Individual Project Report

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Learning Objectives:

The visualizations are created to accompany the article “Doctors Are Failing Patients With Disabilities” written by Emma Yasinski using data provided by Centers for Disease Control and Prevention (CDC). Ideally, viewers are able to recognize that patients with disabilities still have trouble accessing the medical resources in multiple aspects. Particularly, we hope viewers will perceive there are greater obstacles for patients with disabilities to see a doctor and doctors’ bias towards patients with disabilities is unreasonable. In addition, we hope viewers are able to compare and explore the data in different years and different states and think about this problem.

Design Process:

1) Interactive Visualization

The most important thing mentioned in this article is that medical care isn’t easily accessible for patients with disabilities so my idea is to use some visualizations to highlight this point. After digging in the Disability and Health Data System in CDC, I found data about patients not being able to see a doctor due to cost in the past 12 months with or without disabilities. The data of different states and different years is available.

Figure 1 is my initial sketch design. The data of each state is shown in a map with a button shifting between people with disabilities and without disabilities. However, during the peer discussion, I got the feedback that in this case, you need to remember the content of a map in order to compare it to another map. In another word, two maps are not able to show at the same time.

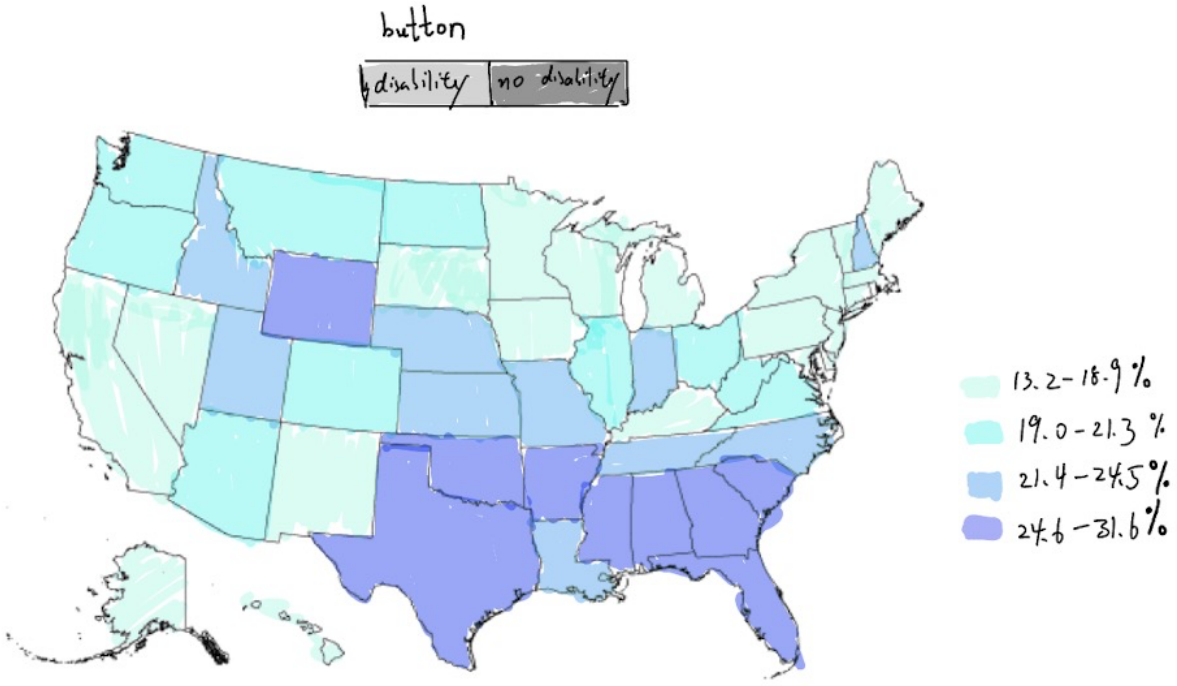

Fig 1: initial sketch initialization of patients not being able to see a doctor

Therefore, I decided to put two maps side by side and connect two maps with a click of the state as shown in figure 2. When hovering over the state, a tooltip of the state and the percentage is shown.

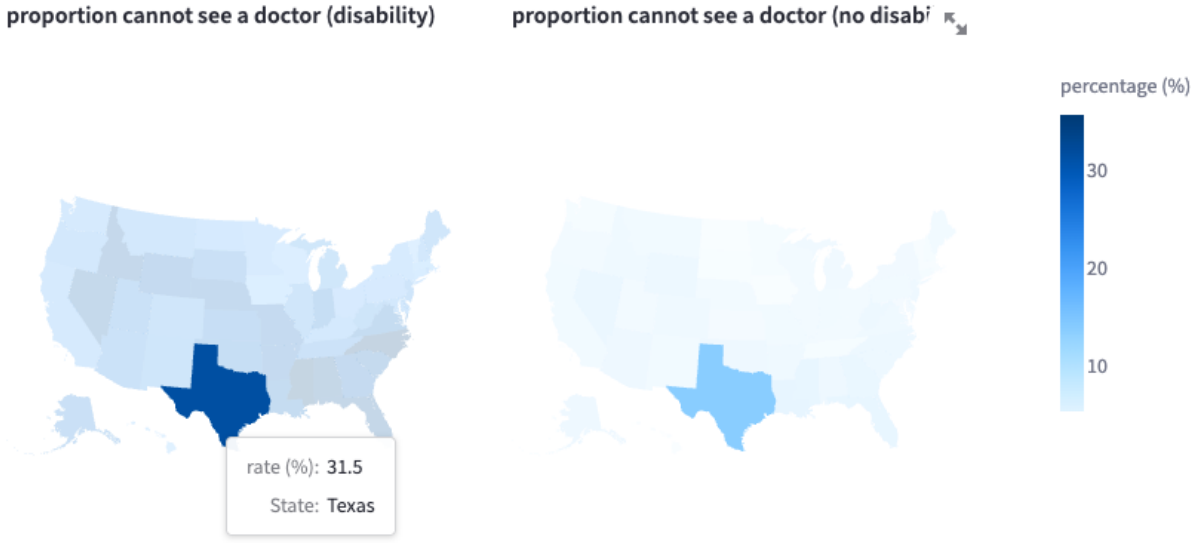

Fig 2: side by side map to compare people with or without disabilities

Though the above visualization can obviously show the proportion between different states and we can tell people with disabilities have a higher portion not able to see a doctor, one issue is that it is hard to compare the difference between people with disabilities or not of one state with another. For example, we cannot easily tell whether California or Texas have higher differences because humans can hardly compare how much one lightness differs from another. I tried to encode the difference into a dot size to show on the map but that is not intuitive and makes the map messy. Since humans are better at comparing length, I use a bar chart shown in figure 3 to rank and show the proportion difference between people with and without disability in each state.

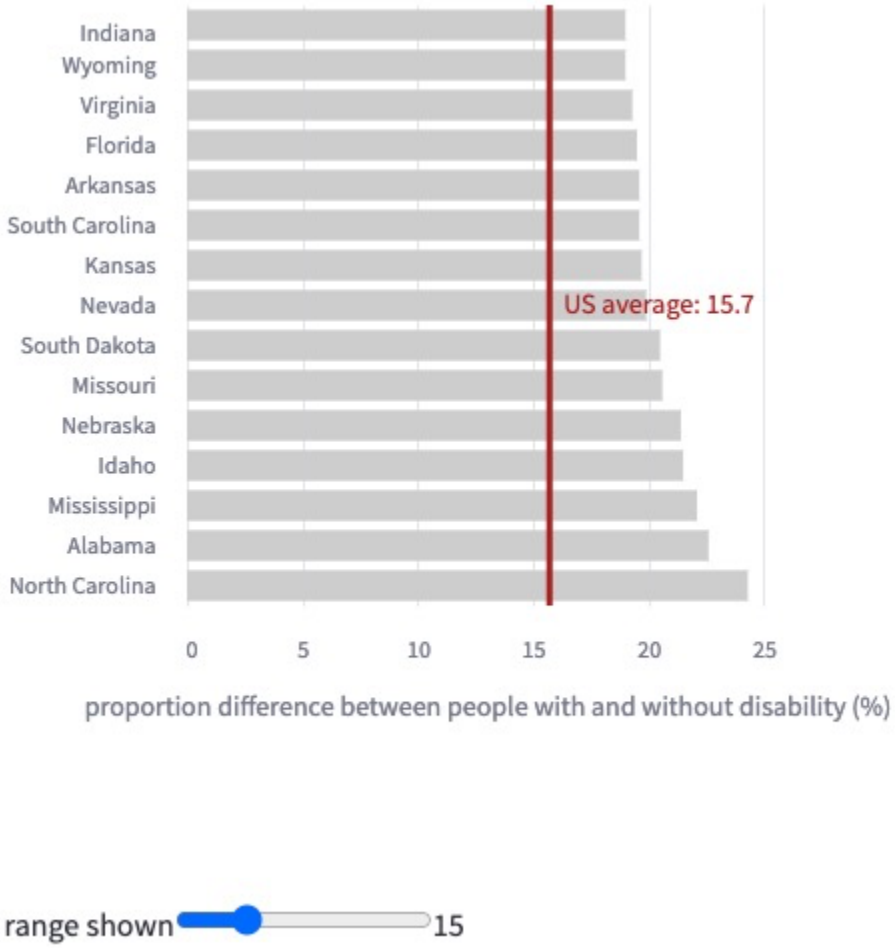

Fig 3: line chart to rank and show the proportion difference in each state

In this graph, the red line shows the US average value and a slider is used to scroll the states displayed. At first, I want to show all 50 states but it takes too much space on the screen and the reader cannot see the bar chart and the map chart at the same time. Then, I tried to show only 15 top states but that limits the viewer's exploration. This slider can perfectly solve the solution. Each bar is also clickable, and it is connected to the state in two map charts. The exact number will be shown in the tooltip.

Finally, I also want to show the trend of this proportion from 2016-2020 so I use a line chart. The final combined visualization is shown in figure 4. By choosing a year in the tab and clicking a state you are interested. It will present the proportion rate over the years of that state in the line chart with that specified year having a larger dot size. Here, we choose the similar color as the map chart so that viewers can easily pair a line with a map. When no states are chosen, the line chart shows the US average trend. At first, I tried to make the dot in the line chart clickable to shift different years data but after showing it to my friend, they did not notice the dot is clickable so I simply use tabs in the Streamlit to shift years.

2) Static Visualization

Another visualization I made is about the health and chronic condition of people with or without disabilities. The goal is to let users know the health condition of people with disabilities should be paid more attention and the bias of doctors is unreasonable. The initial sketch is shown in figure 5.

I got the feedback from the instructors that more information could be contained in the visualization. Therefore, I found more health conditions from the CDC dataset and I also found that their dataset includes gender, age and race. After comparison, I found that gender and race do not change health conditions a lot and gender or race discrimination is not the goal of this article. We need to emphasize the most vulnerable group in terms of health conditions.

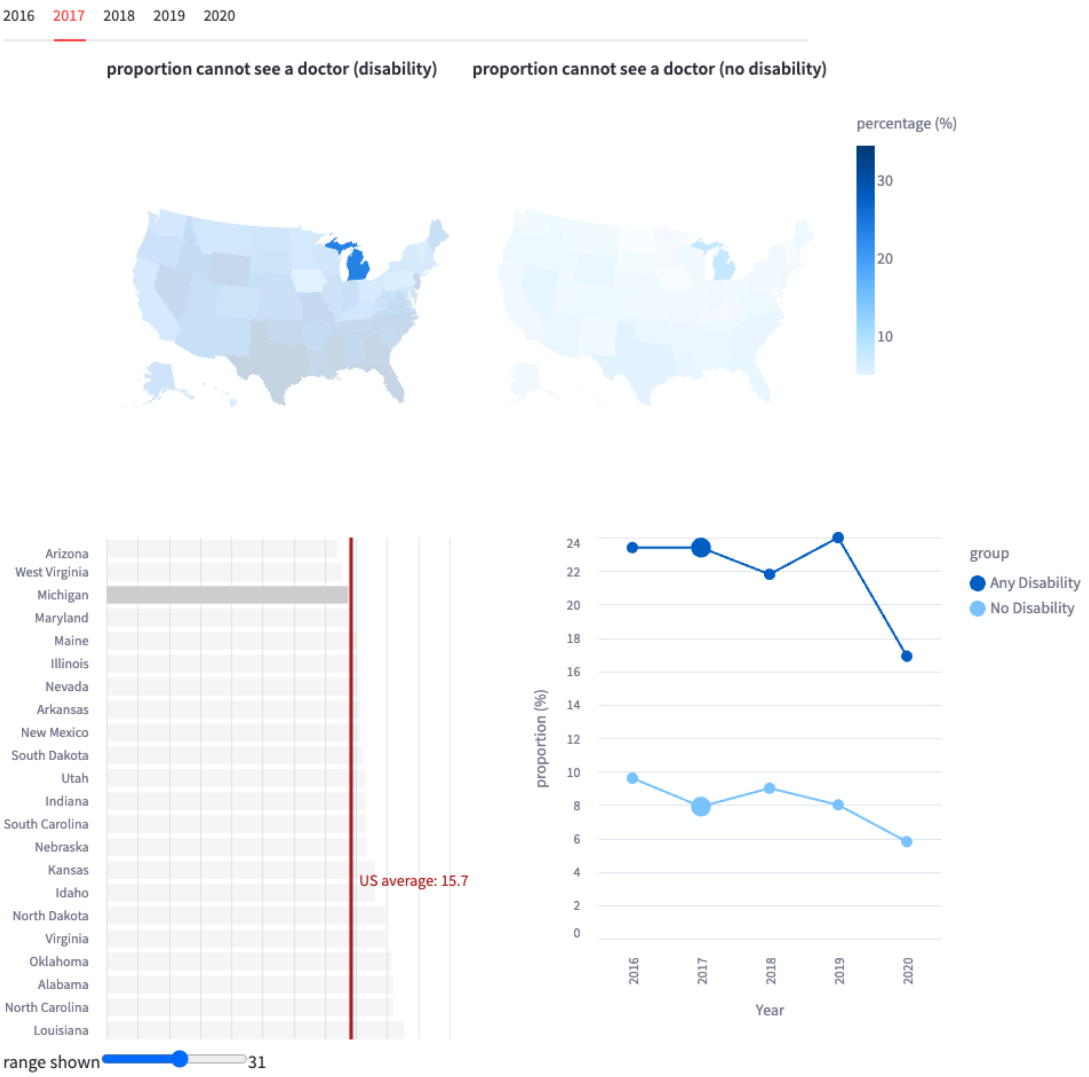

Fig 4: final visualization with year 2017 and state Michigan chosen

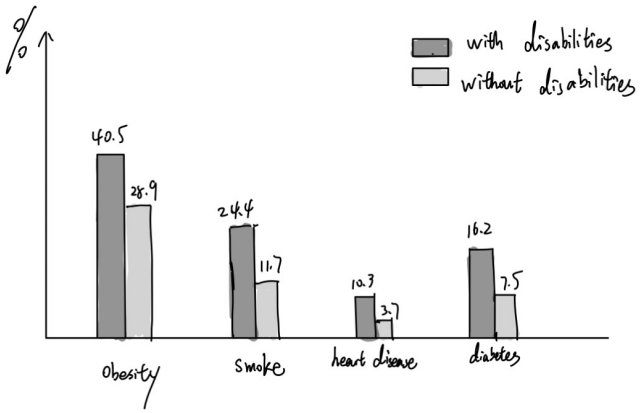

Fig 5: the sketch of health conditions of people with or without disabilities

However, how to encode age group information into the visualization is a problem here. I tried several ways to accomplish this task. For example, I have tried stack bar charts to show it with age groups encoded with opacity channels. However, it does not make much sense to me because the y axis will be the cumulative rate and some bars are more than 100. In addition, though we can still find that overall, patients with disabilities have worse health conditions, it is hard to compare people with or without disabilities in the same age groups because they do not align.

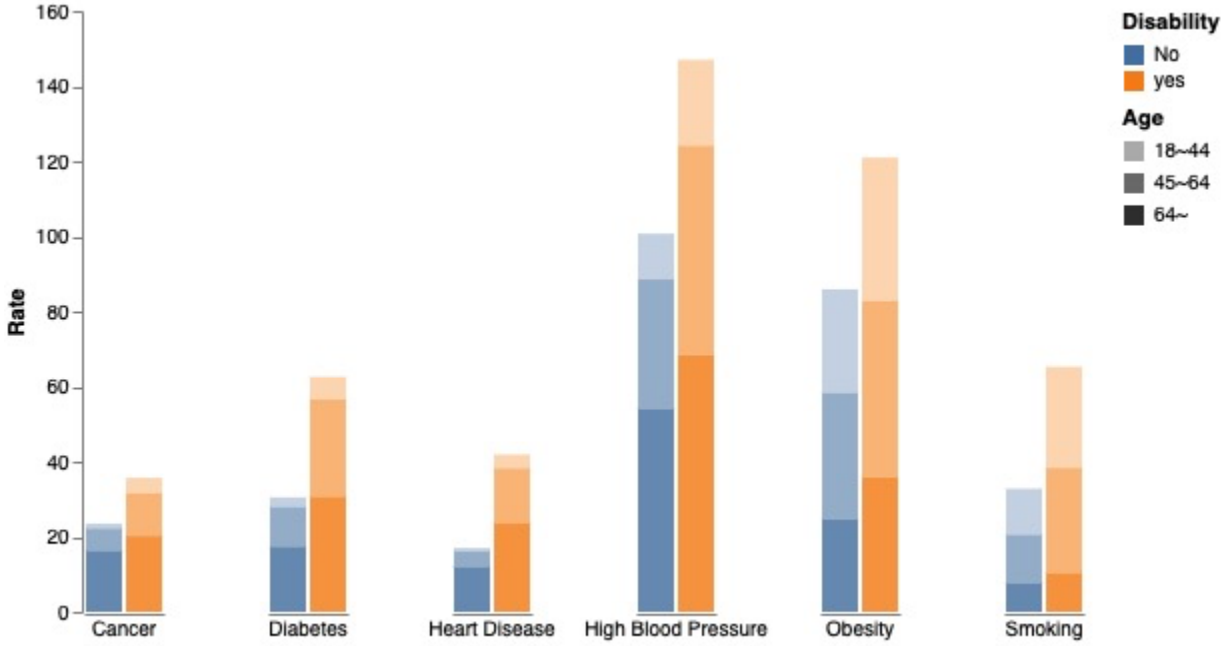

Fig 6: use stacked bar chart to show age

Therefore, I decided to divide it into three horizontal bar charts as shown in figure 7. One decision I made was whether I should group the bars as figure 7 or dividing it into 2 bar charts and each bar chart shows 3 bars in a group representing the age. As our main goal is to compare data with or without disabilities instead of the age and bars in one group can be compared more efficiently, I decided to show the visualization as figure 7. We can easily see that though people with disabilities indeed have higher rates of obesity, they are also more likely to have more serious chronic disease such as cancer or heart disease as well and older people should especially be paid more

attention. This should be an alert to doctors who have bias towards patients with disabilities.

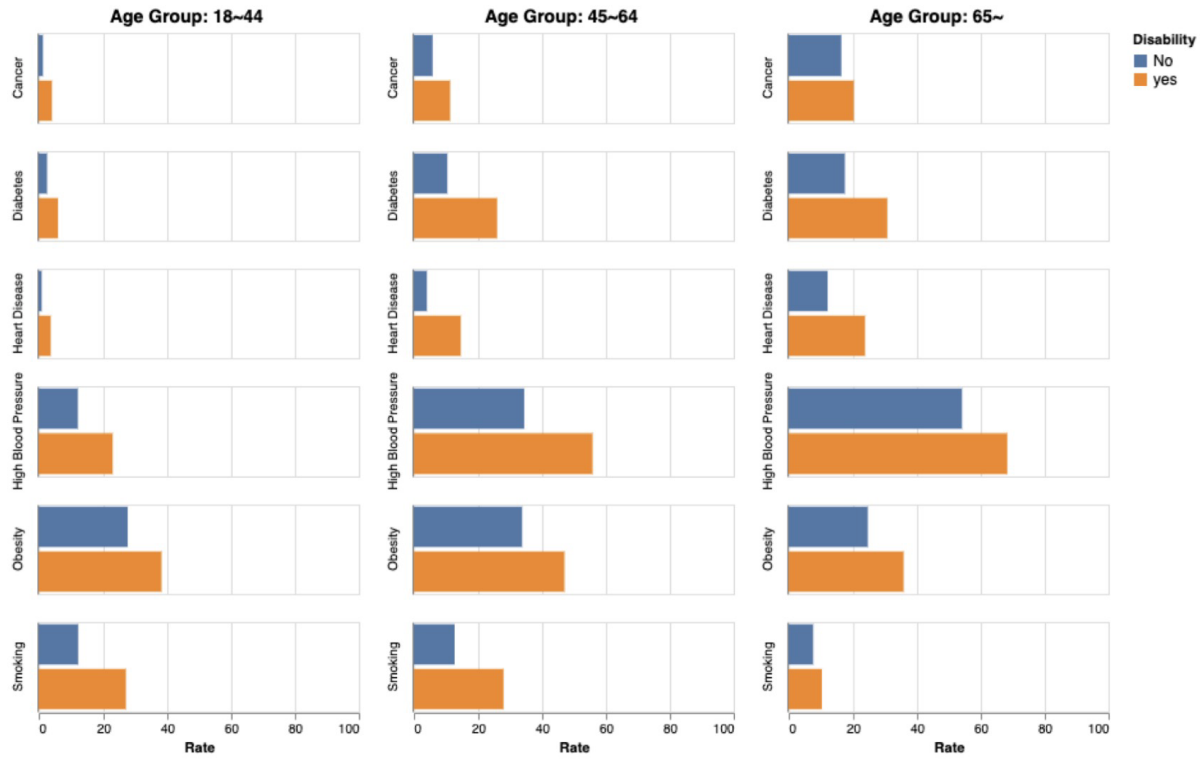

Fig 7: final static visualization showing additional age group information

Qualitative self-evaluation:

First, in terms of expressiveness, I believe my visualization is closely related to the article and is able to let users have a better understanding about the health condition and medical care of the patients with disabilities and the interaction provides users an easy way to explore the data.

Then, in terms of effectiveness, I carefully choose channels to encode data and consider human's perception and cognition. For example, in my interactive visualization, I choose sequential color in the map chart and by choosing a similar color in the line chart, readers can easily connect one map with one line. The four charts in one visualization can easily cooperate together by one click of the state. In addition, as mentioned in the design process, I paid attention to the viewer feedback from the

instructors and peers and thought of ways to improve my visualization to provide better reading and interaction experience.

There are also some things that can be improved. One metric of the visualization is the data density. For my interactive visualization, though there is a lot of data, I divide them into four charts so each chart will contain less data. For my static visualization, data density is not high either and another issue is that it cannot scale easily. Current design works because there are only 3 age groups, what if there are more? Maybe a better design could be used to solve this problem.