Project 2 INFO 3300
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Introduction:

Maternal mortality is a major issue all around the world. Maternal mortality is defined as the death of a mother during and shortly following pregnancy. Women die as a result of complications during and following pregnancy and childbirth, with most of these complications being preventable or treatable. Some of the major complications that account for a large proportion of maternal deaths are severe bleeding, infections, high blood pressure, and complications from delivery. Maternal mortality rates are exponentially higher in low income countries than high income countries, reflecting the inequalities in access to quality healthcare services. This visualization sheds light on these inequalities as well as provides interesting insights into the differences between within income group maternal mortality rates.

Data Description:

Our data is from the UNICEF data warehouse (https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=.MNCH_MMR..&startPeriod=1993&endPeriod=2000). We queried the UNICEF database to get maternal mortality data by country as well as the indicator variables associated with maternal mortality. These indicators included infant mortality rate, percentage of mothers who receive postnatal care, early childbearing rates, the proportion of healthcare facilities with basic sanitation services, as well as the percentage of child births attended by skilled professional health personnel.
We used a second data source from The World Bank (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups) in order to get our country's income information.
Finally we used a topoJSON data file to do the map visualizations. We used the countries-10m.json file which can be foud at https://github.com/topojson/world-atlas.

The UNICEF data warehouse dataset came in long format. To reform this data we created a python script that utilized the Pandas package and SQL to reshape the data into a wide format. In the python script we also renamed columns so they were more readable, as well as made sure the formatting of country names was the same for the UNICEF data and the topoJSON file. For example, in the UNICEF data the US was originally spelled “United States” but in the topoJSON file it is “The United States of America”. So, we used the script to make sure the spellings and formatting was consistent across all data files. In our javascript file we add the income information from The World Bank data to our UNICEF data.

Variables Used:

- GeographicArea: name of each country
- TimePeriod: year in which the statistics were reported
- Infant_mortality_rate: number of infants, out of ever 1,000 live birth in each country, die before the age of 1 year

- Proportion_sanitation_services: the percentage of healthcare facilities with basic sanitation services
- Maternal_mortality_ratio: maternal deaths per 100,000 live births (deaths due to complications with mothers pregnancy or birth)
- Skilled_birth attendant: the percentage of child births attended by skilled professional health personnel
- Early_childbearing: the percentage of women in a country who gave birth before age 18
- Postnatal_care_mothers: the percentage of mothers who receive postnatal care within 2 days of giving birth

Visual Design Rational:

Choropleth Map:

The goal of the choropleth map is to show the maternal mortality ratio of each country in an aggregate way. The maternal mortality ratios are grouped into 5 different levels to, represented by the 5 different shades of red, to display an aggregate summary of a country's maternal mortality ratio. The darker the shade of red, the higher the maternal mortality rate. To map our data to the visual elements we used text labels and country outlines as our marks. We primarily used color as our visual channel, but position could also be one too (country outlines are positioned on the map relative to where they are in the world). For each country the country outline mark is drawn relative to the country's actual location. This country is filled in with a shade of red which corresponds to the country's maternal mortality rate (dark shades of red correspond to higher maternal mortality). For this map, and for all of our projects, we primarily used the color red. Originally we were using blue, but then realized that red might be a better choice in describing maternal mortality rates. This reasoning is cultural, as red typically is thought of displaying something more serious, and is associated with death. As the shades of red get darker, the user can intuitively assume that the mortality rates are increasing. We also included a scale below the map that shows which colors correspond with which rates. Although the color scale legend (which is based on the one from Prof Rz.) has some pretty big performance issues (as it draws a lot of rectangles over and over again), we thought it was necessary in order to help improve the user experience. By looking at the scale the user can see which rates fall into which color category. This is especially useful because when the user filters by income level, the scale changes. Without including the scale, it might be hard for the user to tell which rates correspond to which colors. Countries that we did not have data on (like Antarctica) were shaded a light grey. This clearly lets the user know that it is not part of the data.

Bar Chart

The key objective of the bar chart is to display the 10 countries with the highest maternal mortality rate. Further, we wanted this bar chart to update when the user filters by income level. To map our data to the visual elements we used were the bars (rectangles), text labels on top of every bar that showed the maternal mortality rate of that country as our marks. The channels of this visualization were both horizontal and vertical aligned position (country being on the x axis, and maternal mortality on the y axis). One consideration we discussed when creating this visualization was the y axis. When the user filters the data by income, the y axis scale stays the same. Rather than updating the scale to represent the new data, we leave the y axis scale on

the full data. So, for higher income countries the bars are noticeably a lot smaller than they are for the “All Countries” and lower income country filters. We thought this choice highlighted the large difference in maternal mortality rates among countries of different income levels. We displayed the maternal mortality rate in text at the top of each bar in order for the user to more clearly see what the rate was for each country. Lastly, we added the light gray horizontal grid lines in the background of the graphs for users to be able to understand each bar’s height and, respectively, the maternal mortality rate, more clearly.

Interactive Elements + Rationales:
To brainstorm interactivity we did iterations of sketches as well as looked at other websites and talked to TAs and friends.

The first interactive element we implemented was the filtering of countries by income level. In studying maternal mortality we realized that there was a large difference between maternal mortality rates in low income versus high income countries, due to many factors. But, what can be even more interesting and show some pretty surprising results is looking at maternal mortality rates within income groups. By allowing users to filter countries based on income level, users can compare each country to those in similar income levels. This is interesting because when looking just at higher income countries, you can see that the US has one of the highest levels of maternal mortality, whereas if you look at all the countries, it seems that the US is doing fine. When a user clicks on one of the income filter buttons, the map data is updated to gray out the countries that are not in that income group, and the color scale is updated so you can see the maternal mortality rate groupings based on only the countries in the income group. The bar chart with the top 10 countries also updates to show the top 10 countries within the selected income group. We invited users in the text above the visualization to click on the buttons to filter countries by income level and explore their findings. We also put the buttons at the top of the visualization so that it was obvious and clear to the user that the buttons were to be clicked and used, and that they were easy to find.

The next interactive element we implemented was a mouseover tooltip feature on the map. When a user hovers over a country on the map, a tooltip is displayed showing the user the country name and the maternal mortality rate. The tooltip is a black text box with a reduced opacity so the user can still the through to the map behind it. Additionally, when hovering over a country, the country is outlined in a dark black (rather than the standard thin white outline). This helps make it more clear to the user which country they are hovering over and getting more information about. This affordance is interesting because by just viewing the map, without the tooltip, the user can only see the aggregate information. They can only see which maternal mortality rate grouping a country falls into, not the exact rate or even the country name. This tooltip provides easy and quick info for the user that is easily discoverable just by hovering and moving your mouse on the screen.

The next interactive element we implemented was an onclick feature on the map. When a user clicks on a country on the map, a textbox with more information about the country's maternal mortality rate and indicator variables is displayed. The textbox appears in the bottom right corner of the map. We also considered displaying the textbox on the map next to the mouse, however we thought that since the text box was so big, having it cover part of the map would be difficult for the user because they would not be able to click on countries under the map. This onclick feature provides really interesting information to the user. From the information provided, the user is able to learn more about the indicators of maternal mortality such as hospital sanitation services, postnatal care, early childbearing rates, and more. Since the onclick feature is not as easily discoverable as the hover feature, we made it more discoverable by writing in the beginning paragraphs about the affordance. We suggest to the user that they click on the countries to learn more about the indicator variables.

The Story:

Maternal mortality rate is the number of deaths caused (or influenced by) complications due to pregnancy or childbirth out of every 100,000 pregnancies. These deaths are largely preventable. According to the CDC, 60% of deaths in the USA caused by pregnancy or birth complications would be preventable with adequate training and resources. It is estimated that a much larger portion of Maternal mortality are preventable worldwide.

Historically, studying maternal mortality has not been prioritized, and we are able to see the consequences of that in this data.

One especially important finding of this project is that when comparing the US to all other countries, it looks like we have a very low maternal mortality rate, but when you compare it to just high income countries, the US has one of the worst maternal mortality rates.

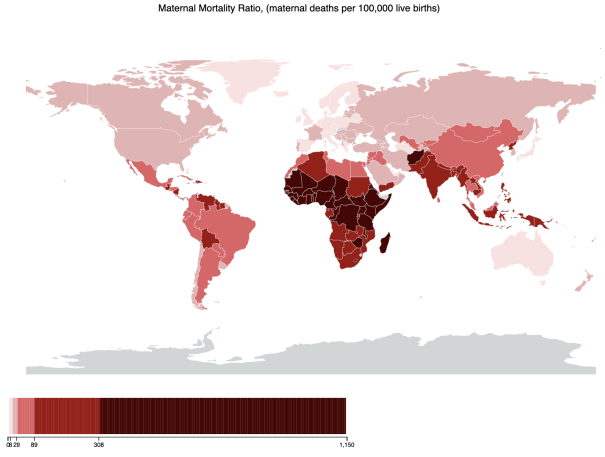

Image #1

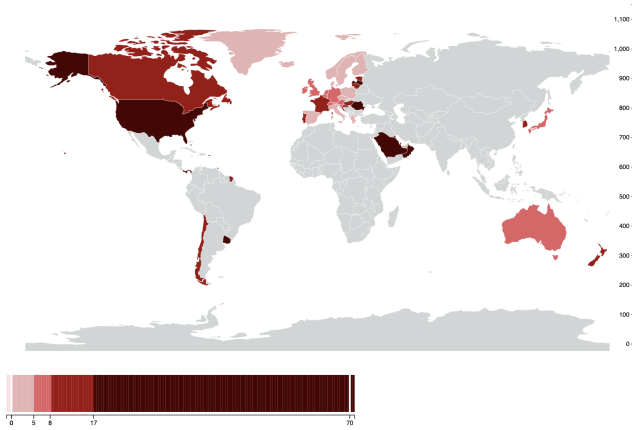

Image #2

As you can see above, in image #1, all countries' maternal mortality are being compared, and the US looks as though it is doing amazing with maternal mortality at very low rates. Whereas in

image #2, when only “high income countries” are being compared, the US has one of the highest rates of maternal mortality.

We hope in this visualization to raise awareness of how the US needs to do better. If the majority of these can be solved by training doctors and nurses for specific emergencies, and making sure they have emergency kits to address the more common reasons for maternal mortality (CDC), then we need to prioritize these changes. We also hope this visualization sheds more light on the indicators of maternal mortality. If we can help address issues, like sanitation at health care facilities, postnatal care for mothers, early child bearing, and having skilled birth attendants we can hopefully do more to help combat maternal mortality. The safest place for a woman to deliver her baby is at a functional, clean health care facility with the aid of skilled healthcare personnel. This visualization sheds light on the issue of maternal mortality and the factors that contribute to it.

Outline of Team Contributions:

Emily: worked on making the world map, and making each country clickable. She also worked to make the countries light up different colors on a color scale based on the maternal mortality ratio. She worked on a good part of the write up as well.
Writeup + research for writeup: 3 hours
Making the world map color by maternal mortality, and making it interactive (countries clickable) took the most time, 9 hours
Debugging smaller issues: 3 hours

Kylie: formatting and cleaning the dataset, combining other datasets, bar chart, filtering bar chart and map by income level, map tooltip, map onclick textbox,CSS styling of web page. Kylie helped with the write up as well!
Cleaning and reformatting the data took approximately 3 hours.
The interactivity (tool tip, filtering, onclick textbook) took the most time -- probably 10 hours.
CSS styling took 1 hour.
Creating the basic static bar chart took 1 hour.
Writeup - 1.5 hours.

Sources:

https://www.healthsystemtracker.org/chart-collection/health-spending-u-s-compare-countries/#:~:text=However%2C%20even%20as%20a%20high,highest%20per%20capita%20health%20spending.