Exploring TB incidence around the world and changes over time

Background and goals of visualization

Tuberculosis (TB) has been entwined with humanity for millennia. Once romanticized as a malady of poets, today, tuberculosis is seen as a disease of poverty, that walks the trails of injustice and inequity we have blazed for it. As of 2023, TB has likely returned to being the leading cause of death from a single infectious agent, replacing COVID-19 (which briefly took the lead from 2020 – 2022, according to the 2024 WHO Tuberculosis Report).

Thus, I wanted to take the opportunity of this report to do a data visualization of current TB incidence rates around the world, as well as the changes in TB incidence rates over time. The main goal of this visualization was to identify the countries most greatly impacted by TB and to get a sense of the evolving incidence in different countries.

For this visualization, I used the Tuberculosis burden dataset, spanning from 2000 - 2023, provided by the World Health Organization. For this specific visualization, the relevant fields used include:

1) Country
2) Region (based on WHO)
3) Year
4) TB incidence per 100k population

The task to be completed by this visualization is the identification of the countries with the highest or lowest TB burdens and the change in TB burden over time in different countries.
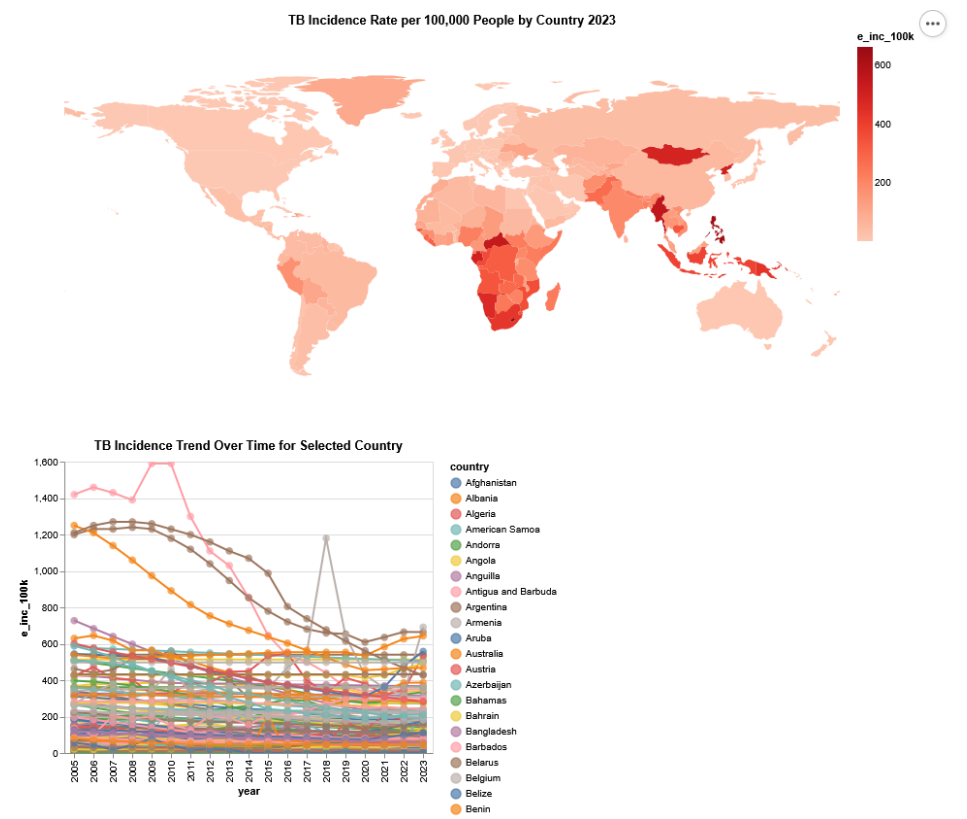
Initial Visualization

The visualization is available in the attached HTML file, with screenshots included for reference in case the HTML file has issues.
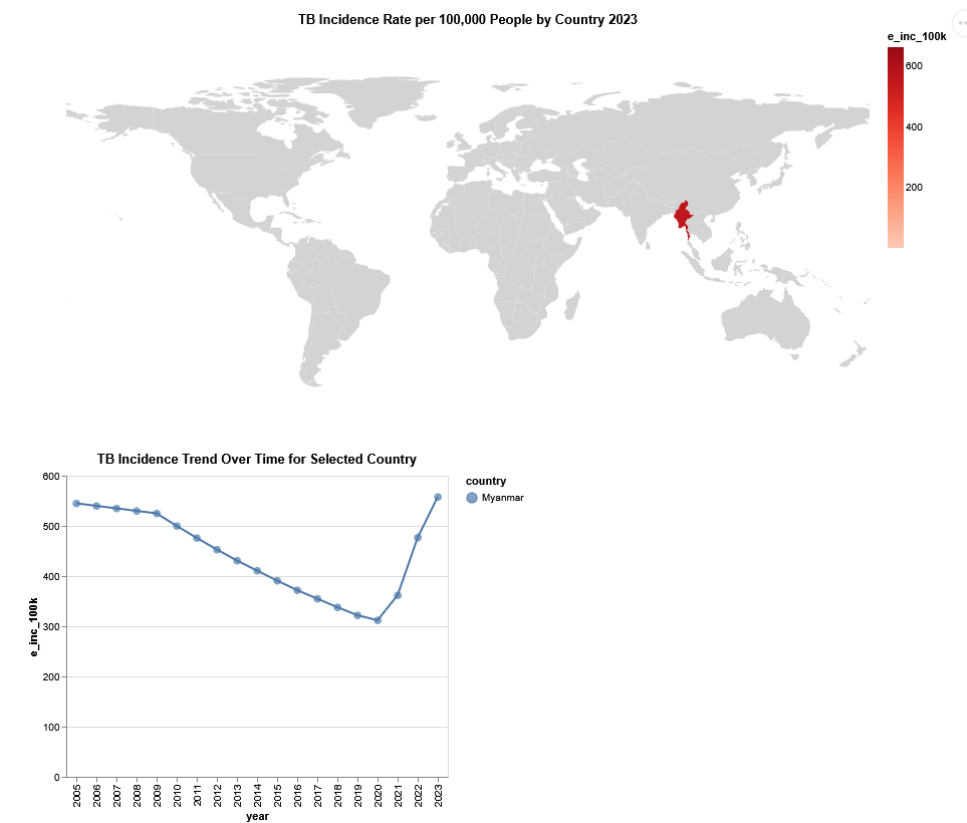

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Overall visualization, V1

TB Incidence Rate per 100,000 People by Country 2023

TB Incidence Trend Over Time for Selected Country

Country specific visualization (Myanmar), V1

TB Incidence Rate per 100,000 People by Country 2023

TB Incidence Trend Over Time for Selected Country

Description of Key Elements and Justifications

	Map Graph	Line Graph
Data	Incidence of TB per 100,000 population in 2023, for each country	Incidence of TB per 100,000 population from 2005 – 2023, for each country
Aesthetics	Intensity of color indicates value – darker color indicates higher value	Color distinguishes countries, position encodes values
Scales	World map, equirectangular	Linear mapping from 2005 – 2023 on the x axis, linear mapping from 0 up to 1400 on the y axis (depending on selected country)
Geometric Objects	Countries	Circles representing data points, connected by lines
Statistics	Raw data points	Raw data points
Facets	A single map	One plot
Coordinate System	Geographic	Cartesian

Key elements present:

1. Geographic coordinate system – to provide a geographic sense of the areas that have the highest incidence of TB visually.
2. Color saturation to indicate value – to give a quick impression on which countries have the highest incidence of TB.
3. Tooltip providing numerical data on mouseover, in both map and line graph – to communicate additional information without cluttering the visualization.
4. Filtering of the map and line graph by clicking the map – to provide an intuitive way of filtering the various line graphs to show only the line of interest.
5. Use of circles in line graph – to improve the mouseover experience for tooltips in the line graph.

Evaluation Approach

To evaluate the visualization, I provided the following questions for my participants to consider:

1. What did you manage to discern from the graphs? Did you understand what the visualization describes?
2. Were you able to determine the countries/regions with the highest incidence? Do you feel like you can derive other insights?
3. Was the visualization simple to use and easily understandable? Were the elements readable to you?
4. Does the visualization remain responsive when interacting with filters?
5. Do you have any other comments?

The above questions would be provided along with my visualization, over the internet for them to evaluate. Ideally, the most relevant audience to evaluate this piece would have been public health analysts, policy decision makers, epidemiologists or other researchers. However, as I was unable to access such individuals, I resorted to asking friends and colleagues that most closely resembled these profiles to assist me in this review.

Evaluation 1 & 2

The first participant that reviewed the visualization was a friend of mine, who is a pharmacist in his day job and is also a recent graduate of this course. Upon viewing the visualization, he quickly recognized that African countries had a higher incidence of TB. He agreed that the visualization was simple to use and understand. He suggested incorporating additional dimensions, such as a country's Gross Domestic Product, or some sort of development index, to improve the insights that could be drawn from the visualization. He also suggested adding a filter for countries with higher incidence and/or specific regions, to better wrangle with the visualization.

The second participant that reviewed the visualization was a colleague that works as a healthcare policy analyst. When presented with the above visualization, he was able to understand the visualization intuitively. He suggested that a grey to red scale would be better to highlight hotspots, suggested a filter of the top 10/20 countries with the highest incidence in 2023 to reduce the clutter in the line graph and the option of grouping the continents together to make drilling down to country level data easier to do.
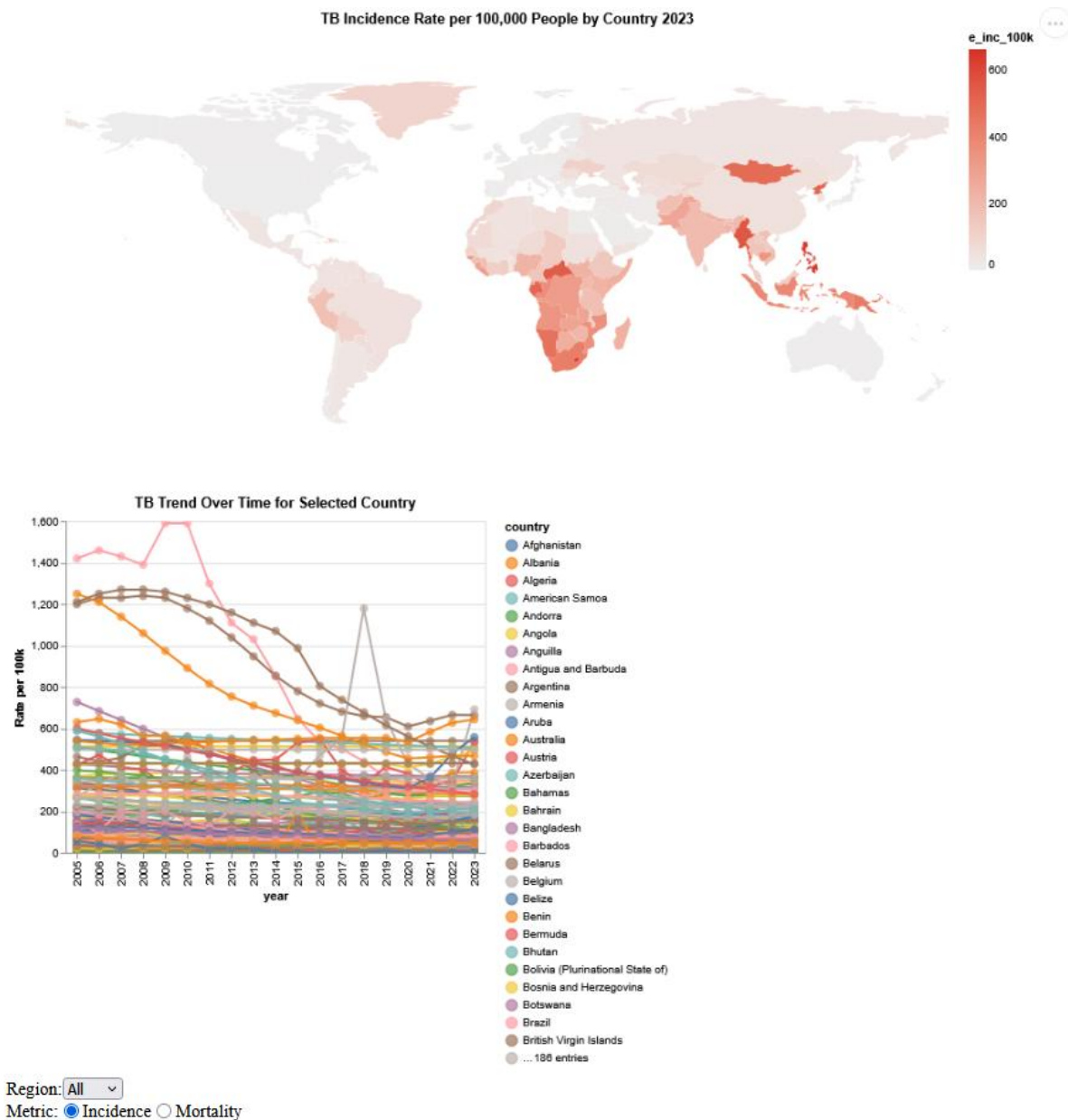
Refined Visualization

After hearing the suggestions, I decided to adjust the visualization before seeking additional feedback. The second version can be found in the attached HTML file below.
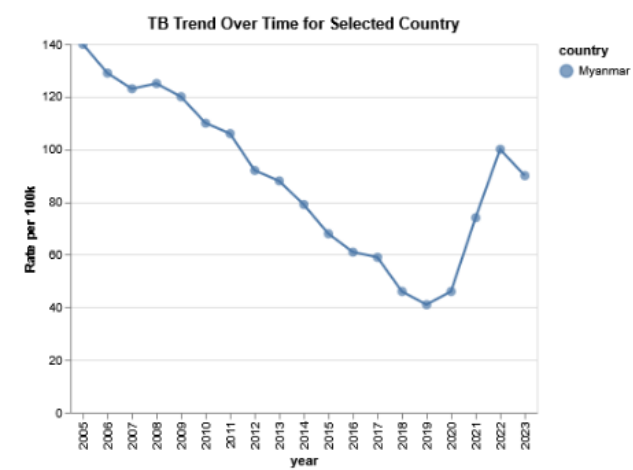

tb_incidence_dashboard v2.html

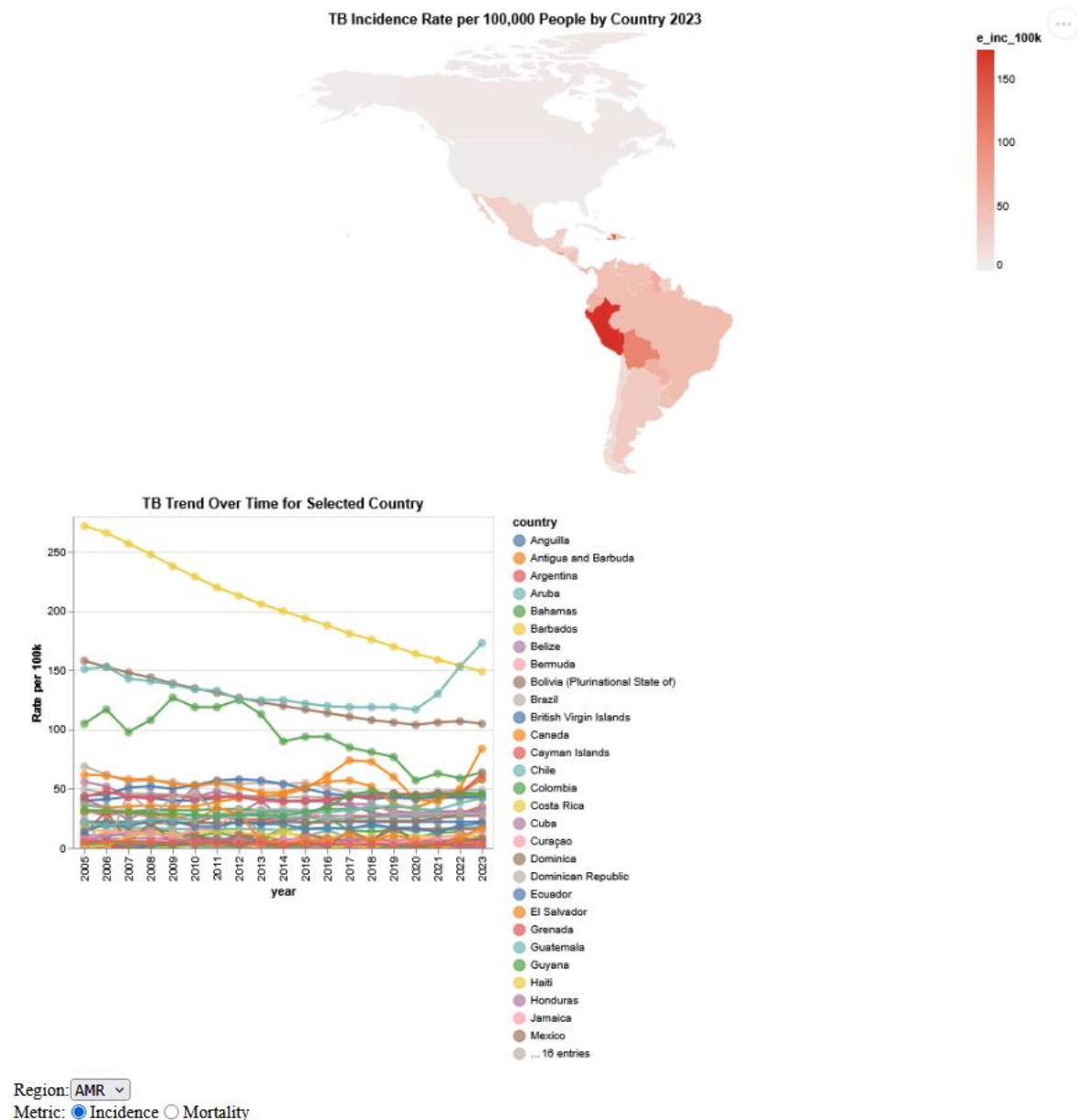Screenshots have also been added for reference.

<u>Overall Visualization, V2</u>

Country specific visualization for mortality (Myanmar), v2

TB Incidence Rate per 100,000 People by Country 2023

TB Trend Over Time for Selected Country

Region: [All ▾]
Metric: ○ Incidence ● Mortality

Region specific incidence of TB visualization (Americas), v2

The key elements that were changed were as follows:

1) Addition of TB mortality rates, per 100k population, to provide additional data for the user to gain more insights
2) Change of color scale to grey-red, from reds, to make countries with higher rates of TB stand out more.
3) Addition of a region filter, based on the WHO region data found within the dataset, to provide a stepping point between the world data and country specific data.

Evaluation 3

The third participant that reviewed the visualization is a friend that works as a consultant. In particular, she does not have a healthcare background, nor does she interact with data visualizations frequently, for me to get a better sense of how individuals less sensitized to data visualizations would interpret it. The same evaluation approach stated above was used for the third participant.

Viewing the updated visualization, she shared that she understood the gist of the visualization, noting that the overall rate of TB incidence was low in most of the world. She also noted that the colors were intuitive to her. She shared that the visualization could benefit from a dropdown list of countries to filter, as she had trouble locating smaller countries or did not know their geographical location. She also shared the view that the overall line graph was messy and suggested that "TB" be spelt out in the title. Finally, she mentioned that providing some instructions would have been helpful as she did not know how to unselect countries (done by clicking out of the visualization).

Personal Findings

Overall, I found that the visualization had achieved the desired effect of showing the incidence of TB around the world and its unequal effects on different countries. I found the following design elements particularly effective:

1) The use of the map helped give a geographical sense of which regions tended to be most impacted by TB, enhanced with the region filter.
2) The change to a grey-red color scheme helped with highlighting the countries most affected by TB well.
3) The connected graphs helped make the use of the visualization easier, showing the trend for the selected country.

However, further improvements can be made for this visualization, namely:

1) Adding more relevant data like gross domestic product, to drive deeper insights
2) Adding a dropdown filter for countries, to select smaller countries and rely less on geographical foreknowledge
3) Filtering to only show the top 5/10/20 countries in the relevant view to more easily identify areas needing help

While several improvements can be made to the visualization, I hope that the visualization as it stands is able to communicate to the reader how TB is not a relic of the past for many countries and that more should be done and can be done in many places around the world.