Does unemployment affect suicide in the US?

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Abstract. In this project, we aim to explore whether suicide is mainly caused by unemployment in the U.S or not. We want to visualize their rates to see if there are any links between them. It is useful because past works are mainly focused on the analysis and statistical methods, but they lack clear and well-designed visualizations exploring their relationship. Therefore, we've decided to make contributions to this by providing insights from the data visualization perspective.

1 Introduction

Suicide became a serious issue in recent years. Many people researched this topic to explore the reason behind this phenomenon. With the break-out of Covid-19, many people lost their job and became unemployed. We want to explore if there is any relationship between these two issues, specifically, whether suicide is mainly caused by unemployment in the U.S or not.

Many previous works focused on analyzing the correlations and the potential causes but lack the proper visualizations to display the result. Some papers did a great job displaying the information but lack the careful analysis that follow the logic of their visualization part. We will combine the advantages of these works by linking the analysis and visualizations to provide insights from a new perspective.

We also aim to explore the result of the research question in a user-friendly way, so that people even with no data science background can understand it. In this case, we developed a web-based app to provide data vividly and various graphs following the research logic.

Table 1. Contributions of each team-member

Name	Associated works
Chengyuan Zhou	Data Preprocessing, Scatter Plot, Sunburst Chart, Zoomable Circle
Yuqi Xiao	React, d3 Integration, Barchart, Web design, Page Layout with BootStrap, CSS
Qiyun Zhang	Data Preprocessing, Heat Maps, Sunburst Chart, Zoomable Circle, React, d3 Integration,

2 Data

2.1 Suicide and Unemployment Rate

Our data consists of three parts. The first part is suicide rate for all 50 states in U.S from year 2014 to 2016 provided by multiple sources including:

- Centers for Disease Control and Prevention
- WHO online Mortality Database
- United Nations Development Program, human development index

. The raw data contains information about year, states, country, and suicide rate.

The second part is the unemployment rate for all 50 states in the U.S from the year 2014 to 2016 provided by the US Department of Labor's Bureau of Labor Statistics. The raw data contains information about the year, month, state, country, and unemployment rate.

We did a lot of data preprocessing for these two parts of data since the raw data consists of some layouts. We also did data screening to select the demanded years of data from the 102230 raw data points. Linking different datasets is also required, and since the primary keys of these datasets are different, we need further map them to the same keys(for example, we need to convert "New York" to "NY"). Then we can get a well-formatted dataset of the unemployment rate and suicide rate.

2.2 Data of Other Potential Factors

Suicide is a complex event that is the result of the interaction between a number of potential factors. Risk factors include health factors such as depression, substance use problems, serious mental illness, and serious physical health conditions, environmental factors such as access to lethal means, and stressful life events including divorce, unemployment, relationship problems, and financial crisis.

We took data from multiple articles talking about suicide from sources like APA (American Psychological Association), Department of Health in Wyoming State, New Mexico State, etc.

We want to make sure that the data are credible, trustworthy, and valuable so that our analysis is solid.

The third part of our dataset is about other factors of suicide. We gathered these factors by doing research. We explore these factors by viewing the data visualization results of the first two parts of data, and find states with high suicide rates to explore their common reasons and based on the research result, we calculated the frequency of each factor to generate the dataset.

3 Approach

3.1 Design

We've chosen a visualization dashboard as it is a straightforward and efficient way of displaying data. We used a compact layout to fit all of our charts into one page. Users will be able to scroll up and down for different visualizations and there is no need to switch between different tabs as there is only one page. We turned the background to dark color because this will highlight the charts so people will not be distracted by other non-essential elements. We also make sure that the color usage is friendly for colorblind people.

The charts we've created include:

- Choropleth maps for unemployment rate and suicide rate
- Interactive sunburst chart showing the proportion of unemployment and suicide for all states in years 2014, 2015 and 2016
- Interactive and animated bar chart showing the two rates in order
- Interactive scatter plot showing the correlations between these two rates across year 2014, 2015 and 2016
- Zoomable circle chart showing all other potential factors that may cause suicide according to our dataset

All charts are integrated with react framework using node.js with bootstrap grid system.

3.2 Technical Considerations

We selected React framework to be the primary tool for the charts/images integration and display because React is easy to use, has strong support for d3 libraries, and has rich documentation/resources online. We utilize bootstrap for the grid system because it could be easily installed into react framework using npm. It has various components and a great grid system, as well as responsiveness, which helps us to develop our web project and layout the element easier.

3.3 Development

We used Pandas to pre-process data, and Python to convert self-generated data to .json format as this is the most common format for most of the dynamically generated charts. For visualization, we learned new frameworks and dealt with many unexpected issues such as incompatible environments. Since we first develop the charts and webpage without using any framework but just d3, there are compatibility issues when we switch to react framework. Thus we've done lots of researches online trying to fix the problem caused by incompatible environments or versions of libraries and packages. Finally, we applied d3 with bootstrap and react framework to achieve the purpose of our project.

3.4 Evaluation

The finalized web page will be in form of a dashboard. All charts with corresponding descriptions/explanations are placed in one single tab. Users can scroll up and down to view all charts and analysis results.
We also add some filters functions for users, in case that they only want to view data of a specific year (refer to Fig.2), or they want to view the data in a specific order (e.g ascending/descending).

Some of the charts are:

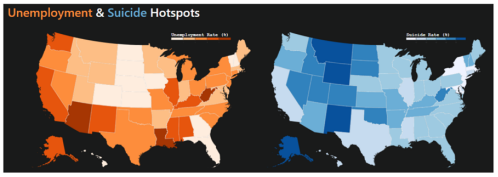

Fig. 1. Two heat maps showing the hot spots of unemployment and suicide across U.S.

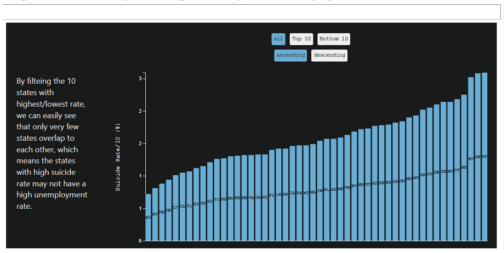

Fig. 2. Responsive bar chart that shows the suicide rate in specified order

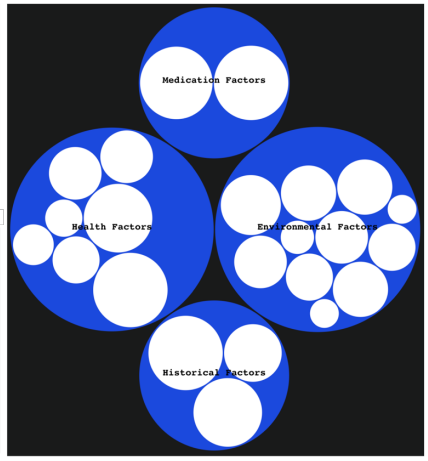

Fig. 3. Zoomable circle chart that shows all other potential factors that may cause suicide

4 System

This project aims to build an interactive web dashboard. so we need a server to render our data. We chose to use React.js framework because it is able to change data without reloading the page. Also, react allows us to build individual interactive chart components and import them into the main page. In this case, it gives us the flexibility to do chart development individually without conflicting with each other when we are dealing with GitHub version control. We order our repository structure by separate as components, styles, and assets, which make it easier to manage and import with a predefined directory path. We have also built and deployed our react app on the GitHub-pages environments which makes it accessible to anyone who has our project URL.

5 Related Work

Most research we can find online about unemployment and suicide rates is focused on the analysis, causes, and statistical methods. However, they lack clear

and well-designed visualizations. Thus we've decided to make contributions to this.

6 Conclusion

In this project, we've explored the relationship between suicide and unemployment by visualization. We've also explored other potential factors that may cause suicide based on the data from several credible sources.

Here is our story. Based on those research, we know that unemployment may or may not be one factor of suicide. To explore this question, we visualize this factor in different formats, such as heatmap, bar chart, scatter plot, etc. to best understand the idea. But we do not see very strong relations between them.
In this case, we are curious about which factors influence suicide besides unemployment, but we do not find the data that evaluate different factors' effects on suicide quantitatively. Thus, we do further research by reading others' papers and summarizing potential factors and generating our own data of other factors' effects on suicide to prove this idea by visualization. We found other factors. For example, health factors such as depression, substance use problems, serious mental illness, and serious physical health conditions, environmental factors such as access to lethal means and stressful life events including divorce, unemployment, relationship problems, and financial crisis.
For future work, we would have dived deeper into the specific states with high suicide rates to explore more potential factors of suicide such as demographic, environmental, and economical factors.

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