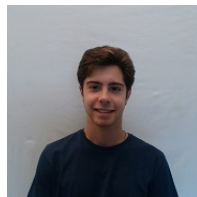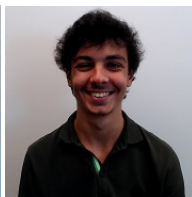# Universidade do Minho

Mestrado em Engenharia Informática

Impact of Inflation on the Mental Health and use of Social Media Worldwide

Análise Inteligente em Sistemas de Big Data

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Contents

Abstract

The global discourse surrounding mental health has witnessed a significant increase in recent years, with growing awareness and acknowledgment of its importance. Concurrently, social media platforms have become prevalent, providing new avenues for individuals to connect, communicate, and express themselves. Meanwhile, economies have experienced fluctuations in prices, resulting in varying degrees of inflation. This project aims to explore the interplay between these three crucial aspects—mental health, social media, and inflation—by analyzing three distinct datasets. The primary objective of this project is to comprehensively analyze the impact of inflation and social media on mental health, examining their relationships within the context of income disparities. We ought explore the influence of economic factors and virtual social environments on mental health outcomes and identify potential interventions or policies that could address the associated challenges.

Keywords: Big Data · Data Analysis · Inflation · Mental Health · Social Media

1 Introduction

Being mental health an increasingly spoken about topic, and as we understand more and more its relevance, it's important to understand what can affect it, and how so. During economic downturns, increases in suicide have been reported repeatedly and explained as a consequence of the stressful environment following the economic recession, with increased unemployment rates and a general feeling of job insecurity, therefore, we used inflation in various fields of the economy as a way to represent this financial factor that can possibly affect mental heath. Other thing that has been growing in the last decade is the use of social media, and this is mostly younger generation's influence, which rises numerous debates whether or not it's use is bad for mental health. We also studied that relation as a way of explaining registered phenomenon in mental health registers worldwide.

Public datasets, as well as several big data tools, were used and analyzed, and the architecture was created. Following that, the main findings will be discussed, followed by a critical analysis and some final thoughts in the conclusion.

2 State of Art

As mentioned previously, our subjects of study are greatly discussed worldwide, therefore, we will use this section as a way of giving a context about the "state of art" of our topics, referencing existing published articles in the topic and explaining how they can be relevant.

In the first article [1] the authors analyze worldwide trends in suicide mortality from 1990 to 2015 with a focus on the global recession time frame, by analyzing multiple countries' around the world suicide rates, in relation to the tough financial times that happened from 1990 to 2015, being their main focus to understand the impact the 2008 crisis had in mental health and suicide mortality. They performed a time trend analysis with joinpoint regression to do so.

In the second one [2] there is a study of the effective use of social media platforms for promotion of mental health awareness. Social media platforms are progressively developing as a rich source of mass communication. Increasing mental health awareness with the help of social media can be a good initiative to reach out to a large number of people in a short time frame. They conducted this study to understand the usefulness of social media platforms for health promotion. The study used social media platforms to conduct mental health campaigns and see the reach they can get.

The third [3] is a study of demographics in social media that gives us insights on what platforms younger generations use more, as well as other useful information.

The forth article [4] is about how Gen Z is Changing the Conversation on Mental Health, raising awareness to the topic, answering questions like "What Are The Mental Health Statistics Of Gen Z? ", "How Is Gen Z Changing The Conversation On Mental Health? ", "Why Is There Less Stigma Around Mental Health For Gen Z?" and many other regarding the topic

3   Materials and Methods

To facilitate the analysis of diverse indicators related to the topic at hand, a comprehensive three-part architecture was developed. The initial phase involved carefully selecting datasets from various sources, forming the basis for subsequent analyses. Then we treat the data by merging the datasets, and since the data itself, although not easy to treat, were piratical to merge and do the needed transformations in an early stage, in our case the Extract and Transform stages were somewhat mixed together (Not the traditional ETL architecture). After this transformation we load it to our database and for the final stage of this architecture leverages the capabilities of PowerBI, a powerful data visualization tool. Through the creation of interactive dashboards, the results of the ETL process are presented in a visually appealing and easily understandable manner. This enables users to explore and derive valuable conclusions from the combined datasets.
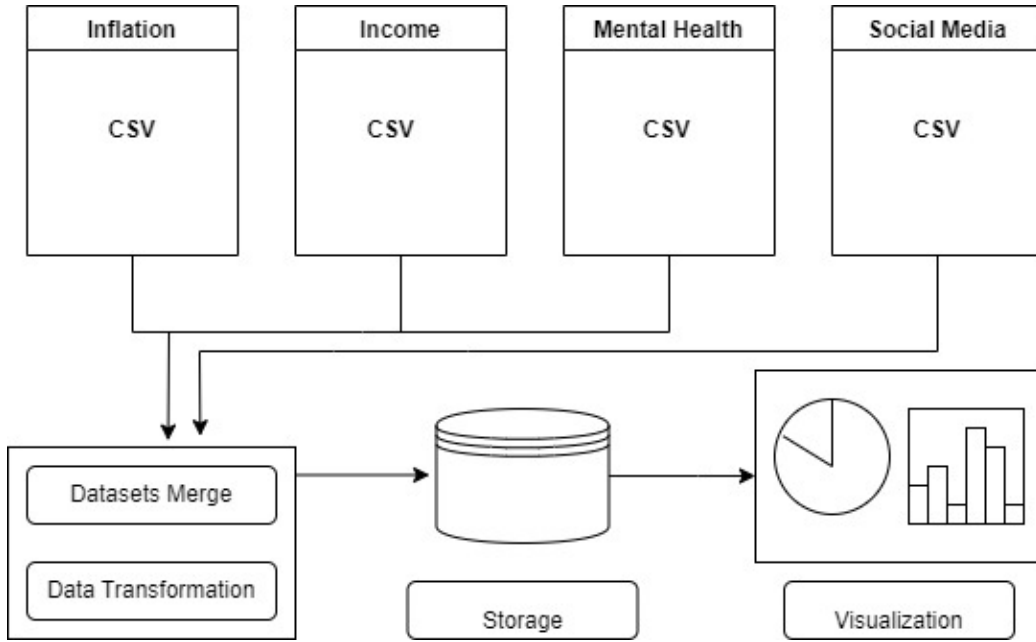

Figure 1: Architecture

By employing this comprehensive architecture, the project aims to streamline the analysis of diverse data indicators related to mental health, inflation, and social media.

3.1 Sources and Data Collection

In order to adequately address the mentioned scenarios, a selection of 4 datasets was made. Among these, one dataset was contributed by the educators, while the remaining datasets were sourced from the websites specified in the references section. All datasets are formatted in CSV. It should be noted that although the data within each dataset was collected at varying time intervals, not all countries possess information for every single day within those respective periods, which in itself, the lack of data, ends up being information as well .

Dataset 1 - A Global Database of Inflation: The first dataset represents the global information of about 200 countries over the period 1970-2022, and includes six measures of inflation in three frequencies (annual, quarterly, and monthly):

- Headline consumer price index (CPI) inflation

- Food CPI inflation

- Energy CPI inflation

- Core CPI inflation

- Producer price index inflation

- Gross domestic product deflator

Dataset 2 - Countries Income: This dataset was built using World-Bank API, fetching the economy information and filtering only the columns with the country id and the income level of that country, being the possible income levels:

- HIC - High-Income Country

- LIC - Low-Income Country

- LMC - Lower Middle-Income Country

- UMC - Upper Middle-Income Country

Dataset 3 - Mental health Depression disorder Data: The third dataset has data from 1990-2017 from around 200 countries with data on various topics of mental health and substance abuse, those being:

- Prevalence by mental diseases and substance abuse

- Depression by level of education

- Prevalence of depression by age

- Prevalence of depression in males and females

- Suicide rates vs prevalence of depression (per 100k individuals)

- Number with depression by count

Dataset 4 - Social Media Worldwide yealy: This forth dataset contains the percentage of the social media plataforms used worldwide, having data from 2009 to 2023 from Facebook, Instagram, Twitter and many others.

Final datasets: To merge the four datasets, the implemented architecture makes use of the Pandas - Python library. This library was chosen because it is appropriate for heterogeneous datasets made up of tables containing various types of data, allowing for better use of these objects. Each dataset is organized by country and and Year; these columns were chosen to perform the merge operation across all datasets.

As our data from social media was only available since 2009, we decided to have two datasets, one before 2009, and another after 2009.

3.2 ETL process

As mentioned previously in our data, it made sense for the transformation process to be right after merging since there were no complex operation needed, therefore python libraries were enough for this.

3.2.0.1 Data types We made sure all numeric columns had the correct type association since after analyzing data some of them were not as numbers

3.2.0.2 Handling null values Our datasets seem to have a significant amount of null values, which in most cases we don't interpret as a total loss of information because usually that lack of data told us something for example education information in most Low income countries had no values, which indicates that the educational panorama in those countries is not yet very defined, and probably still developing. This is why instead of removing the

column or something of that kind when all countries of an Income Level were missing values for that column, we inserted 0 in every country so we later can visualize that in the charts.

Nonetheless, in a lot of other scenarios the missing data was in fact loss of information and so they had to be treated. Firstly we tried to handle all the missing values with a simple regression imputer, but then we thought that it would make more sense ,instead of treating all values as one, to aggregate on income level so the new values were more context accurate for its country, and in this process we decided to use the median of the Income Level countries' values for filling the null values, which was why we added in a later stage of development the income dataset.

3.3 Storage

For storage we used a MongoDB documental database hosted in a Mongo Atlas M0 free cluster. This was very useful to migrate the data once they are very simple tools, and the original plan was to connect it directly to PowerBI for the Data Visualization stage, using Mongo's Connector BI. We tried following all the measures for connecting it this way, creating a dsn and using mongo odbc but somehow it kept not working, which meant our pipeline could not be automatic, which was our intention. That meant that we had to insert the datasets manually.

3.4 Data Visualization

The tool chosen and mentioned was PowerBI because it offers very strong features in the data visualization files, along with the power to still treat data if necessary. Not only this but it's easy and intuitive to use, and as the data is not obtained in real-time, there is no need to use more complex tools. Having the data loaded into PowerBI we created the graphical representation of our study subject.

4 Results and Discussion

We created some dashboards as a way to have an intuitive and easy to understand overview on the studied topics. We created temporal views for the main features of each dataset with the type of chart we considered to make the interpretation easier, and make the important aspects pop out.

4.1 Inflation

To start we'll be taking a look at the inflation rates through the years and where it would be most expected to have effects in the population, so we will look for times where the inflation rates go up greatly. As it can be seen in figure 2, in the late 80's and throughout all 90's we see a very oscillating inflation rate in all fields, being more prominent in Lower Middle Income Countries and Upper Middle Income Countries. In High Income countries and Low Income Countries, even though it is not felt as much, there is also a clear change as the inflation rates in this period also more than doubled. This indicates a world recession that was felt in all types of countries.
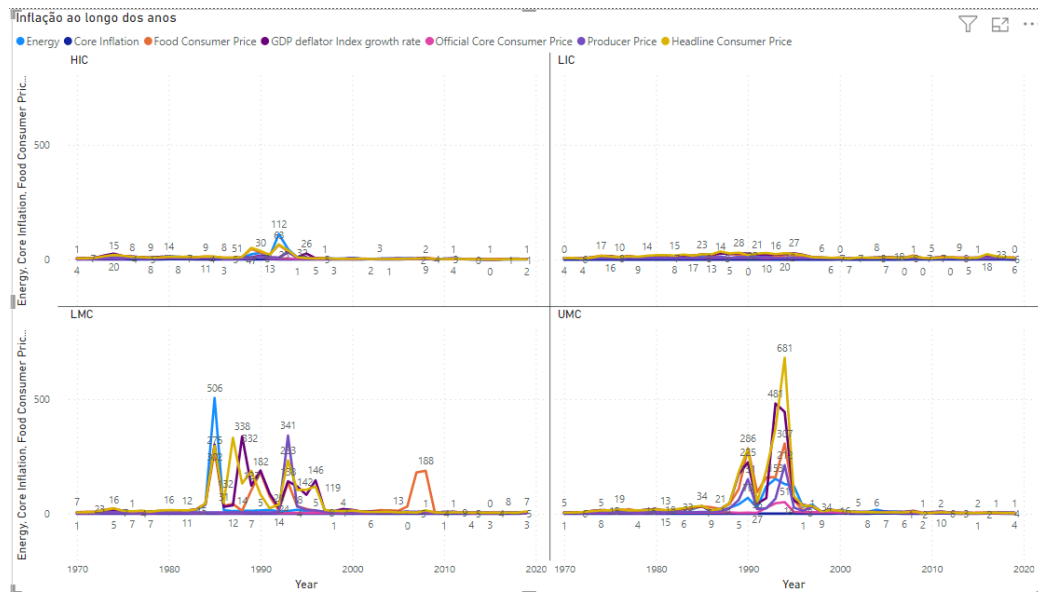

Figure 2: Inflation

4.2   Social Media Dominance

As it can be seen in figure 3 bellow, All the way until 2017 the Facebook percentage kept growing, meaning more and more the use of all social media in the world was on Facebook, but after this year there is a significant decrease in this percentage and we see Instagram and Twitter taking their fair share. This is relevant because in this time period, most of the younger population migrated from Facebook to Instagram and Twitter because these platforms presented better ways of reaching out and getting reached in social media, and as mentioned in previous articles, this younger generations (Gen-Z and since) have more awareness of the importance of mental health.
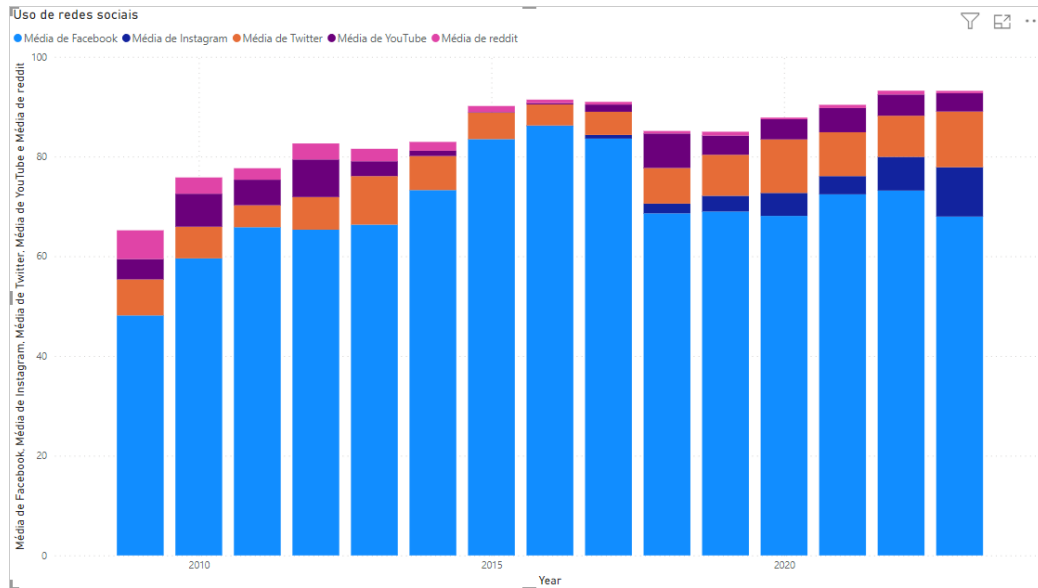

Figure 3: Social Media Dominance

4.3   Mental Health

Next up come insights in various fields of study related to mental health which offer as a broad understanding of the matter.

4.3.0.1   Depression By Age   In figure four we can observe Percentage of population of a certain age group with depression. There is a pattern overall that indicates that the older groups tend to have more percentage depressed, but one very interesting insight is that the richer the country, the less depressed the elders are. We can also see that overall around 1990, the all the classes suffered a suddent raise in the depression rates which suddenly started dropping again in 2017.
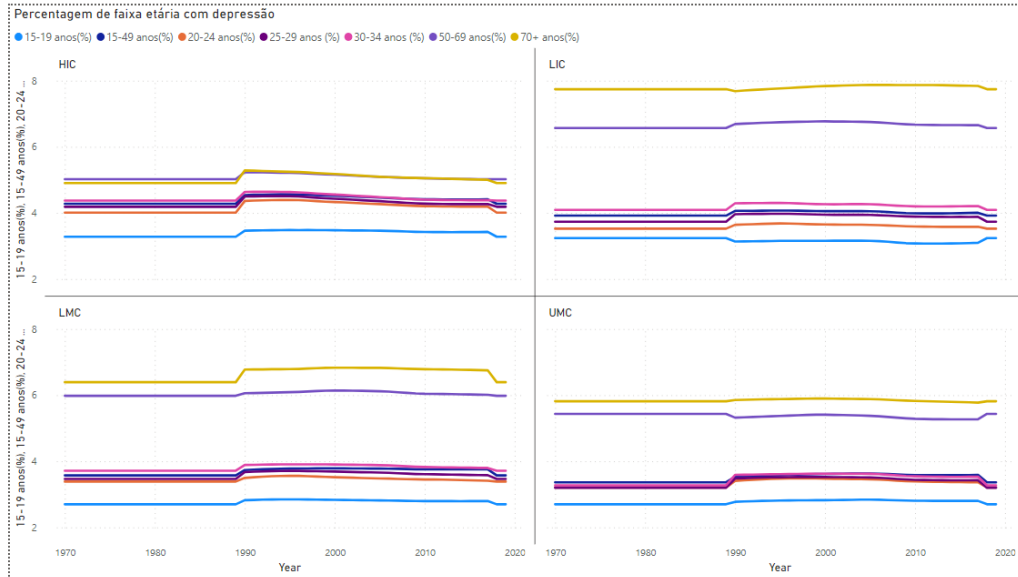

Figure 4: Depression By Age group

4.3.0.2   Depression by education level   Here its one of those cases where the poorer countries had no data, which was replaced by 0. This might indicate limitations in their education systems or data collection processes, but it is not sufficient to affirm it with assurance. Having this in consideration, any conclusions in the education matter will only apply to High Income Countries and Upper Middle Income Countries: Overall, we can see that the depression rates are lower in High Income Countries which

can suggest that these countries have a better education system, therefore contributing for a better and less stressful studying environment than those who are not as rich.
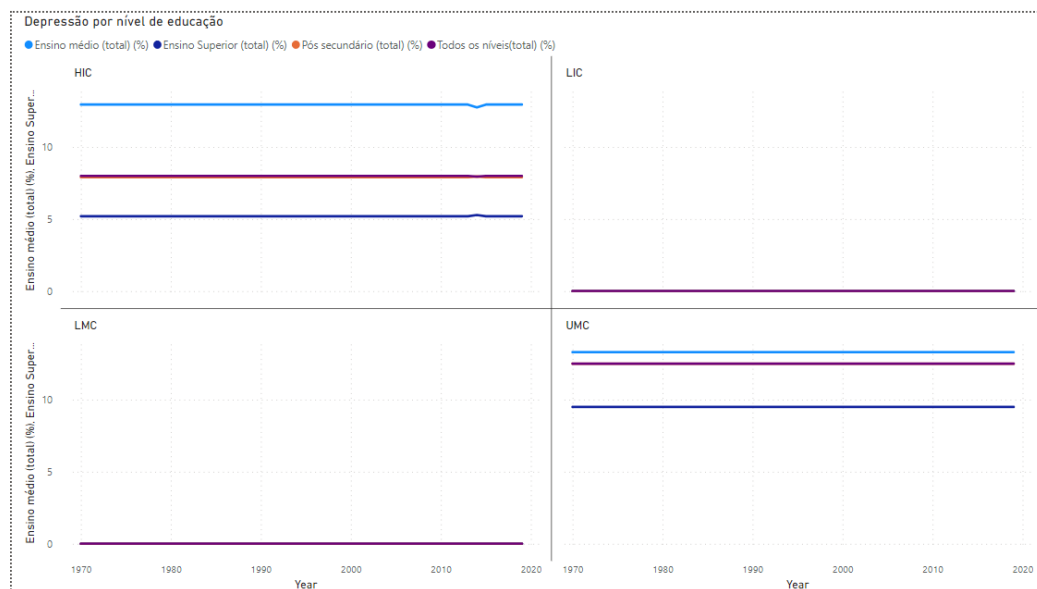

Figure 5: Depression by education level

4.3.0.3 Mental Disturbs and Substance abuse   Curiously, with this chart, we can deduct that anxiety is the biggest in High Income Countries. Another thing to have in account as seen before, in 1990 there was an abrupt raise of all the cases in this matter, and then in around 2017 they started dropping again.
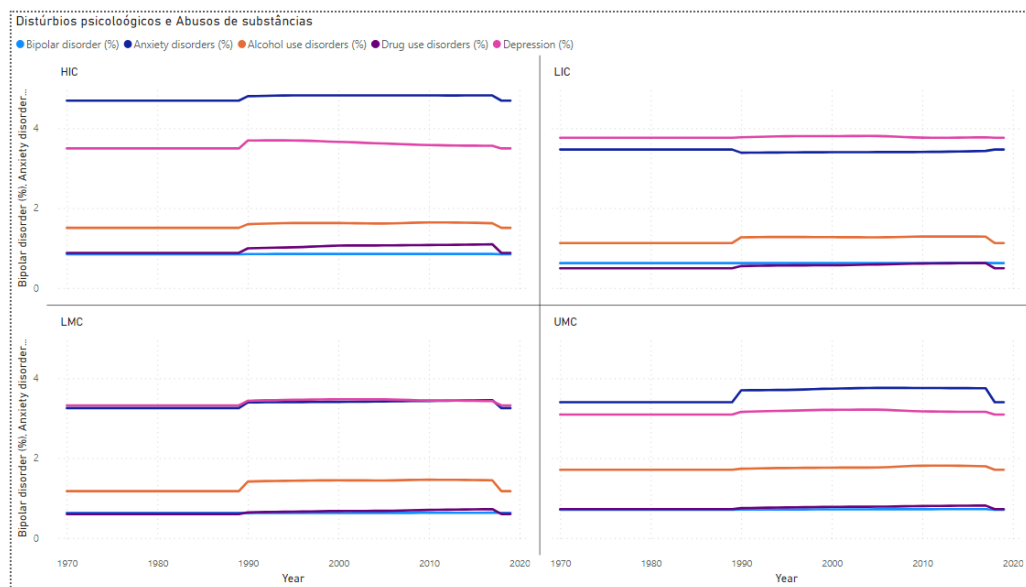
Figure 6: Mental Disturbs and Substance abuse

4.3.0.4 Depression By Gender   The most relevant aspect seems to be that no matter the income, females have a higher depression rate than males all throughout the years. Here we can also understand that in 1990 and 2017 there is the same behavior as previously discussed.
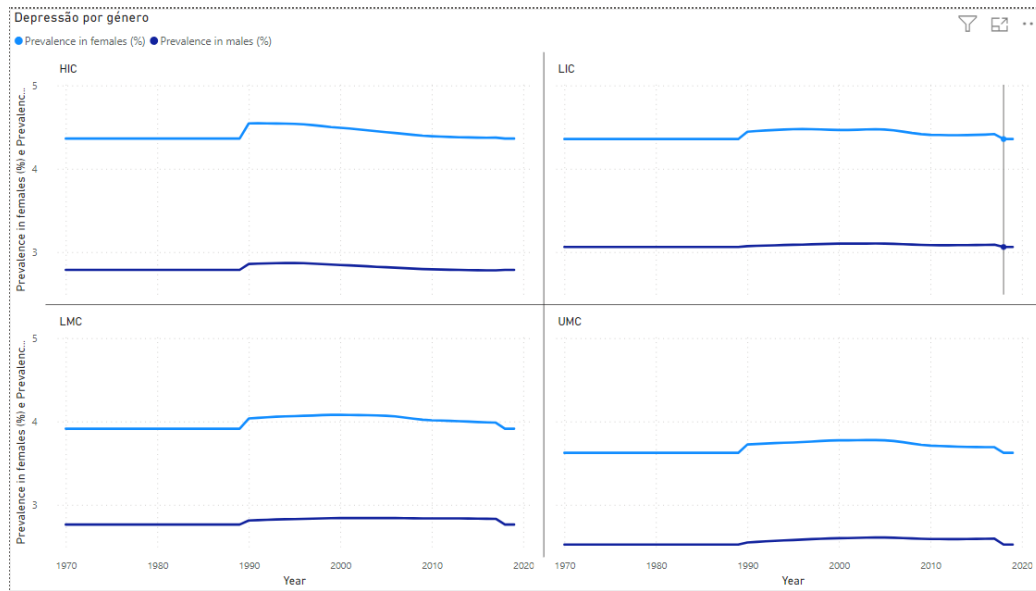
Figure 7: Depression By Gender

4.3.0.5   Depression relation with Suicide (per 100k individuals   For this graphic we chose another format since we thought it would be easier to visualize. Each dot represents years, and the x and y axis are respectively number of individuals with depression per 100k, and suicides per 100k. With this representation we can understand that the lower the dot, the less amount of suicides for that year, and the more to the left, the less people with depression. The curious part comes in that from 1990 up to more or less 2000, all the classes go up and to the right, in a very vertical manner, which is coincidental with the previous charts. And from that point on, it keeps going down and to the left, and that decline is more accentuated from 2017 forward. This means that from 1990 to 2000, there were increases in depression and suicide, and for each depressed person, more suicides occurred, and the opposite situation is seen since around 2000, with less and less people committing suicide by each depressed person.
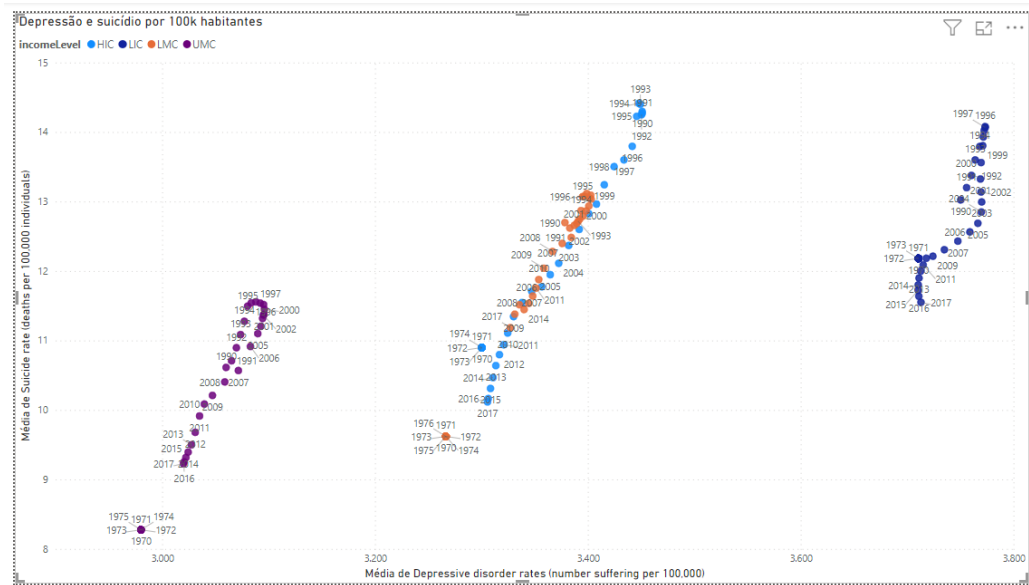
Figure 8: Depression relation with Suicide (per 100k individuals

Another good visualization this gives us is that the Upper Middle Income countries seem to have the least depression and suicides through the years and Low Income Countries having more depression and suicides as well. The High income countries have a very big oscillation in suicides per depressed person, as in the roughest years it had the biggest suicides amount per 100k, but then it decreased drastically. In that roughest period from 1990 to 2000, one thing to have in account is even though the total number of both depression and suicide was smaller in UMC, the ratio of suicide per depressed person was the highest recorded.

5 Conclusions

Having the referenced articles in consideration, among with all the data we have explored, visualized and analyzed, we can affirm that the world recession that occurred in the 90's caused a significant stress in population of all different countries which caused a toll on mental health worldwide contributing for a raise in depression and other mental disturbs such as anxiety, as well as raise in the number of suicides. This allows us to confirm that in fact, inflation and wealth is an impacting factor when it comes to mental health.

Based on the articles presented, it has been observed that Generation Z is inclined towards visually appealing social media platforms such as Instagram, TikTok, and YouTube. This generation represents a significant portion of the user base of these rapidly growing platforms and has been gradually shifting away from Facebook since 2017. A notable aspect of Generation Z is their heightened awareness of the importance of mental health.

Considering the available data, it can be suggested that the prevalence of depression, suicide, and other mental health disorders has shown a decline globally since 2017. This decline can be attributed to the improved accessibility and extensive reach of mental health topics, thanks to the engagement provided by these visually-oriented platforms. These platforms facilitate the dissemination of awareness on mental health to a wider audience and in more substantial quantities than ever before. The increased spread of awareness in this subject matter has resulted in more positive outcomes overall.

6 Refferences

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