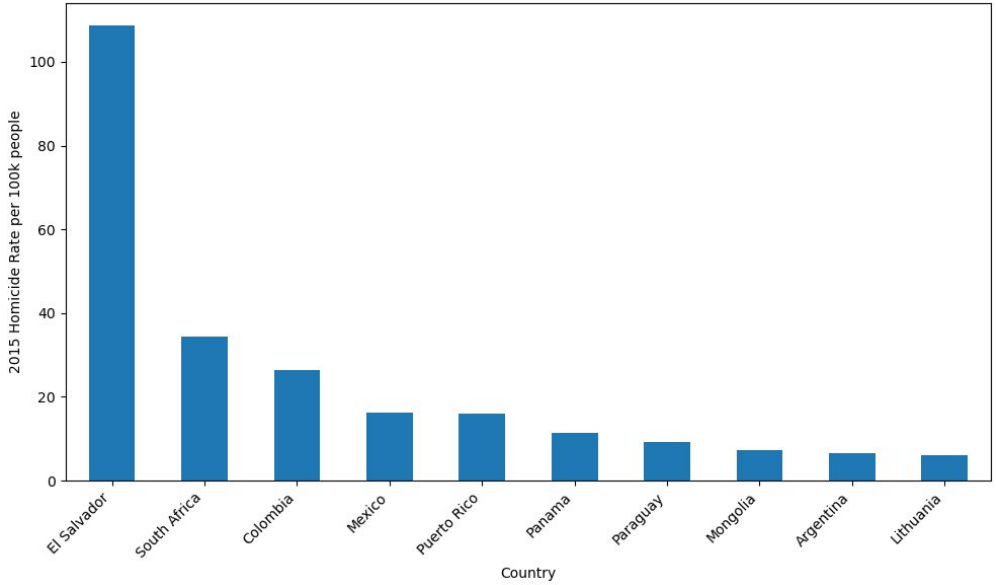
Global Homicide Rates Data Analysis

Spencer Auslander, Paul Boerstoel, Femi Ademuwagun, Samantha Barbey, Anthony Trainor, & Sophie Barstein

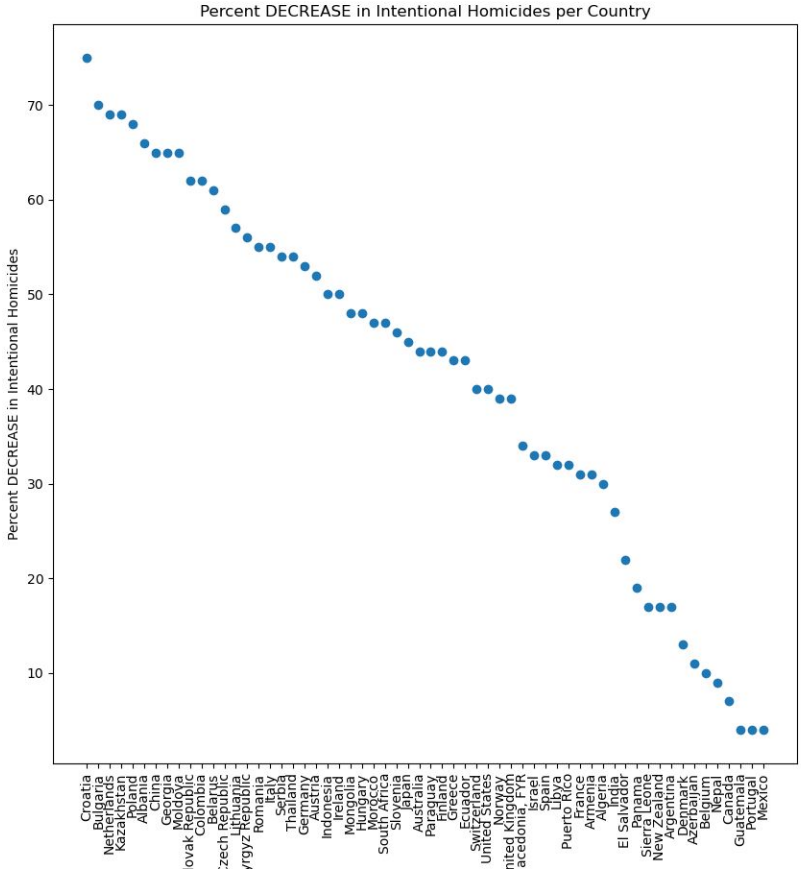
Topic Introduction: Homicide Rate Analysis

In this presentation, we will be analyzing the international homicide rates for several countries throughout the world.

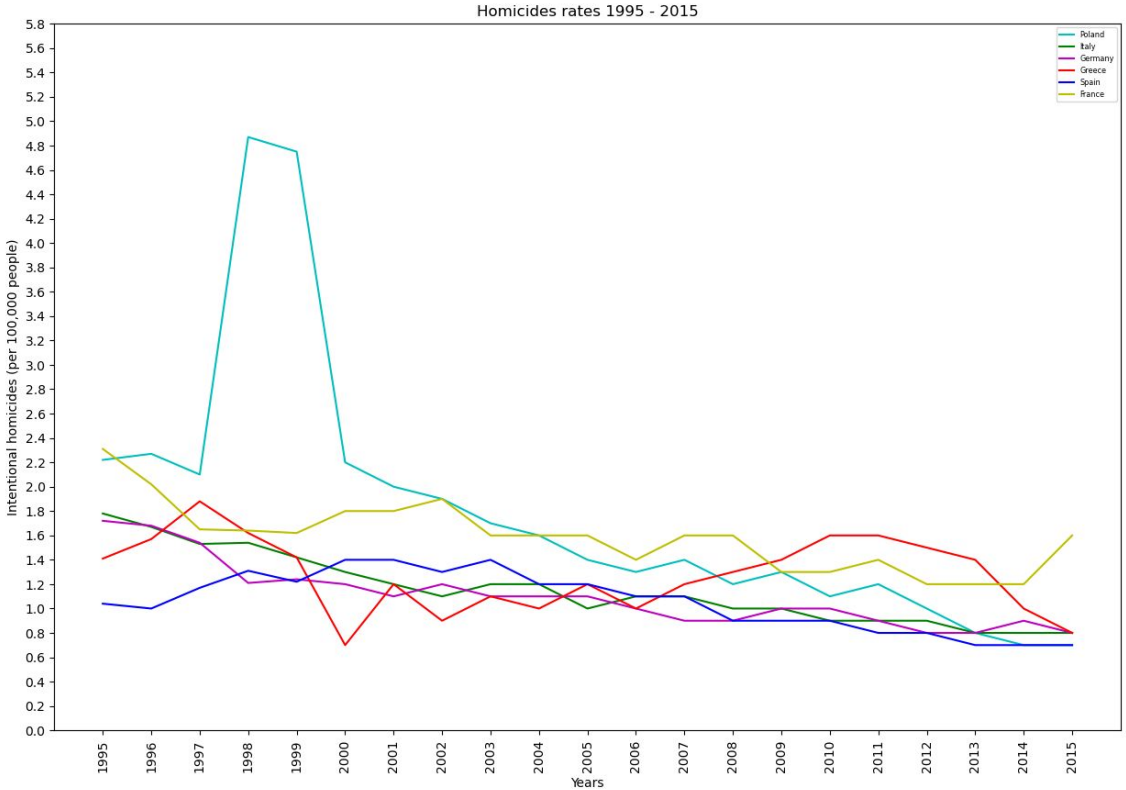


Global Homicide Rates Have Improved

Homicide rates have been on a steady decline for the past three decades.



However, we have seen homicide rates in specific countries spike over time…



Question 1:

What is the correlation between homicide rates and freedom score?

Freedom Score

Hypothesis: The decrease in homicides is caused in part to an increased sense of freedom within the world.

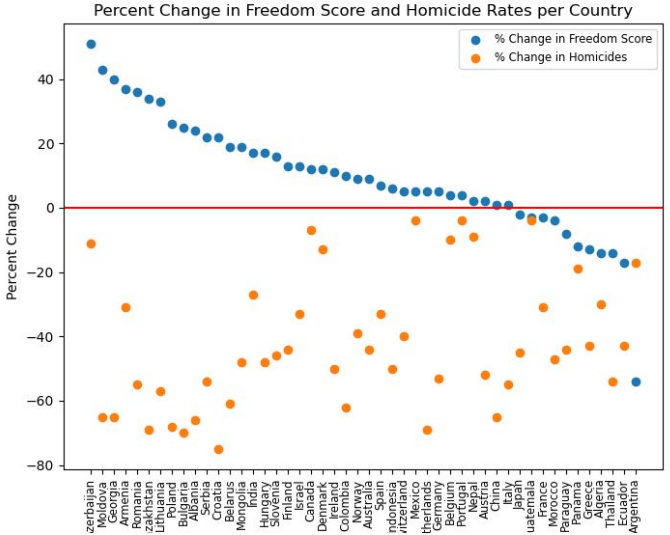
Method: The Index (heritage.org/index) measures freedom by analyzing 12 types of freedom – from property rights to financial freedom - for 184 countries and assigns each an average freedom score. Using Python, analysis of the change in freedom score for several select countries is conducted in relation to the change in homicide rates.

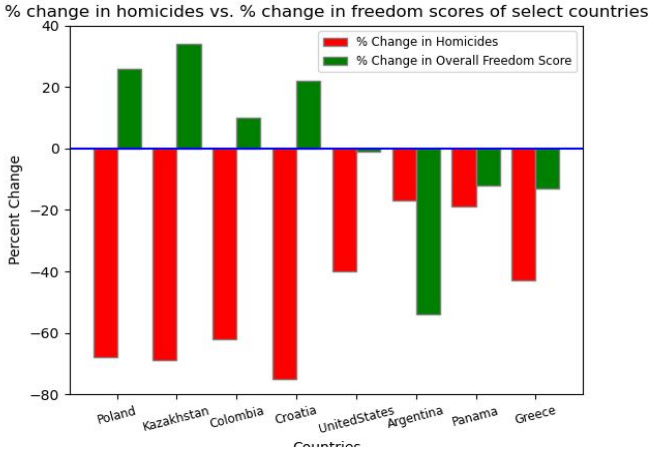
Findings: A majority of countries has had an increase in freedom score. Azerbaijan experienced an improved freedom score with a 51% increase, with a 11% drop in homicide rates. However, Argentina had a 54% decrease in freedom score but also had a 17% drop in homicide rates. The minority of countries who have fallen in terms of freedom score are still witnessing a decrease in homicide rates. In some cases, even seeing a more significant decrease than countries with positive freedom score change.

Conclusion: The change in the sense of freedom a country experiences has barely any correlation to whether or not homicide rates fell during this period or even the magnitude of change in homicide rates.

Freedom Score Info and Graphs

For the figure on the right, each blue data point represents a country's freedom score percent change. Each orange data point represents a country's homicide rate percent change. Data points above the red line represents a positive change, below the line represents a negative change. From the graph, we can see that freedom score, whether positive or negative change, does not appear to affect homicide rates.





The left figure compares the percent change between homicides and freedom scores for select countries. Poland, Kazakhstan, Colombia, and Croatia all experienced an increase in freedom score and a decrease in homicides. This is in contrast to the United States, Argentina, Panama, and Greece who experienced a decrease in freedom score but still saw a decrease in homicides.

Question 2:

What is the correlation between homicide rates and Gender?

Gender Differences in Homicide Rates

Hypothesis: The homicide rates for men will be significantly higher than those for women, though the overall trend for reduced homicide rates over time will remain true for both.

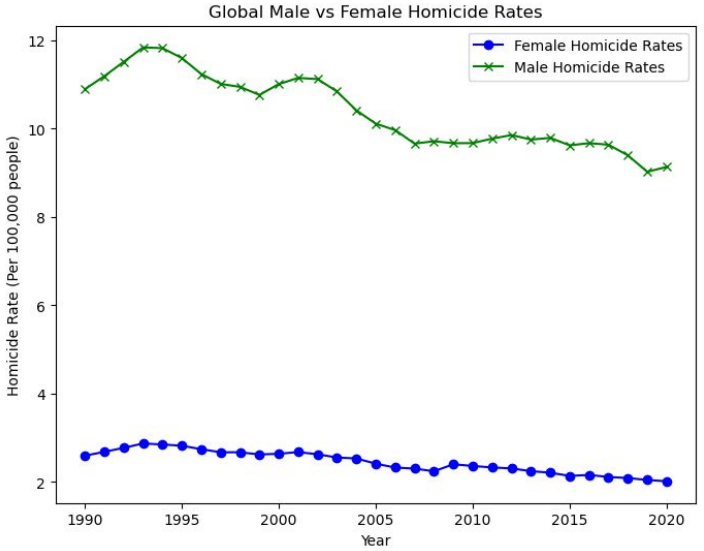
Method: Homicide rate data for both sexes was cleaned then merged by both country and year. Rows where either one wasn't present for either male or female were removed. Using pandas, data was plotted to show homicide trends as well as averages for both genders (Data source: Gender Data). Then, a t-test was performed to determine if there was a statistically significant difference between the two groups.

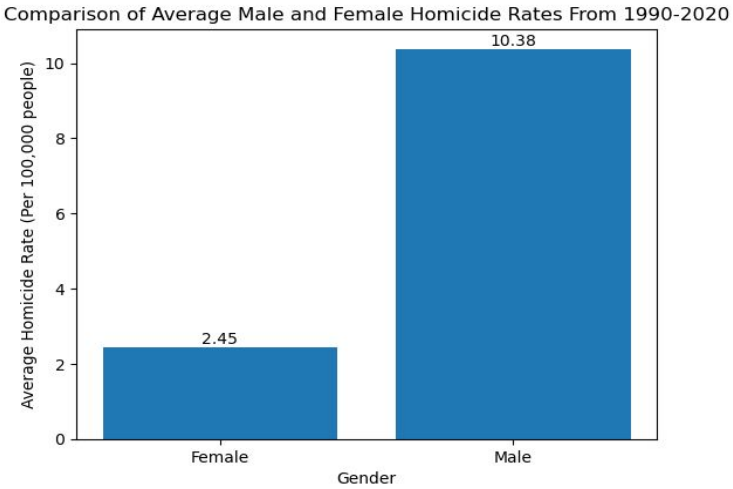
Gender Analysis Findings

Findings: Our hypothesis was supported; though homicide rates were significantly lower for women, the homicide rate for both genders decreased overall between 1990 and 2020. The average male homicide rate per 100,000 people was 10.38, while for females, it was only 2.45.

A t-test was performed which determined that there was a statistically significant difference between the rate at which males and females commit homicide.

T-statistic: -50.59165310910182
P-value: 7.480527958045203e-35
Reject the null hypothesis: There is a significant difference between the groups.





Gender Analysis Conclusion & Limitations

Conclusion: Women are less likely to commit homicide than men are (or they're better at getting away with it).

Limitations: Data did not show the type of homicide or reason for homicide. This information could help us gain a better understanding of male vs female motivation for homicide and provide insight on how to deal with these issues on a societal level. For future research, we should also examine the interaction between gender, socioeconomic status, and other variables to see if combinations of certain demographics are more or less likely to commit homicide.

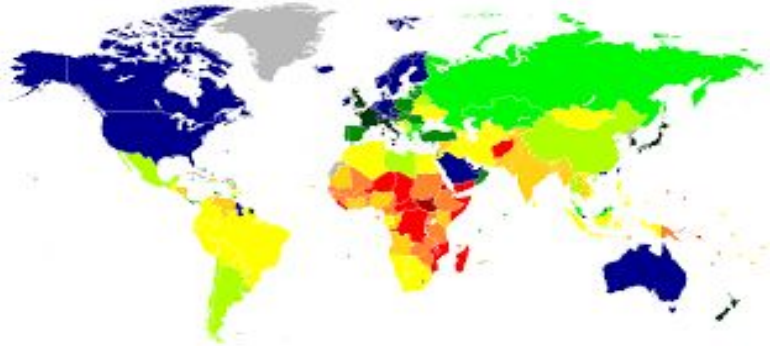
Question 3:

What is the correlation between homicide rates and GDP?

Change in Gross Domestic Product (GDP) vs Homicide rates

Hypothesis: The decrease in homicide rate from 1995-2015 can be attributed to an increase in GDP over that span. Moderate to strong negative correlation is expected.

Method: Data pertaining to GDP, Country's Income Tier, and Homicide rates were cleaned to focus on the 20 years between 1995 and 2015 for 60 countries (Data Source-World Bank: GDP Data). Countries that lacked data for all statistics were removed. The country' income tier was obtained based on Gross National Income (GNI) per capita (High Income:<$14,000, Low Income: <$1100, Middle Income: $1100-$14000). Python was used to analyze the data based on average % change in GDP/Homicides per year

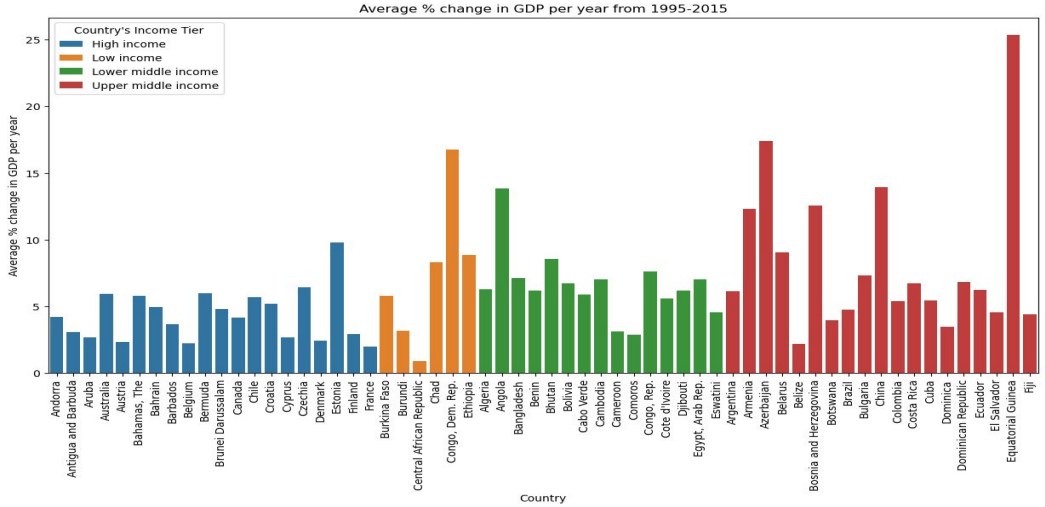


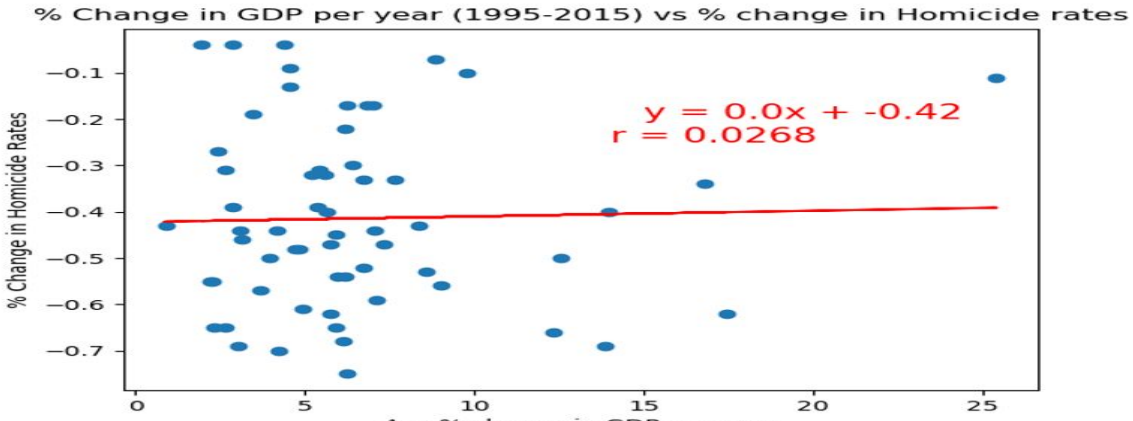
Change in Gross Domestic Product (GDP) vs Homicide rates

Findings(Overall Data):

- There was a noticeable increase in GDP per year for all the countries observed. Countries in the upper middle-income bracket had the greatest average % increase in GDP.

- Overall, there was practically no correlation between the change in homicide rates and change in GDP over the 20-year span. The correlation coefficient (r) value was very close to zero.

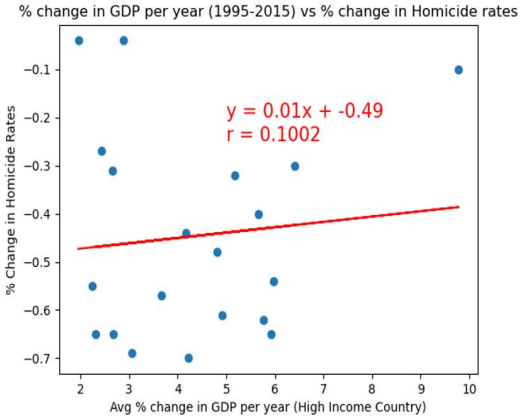


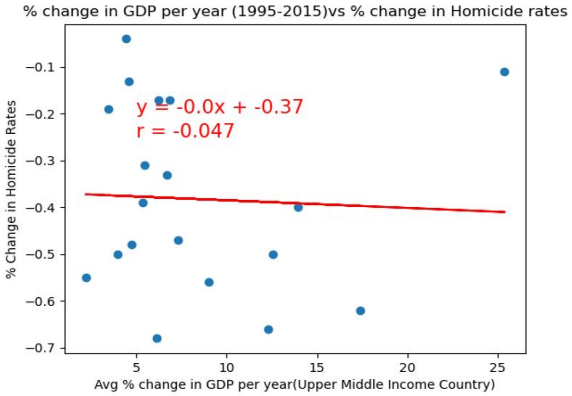


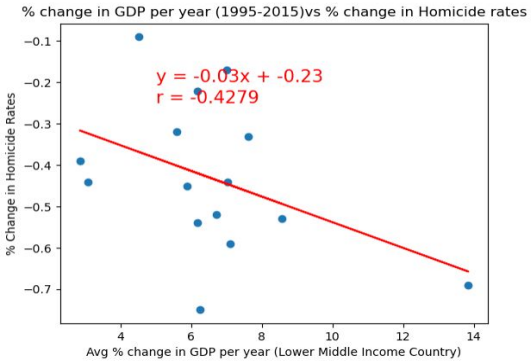
Change in Gross Domestic Product (GDP) vs Homicide rates

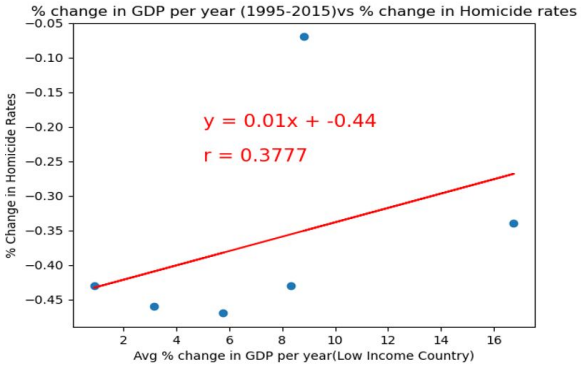
Findings(GDP grouped by Income tier):

- With the exception of the lower middle income group, the plots showed a weak to no correlation between the change in homicide rates and change in GDP.
- The lower middle income group showed a slightly moderate negative correlation between change in homicide rates and GDP.









Change in Gross Domestic Product (GDP) vs Homicide rates

Conclusion: Our hypothesis was not supported by the findings. Based on our findings, there isn't any clear correlation between change in GDP rate and change in homicide rates between 1995 and 2015.

Limitations: GDP is not an ideal tool in measuring human well being. GDP measures the economic output of a country and not wealth creation for the population. An increase in GDP may just mean a sharp increase in the income of the rich and stagnant incomes for the majority of the population. A parameter that focuses more on people and their capabilities should be used. For example, the combination of education, health and standard of living will be a better representation of a country's well-being.

Question 4:

What is the correlation between homicide rates and literacy rates?

Literacy rates

Hypothesis: Increased literacy rates will lead to a decrease in intentional homicide

Method: Homicide rate data and literacy rate data was cleaned, reorganized, and merged on year and country. Years that lacked data for either statistic were removed. We used Pandas to organize and manipulate the data.

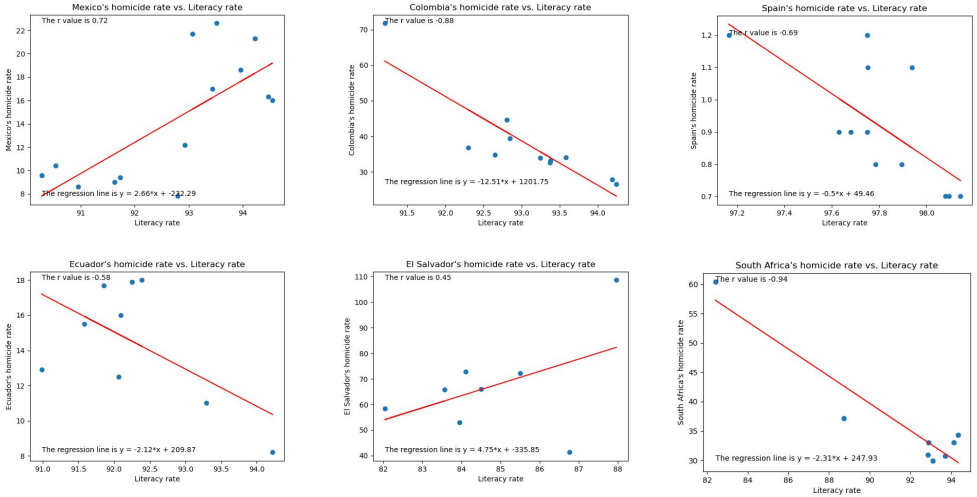
Literacy rates from the World Bank: https://data.worldbank.org/indicator/SE.ADT.LITR.ZS

Findings: Our Hypothesis was not clearly supported. The correlations between the two statistics were not particularly strong.

Conclusion: It's hard to dismiss the conclusion entirely. We would ideally prefer to get more complete data for our analysis before dismissing the link entirely.

Literacy Rate Charts

- During those years we have combined data for, there is no clear trend between an increase in literacy and a decrease in homicides



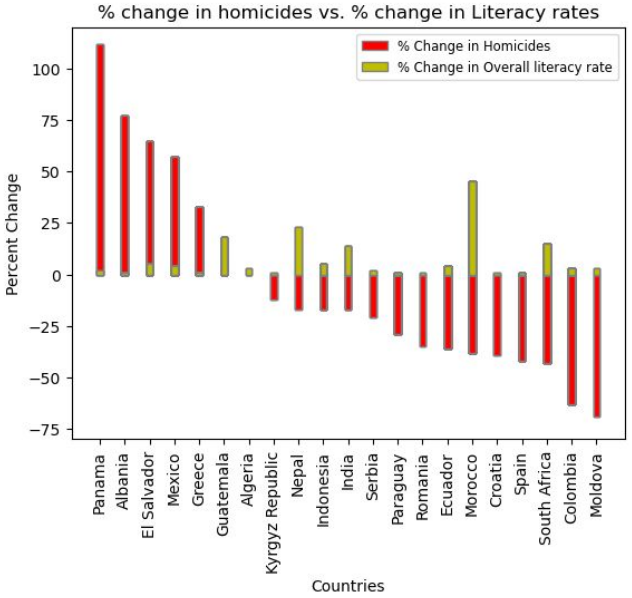


Fig: Shows the overall change in literacy rate (yellow) and homicide rate (red). This is only for years which we have both sets of data and may not fully encapsulate the overall homicide rate trends

The figures to the left show the relationship between literacy and homicide rate for a select group of countries, namely the ones with the most complete literacy data. There are some stronger correlations here, but overall it still does not seem to support our conclusion very well.

Limitations of Literacy rate analysis

- Literacy rate data is simply not as readily available as homicide rate data, and as such there are large swathes of time where we simply lack data for it. This makes it difficult to definitively make a claim about and correlative or causative relationship.
- Additionally, the countries for which literacy data is available are likely to be ones where it is deemed important to track. Countries with already high literacy rates, such as wealthy countries in western europe, do not have much if any data on them listed, whereas poorer countries are more likely to show up.

Findings and Conclusions

Findings Summary

- Homicide rates have overall seen a steady decrease over the past 20-30 years, with some uncharacteristic spikes in a few countries
- As **Freedom Index** increases, homicide rates do not change
- **Males** are more likely to be the perpetrators of homicide as opposed to **females**
- There is no correlation between the change in Homicide rates and **GDP**.
- The relationship between **Literacy rates** and homicide rate was not clearly supported
- Unsurprisingly, the relationship between homicide rates and possible factors is complicated

Limitations of Data and Suggestions for Future Research

- This data explored very broad trends across many countries, for future research, we would suggest to zoom in on one particular country, and track several variables in order to gain a more detailed understanding of the decline in homicide rates.
    - Hypothesis testing should be conducted to determine if the results are statistically significant, and if any of the variables are confounded with each other.
- We cannot really draw causal conclusions from this data, only discover correlations between certain variables.
- Taking data from multiple datasets means there is sometimes not enough data that overlaps between the two sets, making analysis difficult