Final Project Suicide Rates Analysis(1985-2015)

Aditi Mulye, Nikunj Malpani, Keshav Likhar

Introduction

For the purpose of completing our final project, we have decided to choose the **World Bank Dataset**. This dataset contains information about the suicides happening across the world from 1985-2015. Evaluating this 30 years data with respect to countries, sex, age, GDP was really insightful and led to many interesting conclusions.

Our motivation is to analyze the suicide rate and how it has changed over time. According to **NIMH** suicide was the 10th leading cause of death overall in the United States and the situation is similar in most of the ciuntries.

However, a lot of our conclusions were limited due to lack of data. Quite a few major countries including China, India, etc were missing, thus our results could not include the suicide rates of the two most populated countries of the world.

Let's see how we are able to gain insights from this data!

Research Questions:

- How has the suicides rate changed over the years?
- Was the spikes/fall due to a particular continent, nation, gender, etc.
- Is there a relation between GDP with suicides?
- As the country gets richer do the suicide rate go down?
- Are there any particular age-groups which are more susceptible to committing suicides? If yes, what may be the reasons.

Data Description:

This dataset consists of 12 columns and about 27000 rows ranging from 1985-2015 for each country.

Columns	Description
Country	name of countries
Year	year
Sex	Male or Female
Age	various bins
Sucide Number	count of sucides
Population	population of the country
suicides/100k po	sucide rate per 100k people
HDI for year	Human Dev. Index
gdp_for_year	GDP of the country
gdp_per_capita	GDP Per Capita
Generation	based on age grouping average
Data Info	

Thus, in order to conduct a statistical analysis, our first task was to perform data cleaning.

Data Cleaning

- We removed 7 countries from our dataset which had less than 3 years of data thus accounting for less than 10% of data per country.
- Human Development Index (HDI) column consisted of more than 66% of the missing values, thus we dropped that column from our analysis.
- We made a new column : continent, which was derived from the **countrycode package**. This would help us evaluate the suicide rates across the continents with respect to various years.
- We dropped one more column named country-year because it was giving no additional information and just a combination of year and country.

Analysis

Trend of Suicide rates and GDP per capita globally

We begin our analysis by examining the suicide rate per 100000 people over the years. This will help us understand if there is any trend now and then we can compare it to historical data of **GDP**, age, gender available to us.



Fig 1.a Suicide Trend around the Globe (per 100k)



- In Figure 1.a, we look at the suicide rate across the years and below that in Figure 1.b we plotted the average GDP per capita of the world. We can see that the growth of GDP is kind of constant with the boost around 2002 maybe because of the technological world we moved into and a dip in year 2009 because of the global market crash.
- Trying to align it with the inverse of suicide rates across the globe, we can see that the suicide rate in 2015 is around the same level as in 1985, but suicide rates increased significantly where the GDP growth was constant(1988-1995) and decreased with the growth of GDP per capita(1995-2015).
- Peak suicide rate was around 15.3 deaths per 100k which decreased steadily to 11.5 deaths per 100k in 2015(~25 decrease).

- To associate the relationship with the GDP itself would be a wild conclusion, we will need to analyze it further before concluding anything.
- We want to research if something major happened on the global level between 1988-1995 as this period had the highest suicide rate as well the GDP per capita was almost constant.

Trend of Suicide rates and GDP per capita globally with respect to Continents



Figure 2.a Suicide trend over time by Continent

- In Figure 2.a, we have tried to encapture the relationship between **Suicide Rate** with **Time** using LM Model, in addition to segregating different continents. In Figure 2.b, we tried to encapture the relationship between **GDP Per Capita** with **Time** using LM Model, in addition to segregating different continents.
- We can see that for continents Americas and Africa, there is not much GDP increase and the suicide rate of Americas also remained constant, but when we look for **Africa** we can see that there is a steep dip in the rate of the suicide after 1995. We tried looking into it and found that the countries which were contributing to the suicide rate or in the countries where suicide rate was more, we didn't have the data for those from 1995 and can be assigned to poor data quality.

Looking at these two continents we cannot assign the relationship entirely to GDP.

- Now looking at remaining three continents : Asia, Europe and Oceania, we can see a significant rise in GDP per capita across the years mentioned but there is no clear trend for suicide rate as in relationship with the GDP. We can see a rise in suicide rate in Europe from 1990-1995 and constant and slightly higher average rate than other continents.
- One common thing that can be found is that even though GDP per capita of these three continents were higher than **Americas and Africa**, their average suicide rate was higher as well. Let's dive deep into to know more as to why this is the case.

Analyzing the suicide trends by Gender

Looking into GDP per capita didn't help much so let's take into account the gender feature and do some analysis on this.



- We can see that globally the rate of suicide for men has been $\sim 3.5x$ higher than women.
- Both Male & Female suicide rates peaked in 1995, declining since
- This ratio of **3.5**: **1** (male : female) has remained relatively constant since the mid 90's. However, during the 80's this ratio was as low as **2.7**: **1** (male : female).
- Such low suicide rates in the African continent accounts for the lack of data as well as very few countries present, thus, the average is quite skewed on the basis of the availability.
- Looking at figure 3.a, we can conclude that the rate of suicides in males and females are quite different. While the suicides rate of males keep on increasing until 1995, and then start to decrease, the suicide rate of females seem to be more or less constant over the years. We would love to look into this more as to why the rate of male suicides have increased more.





- In figure 4., we can see that the suicide rates for all the age groups in Africa is really low and remains constant irrespective of the age slabs. We cannot conclude anything major about Africa due to the poor quality of data.
- For all the continents, the suicide rate for the age group **5-14 is lowest**. This can be self explanatory as children in their short period of life do not suffer from any trauma that can lead to suicide and they live in a very protected environment. And on the same lines the suicide rate increases with an increase in age for Americas, Asia and Europe.
- Asia has the highest suicide rate for age groups beyond 55 and above. This may be due to poor quality of life and less advancement in medical and other aspects of technologies. On the contrary, Oceania's suicide rates for every category except

5-14 year's old s around the same and overall average of suicides are lesser than other continents as well. This can be due to the fact that the countries in the Oceania are much more developed and have a better quality of life in general.

> Why do old people commit suicide?

* Older adult suicide is often triggered by elders' loss of control over health conditions or financial circumstances that results in feelings of hopelessness.

Why do young people commit suicide?

- * Academic failure
- * Being arrested or imprisoned
- * Bullying, shaming, or humiliation, including cyberbullying
- * Financial problems
- * End of a close friendship or romantic relationship
- * Job loss
- * Loss of friends or family acceptance due to revealing your sexual orientation
- * Loss of social status

Do richer countries have a higher rate of suicide?

Rather of looking at trends within nations, I calculated each country's mean GDP (per capita) throughout all of the years for which data is available. I then compare this to the country's suicide rate throughout the course of those years.

The end result is a single data point per nation, which is meant to offer an overall impression of a country's wealth and suicide rate.



- As we can see in Figure 5, we have plotted a graph against GDP per capita and suicides per 100k with each point representing a country. The dashed line represents the Global average of suicide rate per 100k.
- Majority of the **countries have the GDP less than 20000\$** whereas suicide rates seems to vary significantly. The linear model also suggests the same as it is not able to capture the relationship between suicides and GDP efficiently.
- Coming back to the question of whether the rich countries have higher suicide rates, we can see that there are very few countries that surpass GDP of 40000\$. Among these countries almost all of them have suicides per 100k less than 20.
- One trend we can observe is that as GDP increases above a certain threshold, the suicide rates per 100k are not extremely high as compared to the global average which is shown by dashed line.
- We can see that Lithunia, Russian Federation, Qatar, etc. are outlier countries and we will analyze them further.



- Amongst all the above countries, it seems to appear that **Qatar** has the highest growth rate in terms of the GDP per capita and the suicide per 100K is more or less constant with time. The dip in **Qatar's** GDP during 2008-2010 can be due to the global market crash. This dip is also greater than the dips of all the above listed countries.
- **Republic of Korea** is one the very few countries that has shown the significant increase in the suicide rates per 100k and this may be assigned to the autocratic rule and less freedom for the people.

Figure 7. Suicides per 100k population, 1985 - 2015 by gender



for countries :Lithuania, Qatar, Republic of Korea, Russian Federation, Sri Lanka, United States

- The suicide rate in **Russian Federation** shows a constant increase from 1990-1995. The major cause of this is the break up of Soviet Union and as we know according to history many generals and marshals and other people committed suicide because of this. This may be the major cause for the suicide rates to hike up suddenly.
- The suicide rates for male in countries **Russian Federation**, Lithuania and Sri Lanka are abnormally high, much higher than the average male to female ratio all over the world, suggests that either the laws, or pressure caused over males due to high dependency on males in that society is high. Again this is just the assumption, we will need to dig further and with the limited data, scope and time for this project we cannot confirm this.

> Why Lithuania's suicide rate is much higher than in other countries???

We can attribute the **higher suicide rate of Lithuania** maybe due to the very reason that the sun does not shine much in the country, the weather is mostly rainy : during an entire year on an average the rainfall occurs for about 6 months, and maybe because the alcohol consumption of the country. Like most of the countries of the world, GDP per capita of Lithuania has increased over the time but not significantly but the suicide rates remain high.

Now let's look into the relation between suicide rates and different Generations.

Analyzing the suicide trends by Generation



Figure 8. Suicides per 100k, by Generation

- In Figure 8, we have plotted a graph between the suicide rates per 100k with respect to the generations. The generations according to the year they were born in are decided as follows:
 - o G.I Generation:1901-1927
 - o Silent: 1928-1945
 - o Boomers: 1946-1964
 - o Generation X: 1965-1980
 - o Millennial: 1981-1996
 - Generation Z: 1997-?
- As we can see from the figure 8, there is a constant decrease in the suicide rates with the upcoming next generation. This may be due to multiple factors:
 - One the old generation people are getting older and as we saw in figure 4, older the people get the suicide rate also increase, so because of the reasons mentioned above in that section we can attribute the same here for the increase in the suicide rates in older generation.
 - The other reason might be that as the generations grew, the world grew too in many aspects. Technology, Medicine, Average life Expectancy, GDP per capita grew, along with many psychological reasons that people started to feel: more freedom was there, race and ethnic disparity became less and more emphasis was given to mental health. These all factors combined may be the reason that with every generation the suicide rates dropped significantly.

What would be interesting though would be to look if the suicide rates for different generations were in the same proportion for both the genders as we previously looked in Figure 3.



Figure 9. Suicides per 100k by Gender faceted by Generation

As we thought, irrespective of the generation, the suicide rates of males are always higher than that of the females.

- Looking at the Figure 9, we see that the data of different generations seem to have abruptly appeared or dissapeared. In case ٠ of G.I. Generation since it started in 1901, it is highly likely that all people are dead by 2000. That's why we don't see a line after that. For **Millenials** we see a sudden rise in the suicides rates from year 2000. Since this generation statted from 1981, we can assume that it is very unlikely or as our data suggests that for age below 20 there is less suicide rate all over the world.
- For Generation Z, if we look at the y-axis and compare it with other generations we can see that the suicide rate is pretty low and that is assigned to two reasons. One, since it only started in 1997, people of this generation are still pretty young and second, advancement as a whole of this generation from its previous generations. We can also see this in every generation as the suicide rates go down.
- Although the rates of male and female around every generation follow the same pattern but the ratio of male to female suicide rate remained almost the same throughout all the generations.
- > We will look at the another assumption, if there are any few countries that are pulling up or down the overall average of the suicide rates of the world continent wise.



- In figure 10, we have plotted the suicide rate for each country across the years faceted by continent. As we have already mentioned at the start of the report African continent has just 3 countries. Thus we cannot draw any conclusion for suicide rates of Africa.
- We have fitted a **linear model** to look if all the countries in particular are around the average suicide rate for the continent, but there doesn't seem to have any correlation and it's more because of individual countries' reasons.
- Asia has few countries that are pulling the average suicide rate for the continent up.

Conclusion

- The global suicide rates in 2015 is around the same level as in 1985, but suicide rates increased significantly where the GDP growth was constant(1988-1995) and decreased with the growth of GDP per capita(1995-). Peak suicide rate was around 15.3 deaths per 100k which decreased steadily to 11.5 deaths per 100k in 2015(~25 decrease). Although, we were not able to conclude anything concrete for the correlation of GDP with suicide rates.
- We can conclude that the rate of suicides in males and females are quite different. While the suicides rate of males keep on increasing until 1995, and then start to decrease, the suicide rate of females seem to be more or less constant over the years. Suicide rate of males is almost 3.5x more than females, but recently it has dropped a little.
- For all the continents, the suicide rate for the age group **5-14 is lowest**. This can be self explanatory as children in their short period of life do not suffer from any trauma that can lead to suicide and they live in a very protected environment. On the same lines, the suicide rate increases with an increase in age for Americas, Asia and Europe. Older people have higher suicide rate and that is often triggered by elders' loss of control over health conditions or financial circumstances that results in feelings of hopelessness.
- The suicide rates for male in countries like **Russian Federation**, Lithuania and Sri Lanka are abnormally high, much higher than the average male to female ratio all over the world, suggests that either the laws, or pressure caused over males due to high dependency on males in that society is high. Again this is just the assumption, we will need to dig further and with the limited data, scope and time for this project we cannot confirm this.