36104 DVN Assessment Task 3: Visual Analytics Project

Topic: Gun Violence in USA

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Contents:

1. **Introduction:**

Gun-related violence is a serious problem today. The two major categories of Gun related deaths are: Homicide and Suicide. In a 2010 study on violent death rates, it was found that the USA had the highest number of Gun-related Deaths among the 37 OECD Nations[1] with a significant margin. USA also has about 48% of the total 875 million guns in the world, as indicated by a study done gunpolicy.org, which is highest in the world[2].

2. **Current Literature:**

The current literature in the study of Gun violence points us in a few areas. It is interesting to note that about 30-40% of all the gun ownership transfers that occur without involving a licenced dealer, account for most guns used in crimes. Another common theme noted is that lot of crimes happen due to inter-state gun trafficking which use the weak Federal laws designed to curb inter-state weapon sales. In New-York City, 85% of the weapons that were recovered from crime scenes were from out of state sources[3,4].

To deal with this problem, while public health experts focus on the prevention policies and tougher laws, like background checks, ban on military-style assault weapons and crack-down on gun trafficking[5]. The National Rifle Association, post the massacre of school children in Newtown in 2012, blamed the untreated mental illnesses rather than the loose gun laws for such incidents[6]. A study on mental illness and reduction on gun violence showed that most people with mental disorder are not violent and the violence is caused by other factors. Also, suicide victims, which account for large number of gun fatalities, do indicate psychiatric disorders such as depression.

Research also suggests that environmental characteristics such as distribution of income can have an influence on aggressive and violent behaviour[7]. It is also noted that the aggression and violence is often concentrated in disadvantageous communities that are racially and socioeconomically segregated in the society[8]. So, this becomes a spiral effect as the people with socio-economic disadvantage to begin with at early age are exposed to more violence in their communities and are at a higher risk of being involved in gun violence.

3. **Topics of Interest:**

As we could read, the studies point in a few directions. We can investigate the correlations, if any, between gun related violence on Gun availability. There is plenty of debate on the Gun related policies and we could analyse the impact of Gun laws at a state level to the gun related violence. It would also be interesting to look in the relationship between gun violence and socio-economic inequality and racial segregation. From the available data assembled from gunviolencearchive.org, we could explore the Gun violence incidents and trends. Post current data exploration we can add further data sources to our study to cover the topics of interest.

4. **Data Sets:**

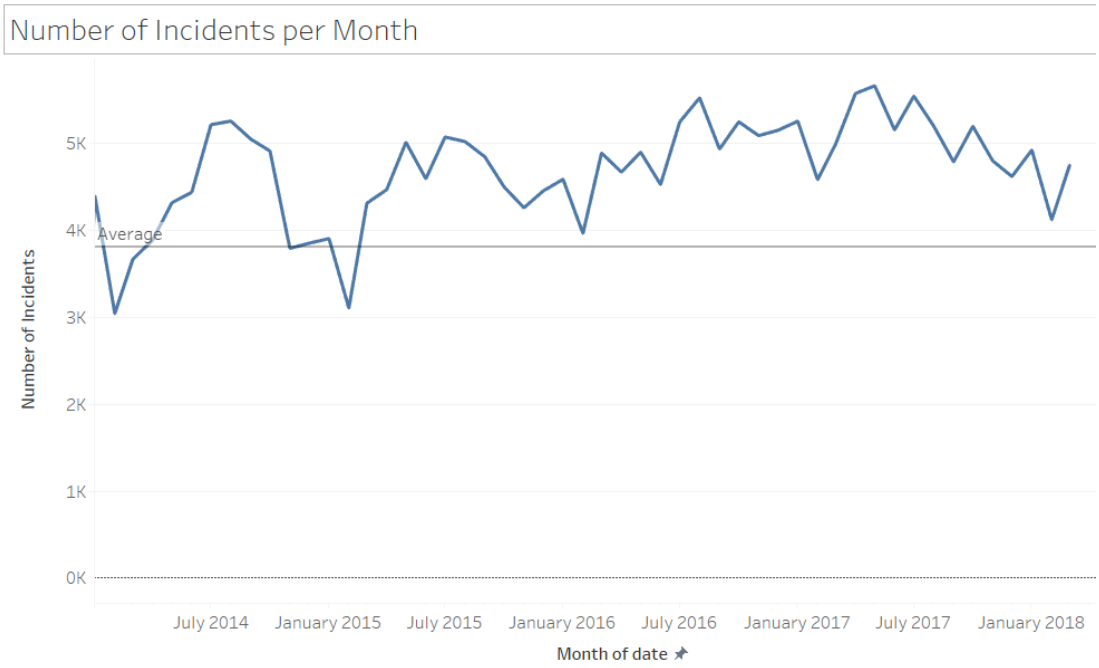
1. For our study, we have chosen the recorded gun violence data from U.S. between January 2013 and March 2018 from the source: gunviolencearchive.org as the primary dataset. This dataset was scraped from the gunviolencearchieve.org website and complied into a large 150mb csv by James Ko, more details into the compilation process can be found at: https://www.kaggle.com/jameslko/gun-violence-data
2. The U.S. State Firearm Laws dataset was obtained to analyse correlations from the http://www.statefirearmlaws.org/national-data website which maintains state-wise fire arm laws since 1991.
3. Number of registered weapons in the U.S. in 2019, by state dataset, collected by an ATF survey in May 2019 available at https://www.atf.gov/resource-center/data-statistics and is compiled by Statistica: https://www.statista.com/statistics/215655/number-of-registered-weapons-in-the-us-by-state/
4. The US State-wise Population dataset is collected from the Wikipedia[11] and lists it's source as the US census website https://www.census.gov/data.html
5. Top cities with mixed race population dataset is collected from Wikipedia[12] and lists it's source as the US census website https://www.census.gov/data.html

5. Data Preparation:

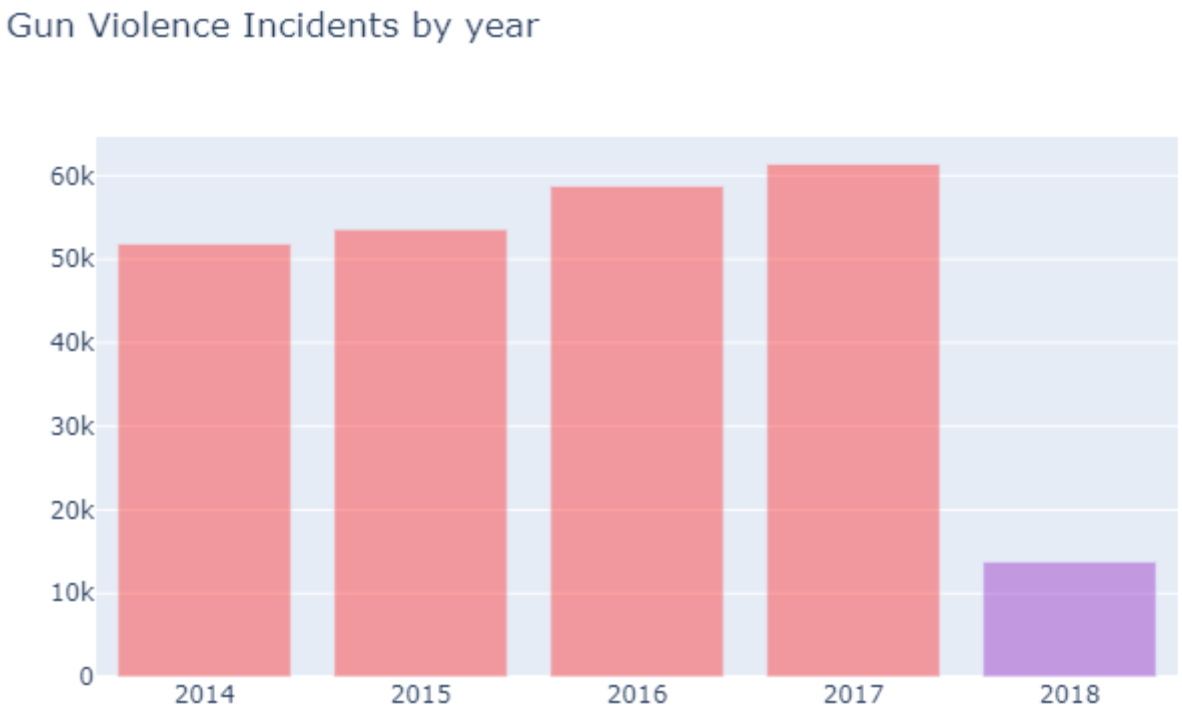
1. The dataset1 had a missing entry of the Las Vegas mass shooting, which was pointed out in the discussion thread at https://www.kaggle.com/jameslko/gun-violence-data/discussion/55307 This has been addressed by adding the entry from the Wikipedia source https://en.wikipedia.org/wiki/2017_Las_Vegas_shooting The detailed step is mentioned in the python notebook.
2. Additional fields have been extracted from date to group by year and month to see the trends in python.
3. For state/city level analysis in tableau, the data was grouped by state/city in excel and connected to other data sources like population, state level firearm data, state level gun availability data and city level mixed race data in tableau.

6. Trends:

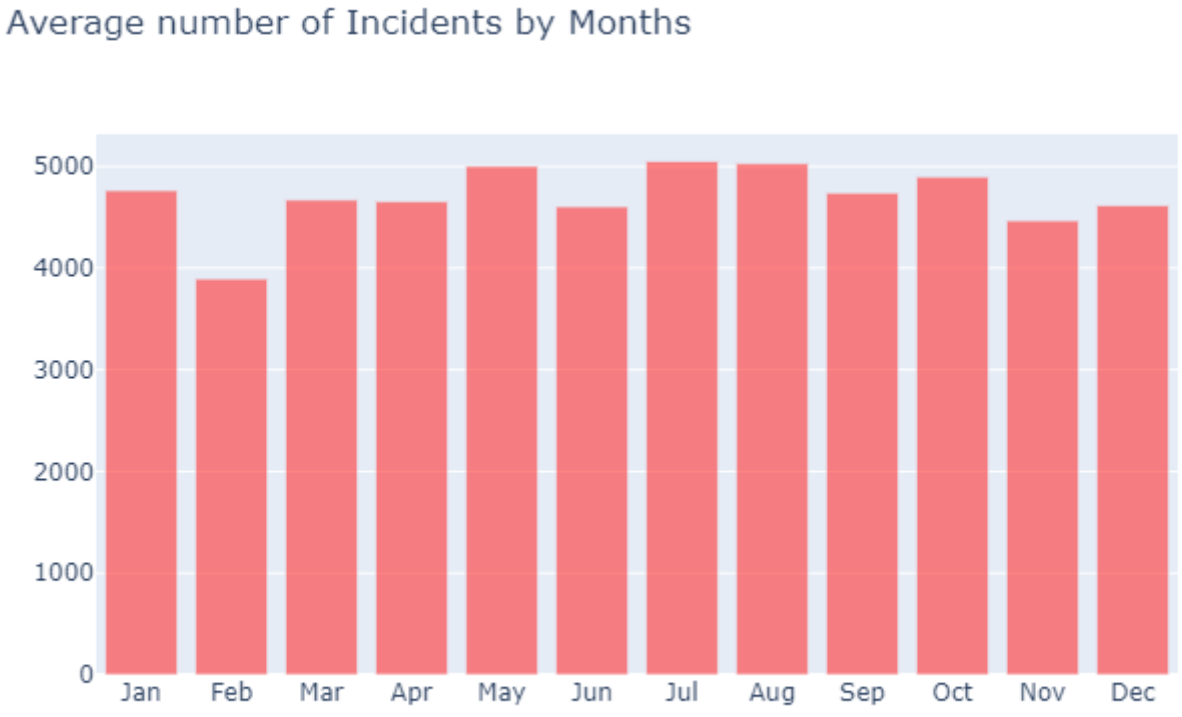
Let us investigate the Gun violence Incidents in the period of 2013-2018. As we can see from the chart below, the number of Gun violence incidents, averaging around four thousand per month, seem to be slowly rising. We can also notice a seasonality nature in the graph with the month February having lower incidents. Let us break this chart further as the trend and seasonality is not obvious.



Below we can see the slow rise in annual incidents. Note that the data for 2018 is only available till March and the data available for 2013 was aggregated so we should ignore those two years for our analysis.



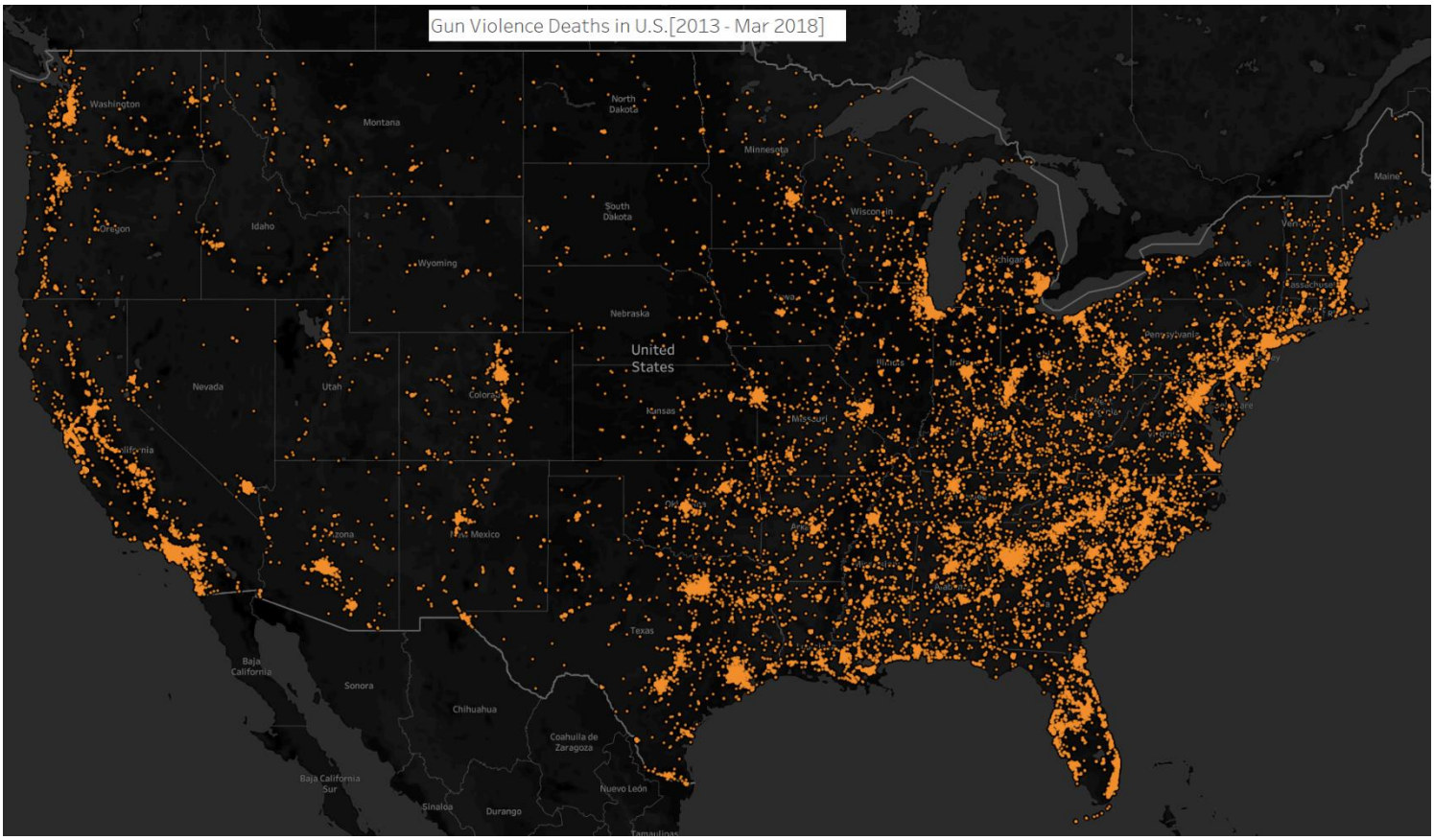
In the below chart we can see the monthly pattern in incidents. July and August seem to have high incidents and February has the least.



7. Further Exploration

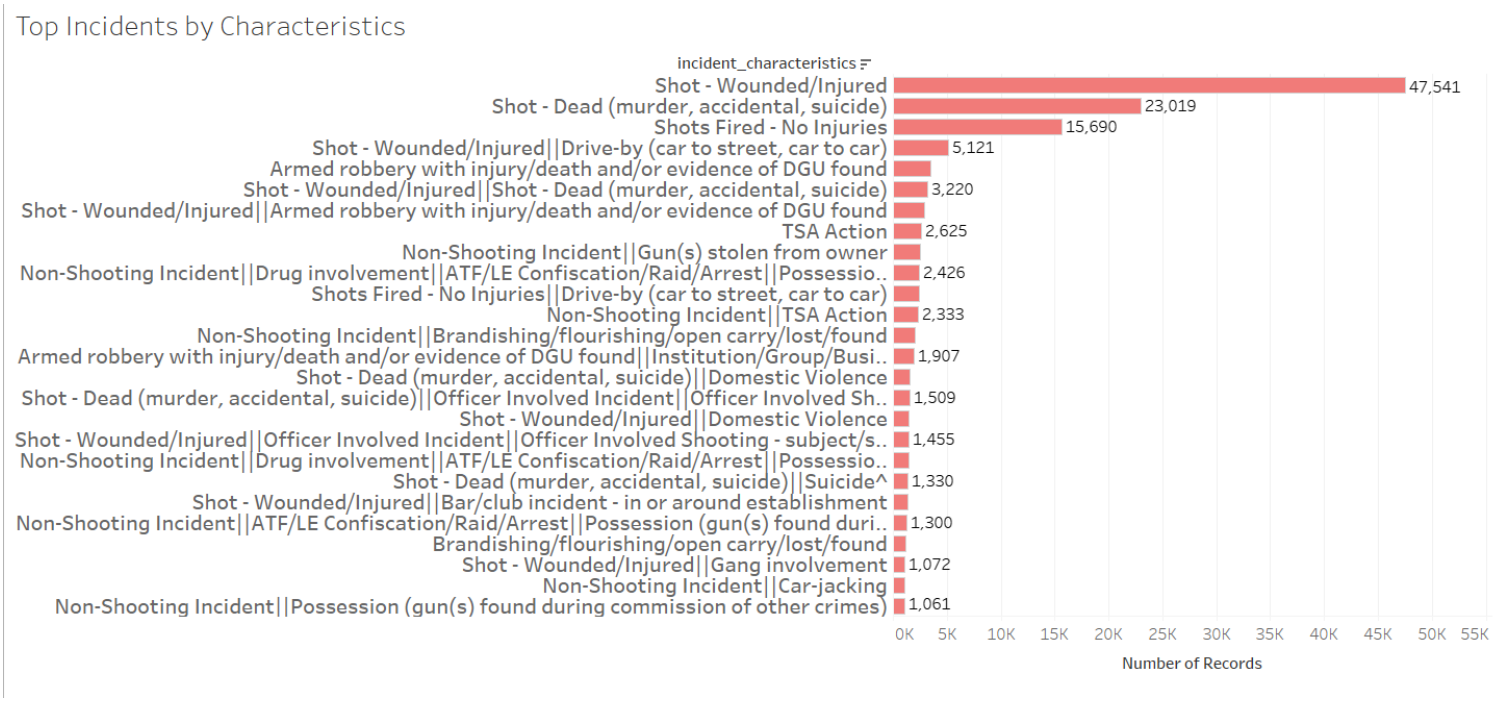
a. Incidents Scatter Plot

Now let us look at where these incidents have taken place in the USA. The below scatter plot on the USA map shows the Gun related incidents which have had one or more fatalities. The incidents are spread across and we can see certain areas like Texas, Florida and California having a high density of incidents. We can investigate these further at a state level.



b. Incident Characteristics

Here we analyse the top characteristics reported on the incidents. As this is a text field with many blank values, we are looking into the top characteristics which have been reported. Here we can see that the Shot- wounded/injured and Shot- Dead are the top two categories. It is important to note that here are also instances like armed robbery with injury where no shots have been fired but the guns are involved in the robbery or non-shooting incidents where guns are found at the crime scene.



c. Key Locations Noted

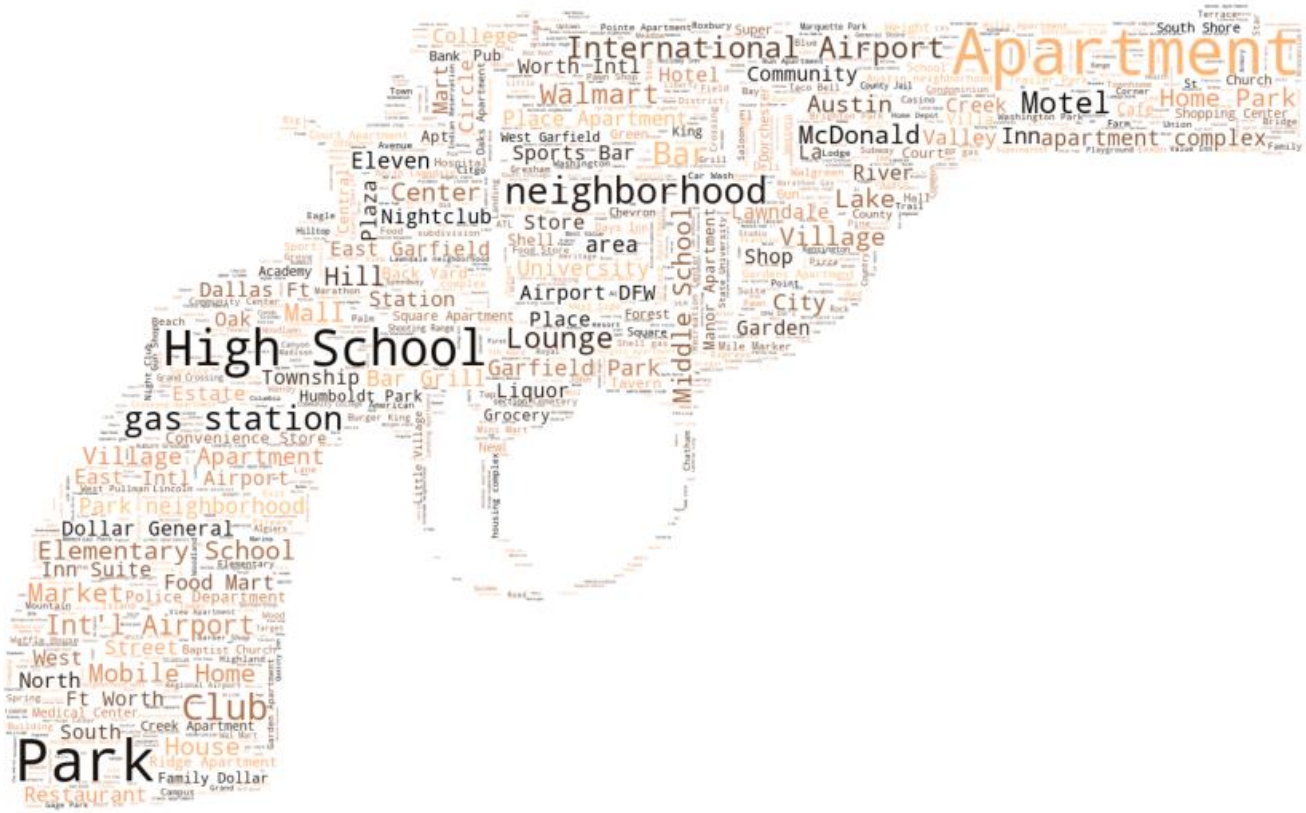
Now let us look at the most reported locations of gun violence within the city/county. This is again text field data so to analyse it, we use the word cloud technique seen below with the most common places of incidents appearing in larger font sizes. Common English stop-words like “and, the” have been removed before plotting. Here we can easily spot some of the prominent spots for gun crimes as:

Airports, Apartment, Schools, Gas station, Park, McDonald, Motel, Walmart, 7Eleven and Club.

One can observe that some of these are popular places common across states generally which are open till late night like gas station, 7Eleven, Airports and McDonald.

The most worry-some seems to be school shootings which have been recognized as a social problem since 1997[14] and research indicates that it is more likely to occur at schools that follow corporal punishments[15].

Key Locations of Incidence



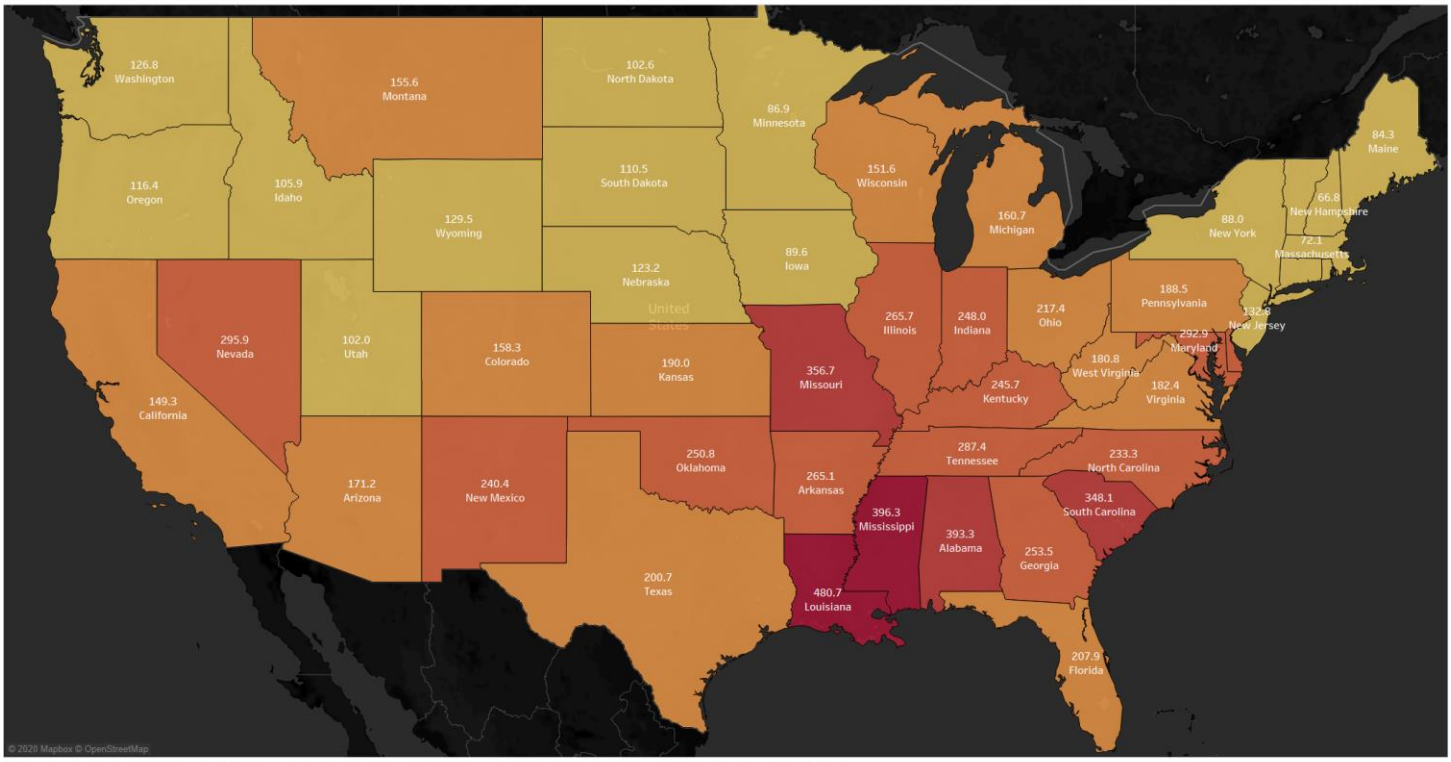
8. State/City Level Analysis:

a. State-Level Overall

While looking at the overall number of incidents it was found to be highest in the states of California and Texas which made sense due to their large population size. So below we look at the population invariant figures by analysing Gun related deaths per a Million(DpM) people in the state. Here we can see the states with high number of DpM in darker red as Louisiana, Mississippi, Missouri, Alabama, Alaska(not seen on map) and South Carolina. It is

interesting to see here that many of these states are in the same neighbourhood, re-instating our earlier observation of weak inter-state federal laws to prevent gun trafficking[3,4].

Gun Violence Deaths Per Million Population

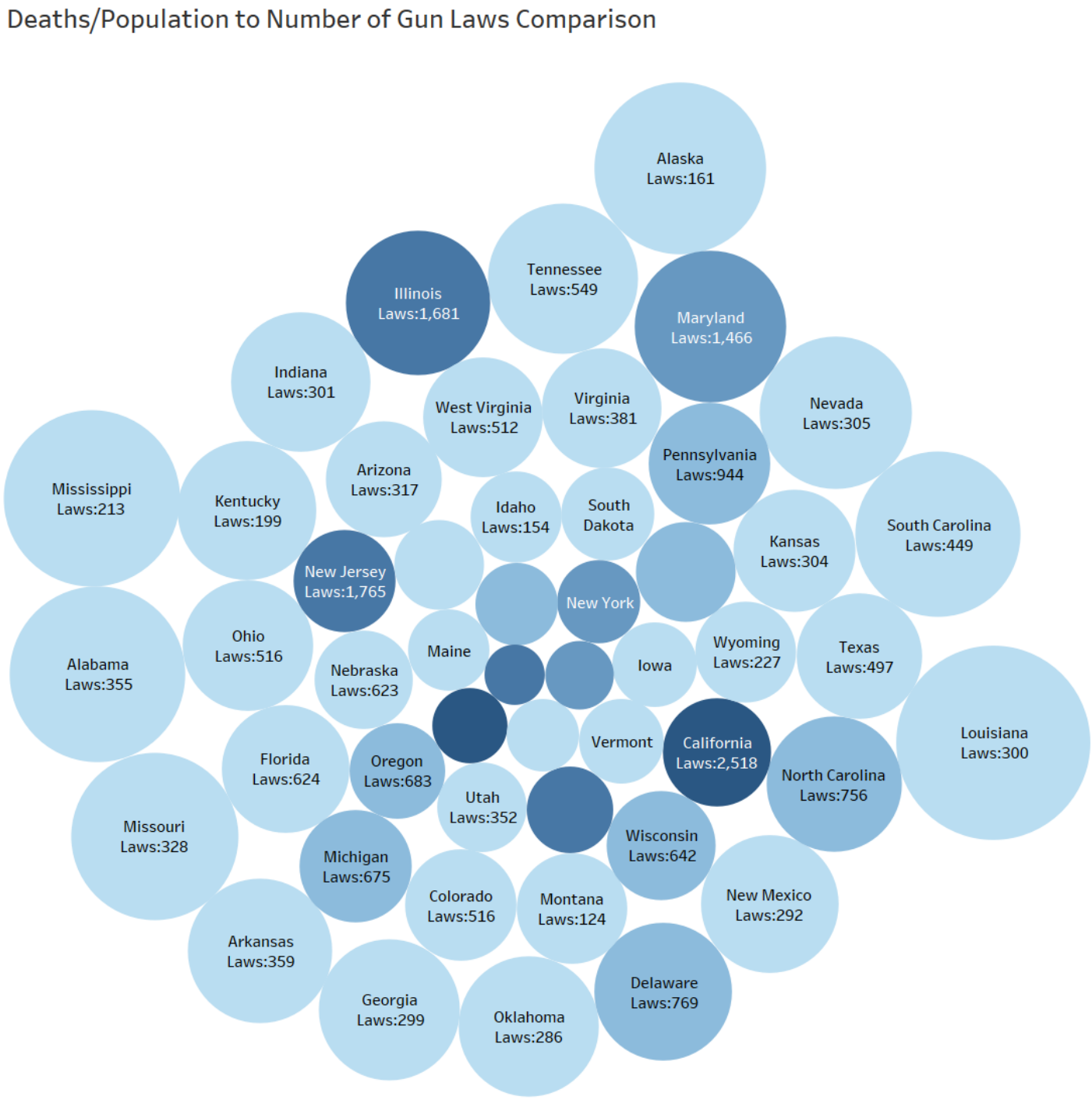


Map based on Longitude (generated) and Latitude (generated). Color shows sum of Kill/pop. The marks are labeled by sum of Kill/pop and State. Details are shown for State.

b. Gun Violence Comparison with Gun Laws

Here we compare the gun violence against the gun laws in the state to see if there are any correlations. We are comparing the earlier seen figure of Deaths per Million(DpM) in each state to the total number of gun laws that the state has. We do this using size and colour, with larger size indicating higher DpM and darker colour indicating a greater number of gun laws. Below we observe that, states with a greater number of gun laws are usually smaller in size and have les Deaths per million, although there a couple of states like Illinois and Maryland which do have a high

DpM. From this we can see that the Number of Gun laws is generally inversely proportional to the Gun related Deaths with some exceptions.



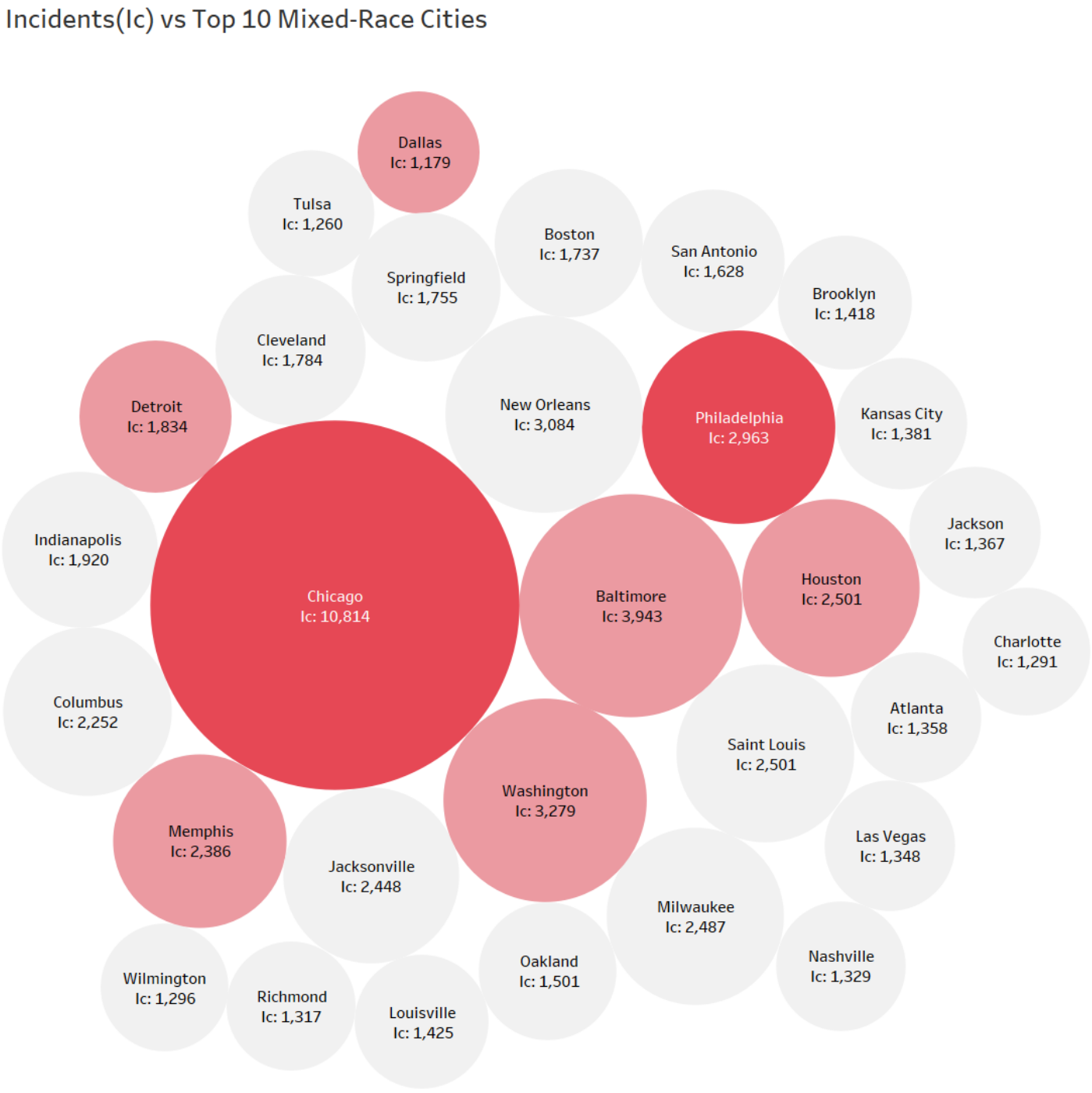
c. Gun Violence comparison with Gun Availability

Here we compare the Gun related Incidents in the state to Gun availability. To make the analysis population invariant, we used both incidents and guns available as a proportion of the population in the state. Here we can observe the states with higher Incidents per million(I) are with larger size in the centre and state with higher guns registered per thousand people are in darker colour. There was also an outlier state Wyoming with over 230 guns registered per thousand people and has been removed from the below analysis. In the chart below we are seeing a mixed pattern, there are plenty of states with high incidents and higher gun availability but there also states with high incidents and less gun availability. The chart seems inconclusive of a clear correlation.

d. Gun Violence comparison with non-white population

Here we are comparing the city level gun violence incidents. The data on US cities with maximum African American and mixed-race population is collected from the census Is compiled at Wikipedia giving only a list of top 10 cities with the mixed-race population. We compare it against the cities with maximum Gun violence incidents recorded. The size indicates the number of incidents and the colour indicates weather the city is in the top 10 list of mixed-race population with decreasing density. It is astonishing to note that 8 out of these top 10 cities feature in the list of cities with high gun violence incident with 4 out of top5 cities being included. This is a very strong suggestion that number of Gun violence incidents are correlated to the mixed-race population. It re-

in-states the notion that violence is often concentrated in disadvantageous communities that are racially segregated in the society[8] and needs further investigating.



Conclusion:

In the study we looked at the US Gun violence Incidents dataset as US reported to have largest gun related deaths among the OECD nations. Research suggested weaker gun laws within state and at federal level could have an impact on gun violence. There were media reports on the increasing mass school shooting incidents and research on racial or economic segregation influencing violent behaviour.

In the analysis, there were certain key findings:

1. The gun violence incident trend is upwards, each year.
2. The common locations of violence include places which are open till late like Gas station, 7Eleven, McDonalds and important places like Airports and Schools
3. The State level Analysis showed high violence per population in neighbouring states in same geographic region: Louisiana, Mississippi, Alabama and Missouri, Georgia, South Carolina which re-instate the research opinion of weak inter-state federal laws on gun control.
4. Gun related deaths comparison with the number of state gun laws showed a negative correlation
5. Gun related incidents comparison to registered guns in the state did not show any conclusive case.
6. Comparing the city level gun violence incidents to the top 10 cities with African-American and mixed-race population showed that 4 out of top 5 cities with Gun violence had large non-white population, suggesting possibility of racial discrimination perpetrating violence[8,16] and needs further investigating.

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Appendix

AT1 A Further Exploration Note:

Further, the Incidents need to be categorised at a state level to see the impact of violence. Gun violence insights on incident type and weapon types should be studied. Further, datasets of socio-economic, state census, state gun laws and gun availability can be explored to correlate to the state/county level gun violence statistics.

State-wise absolute numbers: