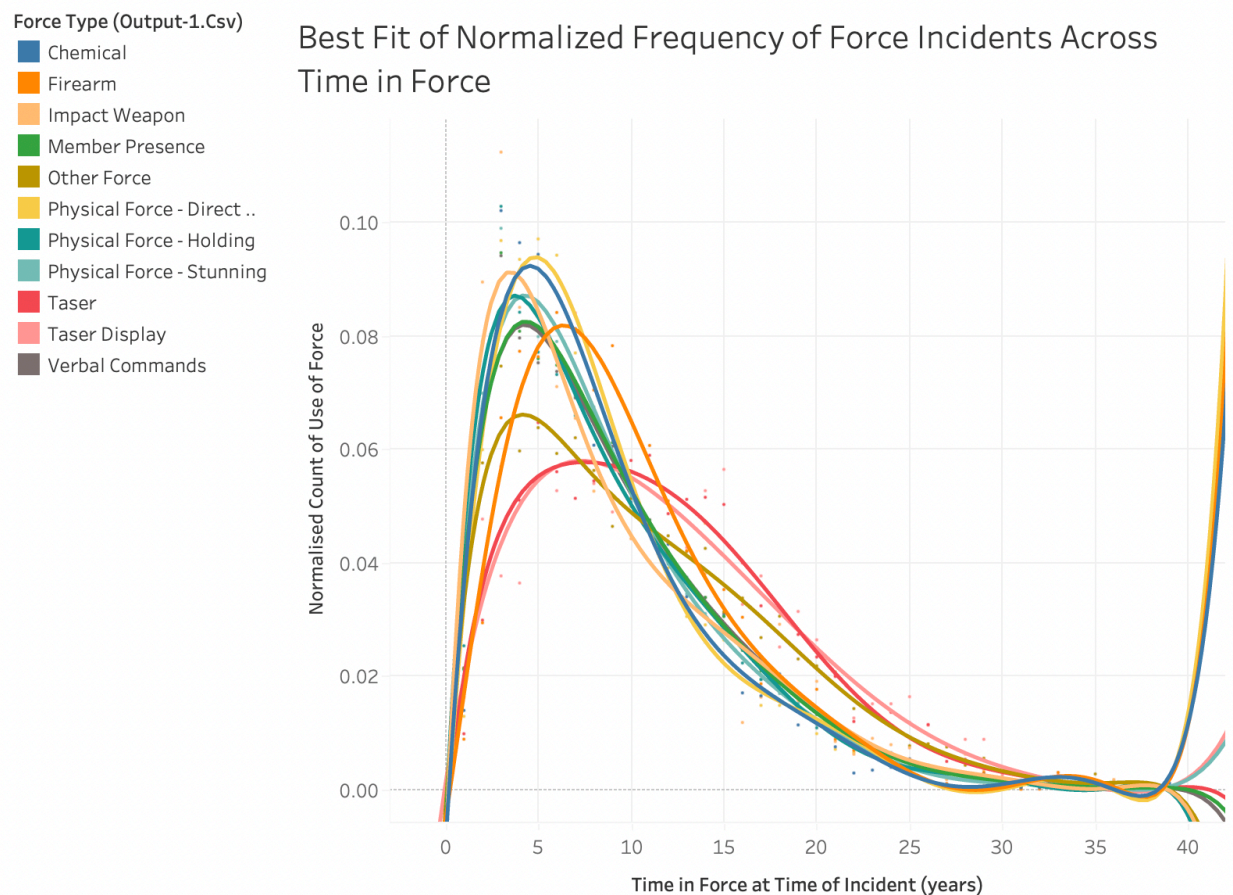

Figure 01: Best Fit of Normalized Frequency of Force Incidents across Time in Force

b) Amongst officers that had filed a TRR regarding use of force, what was the average time these officers had spent in the force at the time of the first TRR report? (Refer to severity grading chart (hyperlink here))

As shown in Figure 02, the average time spent in the force at the time of the first TRR incident report ranges from 3225 days to 4620 days. On average, it takes less time for the first occurrence of a more severe use of force, such as chemicals (3225 days), impact weapons (3292 days) or firearms (3452 days). Comparatively, it takes longer for the first occurrence of a less severe use of force, such as verbal commands (4620 days) or member presence (4567 days). The mean time for first incident across all types of force is greater than the median, suggesting a positively skewed distribution.
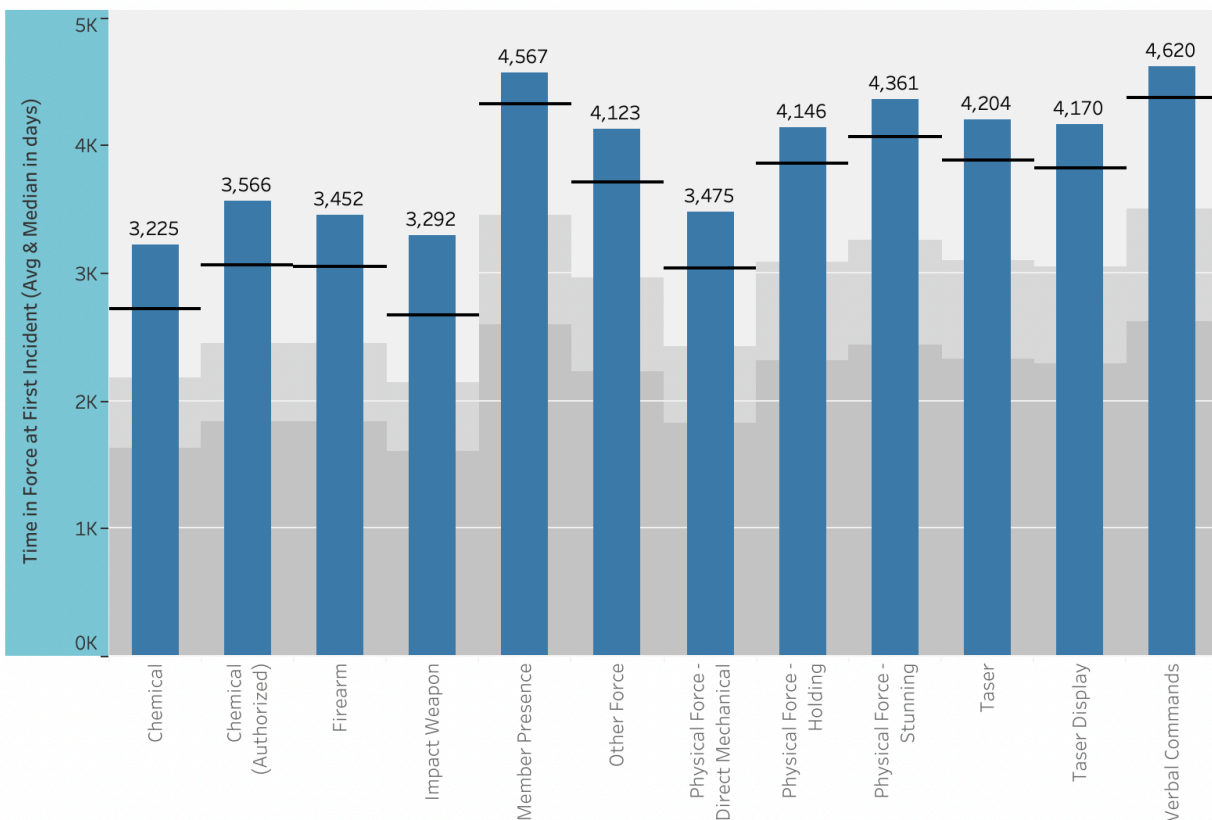

Figure 02: Time in Force at First Incident

Q.3: Qualitative Analysis: Does the analysis described in the write-up adequately analyze the problem we are investigating? Was it thoughtful and thorough? Does it reveal interesting open questions *(optional)*?

Ans.3: The distributions illustrating the frequency of TRRs with different force types across an officer's career is striking for a number of reasons. Their log-normal shape (Figure 01) is particularly evident, and while the plot shows a smooth fit to the data, a log-normal shape is clearly present in the underlying data. We hope to investigate the nature of this shape, as it is indicative of a distinct statistical process. These clear distributions allow us to visually determine two important characteristics of how TRRs occur through an average officer's career: firstly, the mean of the distribution is clearly visible as the peak; and secondly, the qualitative shape of the distribution (for example, a fatter distribution tail towards more senior officers) tells us about more nuanced characteristics about the distribution of officer behaviors, beyond just the mean.

We can see that verbal commands, as expected from our prior results in checkpoint 1, are typical of more junior officers in the force, with a steep spike well before the 5-year point. Comparing this line to "firearm", we can see that firearm TRRs are distinctly shifted to more senior (but still relatively new officers), with the peak after the 5-year point. An investigation to explore is that officers that are prone to firearm use are more likely to quitting the force early - perhaps because of trauma from the event - and thus the firearm usage is skewed to younger officers by this effect of selection, as we had expected this rise to be slower and more shifted to even more senior officers. In our graph for first occurrences (Figure 02) we can clearly see a similar skew, suggesting that younger officers are more likely to use a firearm. The fact that the means are generally higher than the medians across all types of force, we observe that this implies a log-normal-like distribution to this dataset, which is reinforced by the curve from Q1 (Figure 01).

We can also see that taser use is particularly prominent among relatively senior officers - more so than any other use of force. We have been interpreting taser use as a more intermediate use-of-force (somewhere between verbal command and firearm), and therefore this partly goes against one of our hypotheses that more severe uses of force become more common with seniority. Within itself, this raises more questions: why are tasers such a strong outlier (in terms of the bulk of the distribution being around significantly more senior officers)?. Are junior officers more likely to use other means of force (such as a firearm) in the same situation where more experienced officers have learned to use tasers? A good way to approach this would be to break down the usage by geography, as distinct beats are most likely to best isolate unique circumstances. It could be possible that as officers become more senior, they are moved to beats that somehow prompt taser use, while more junior officers are assigned to beats that preclude taser use in favor of other force types.