

How much did each country spend on health care (1970-2019)?

Team 3:
Bradley Ge
Jiatong Song
Jiayu Chen
Pedro Cedeno



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Overview & Motivation



Overview & Motivation

- Health insurance spending is a critical aspect of a nation's healthcare system.
- The driver behind this data visualization is to assimilate how health insurance expenditures have evolved over the years, particularly in the United States.
- This project focuses on health insurance spending trends in the most powerful countries.

Project Goals:

- Facilitate Public Understanding
- Benchmarking and Best Practices
- Highlight Disparities and Trends
- Impact Assessment
- Educate Stakeholders
- Encourage Further Research



Key Points/Terms

Health spending :

Health spending measures the final consumption of health care goods and services including personal health care and collective services, but excluding spending on investments.

Type of financing :

Health care can be financed through multiple financing arrangements that come from government and insurance spending like:

- **Total**
- **Government/Compulsory:** **health insurance coverage provided or mandated by the government**
- **Voluntary Health Insurance:** **health insurance coverage that individuals or employers choose to purchase on their own**
- **Out of pockets:** **expenses for medical services that aren't reimbursed by insurance**

Measurements :

- **USD Per Capita**
- **Percentage on GDP**

Questions



Objective Questions

- Which country has the highest per capita health spending?
- How does the per capita health spending in the United States compare to that of other countries?
- What percentage of the U.S. GDP was spent on health, and how does this compare to the spending as a share of GDP in other countries?
- Did health spending per capita increase or decrease in the U.S. and other peer nations across years?
- What is the historical trend in the difference between health spending as a share of GDP in the U.S. and comparable OECD countries, and how has this gap evolved over the past five decades?

Exploration Questions: Unveiling Insights from the Data

- ❑ What are the main contributors to the year-over-year increase in health insurance expenses?
- ❑ How do economic factors, technological advancements, or changes in healthcare delivery models correlate with spending pattern?
- ❑ To what extent does high health insurance spending correlate with improved healthcare outcomes or patient satisfaction?
- ❑ How do demographic factors, such as age distribution or income levels, correlate with health insurance spending?

Question Evolution and New Insights

- ❑ **Initial Questions:** Captured basic data points on health spending per capita and as a percentage of GDP
- ❑ **Evolution:** Shifted to explore the 'why' behind the data, leading to questions about factors driving health spending
- ❑ **New Questions:** Emerged from analysis, focusing on policy impact, technological advancements, and efficiency of spending relative to outcomes
- ❑ **Reflective journey:** Shows how each answer raises more and more complex questions, illustrating the iterative nature of our learning

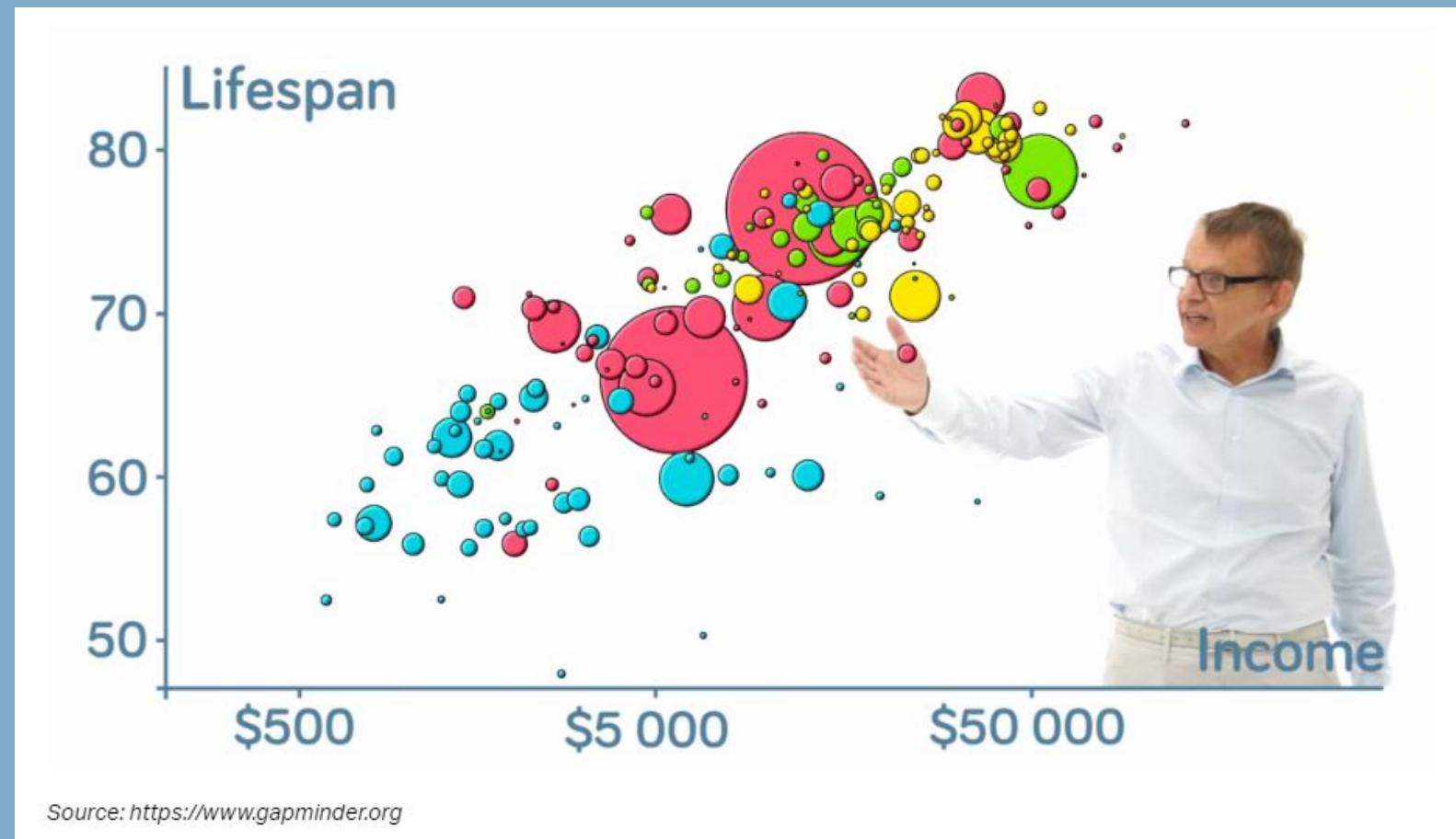
Related work & Inspiration



Related work & Inspiration

- The article provided by Health System Tracker about “How does health spending in the US compared to other countries?”, fostered further analysis.
- The goal is get insights that can help better understand the health insurance expenditure and help businesses or governments to plan better for optimized decision-making.
- Most of the questions for high income nations are addressed, but it would also be important to know more about low income countries health insurance expenditure.

Related work & Inspiration



An animated scatter plot is a common graph used in the economic major. It is used to show the change over time when there are more than two variables. An animated scatter plot can present different variables in a very clear way and include animation to show time variable in an engaging way.

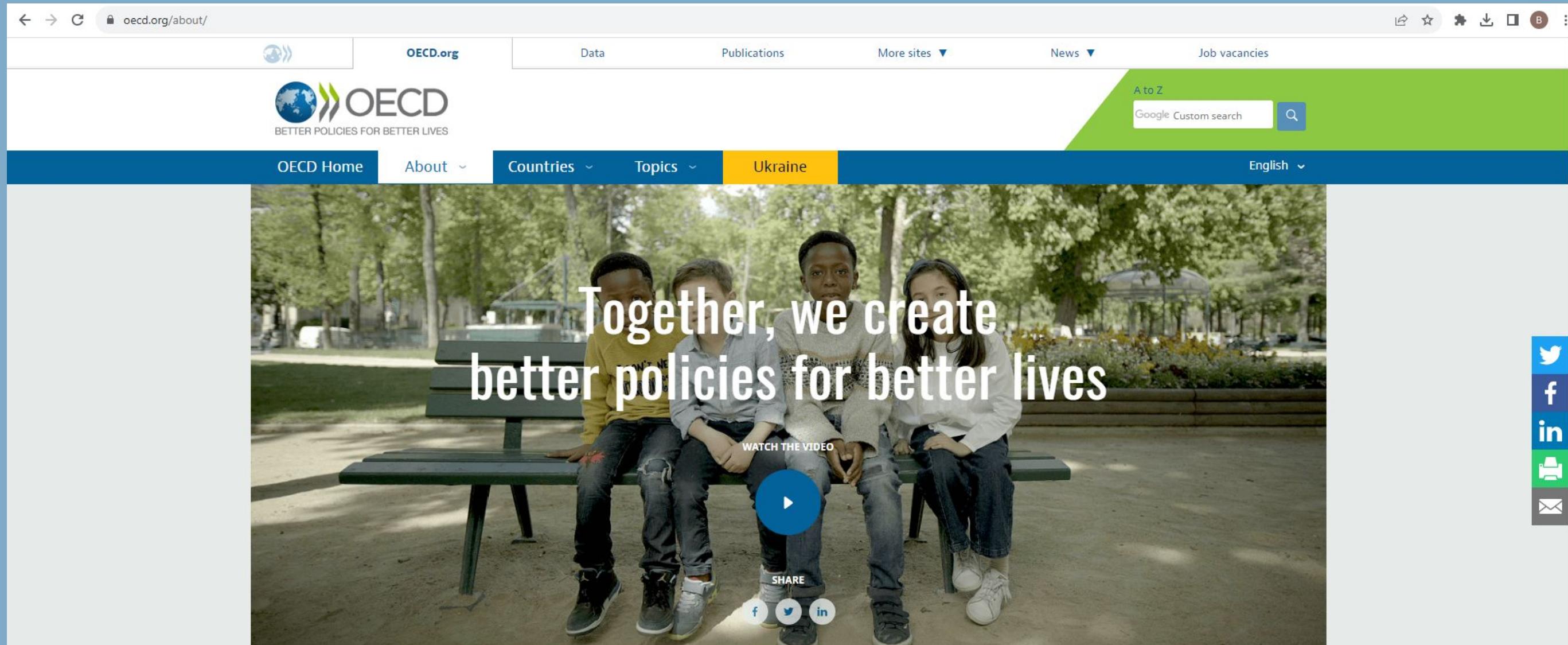
Data



Data Source

**The Organisation for Economic Co-operation and Development
(<https://data.oecd.org/healthres/health-spending.htm>)**

The Organisation for Economic Co-operation and Development (OECD) is an international organisation that works to build better policies for better lives.



Data cleanup

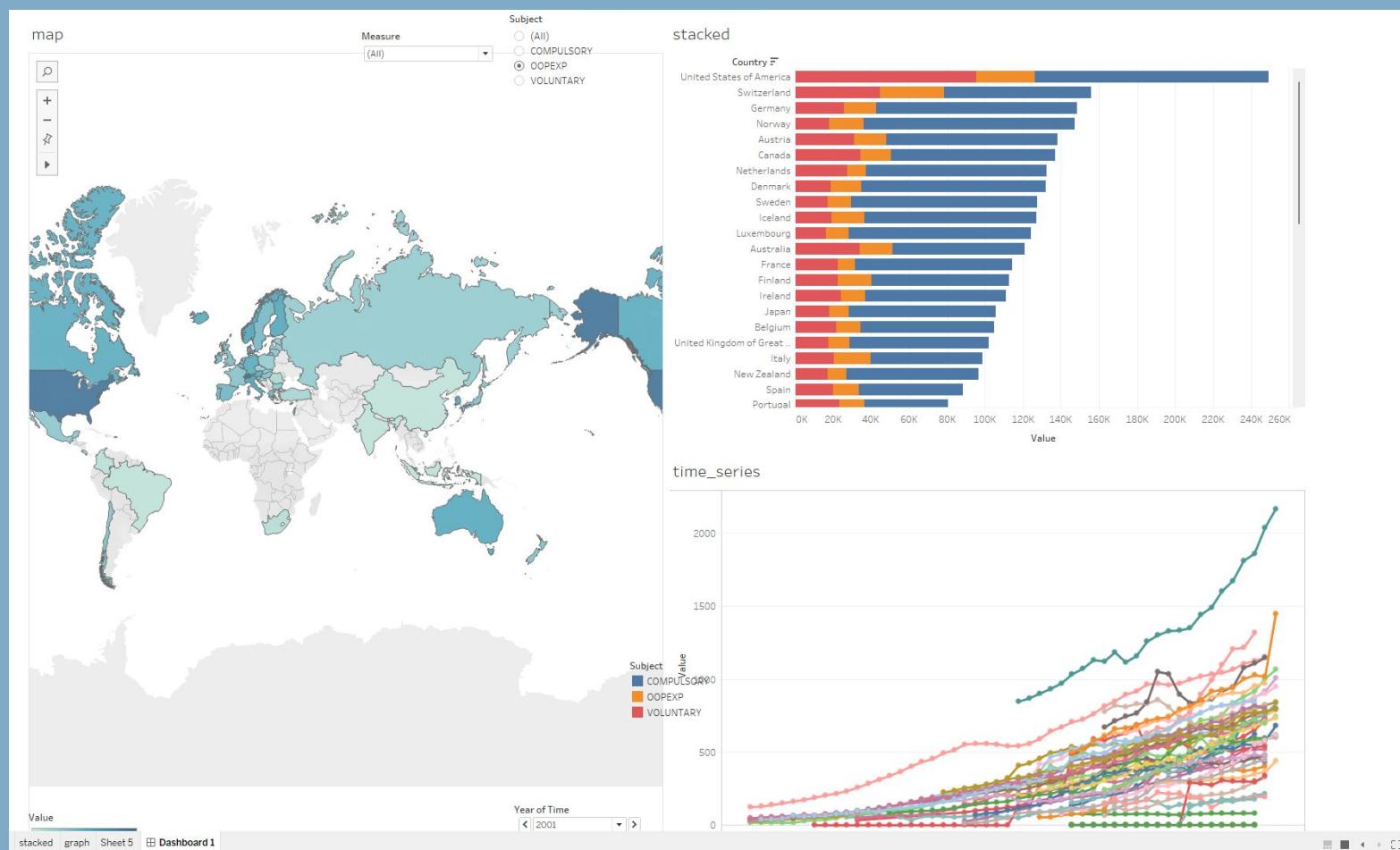
1. We merged our dataset (with only country code) with another dataset that has country codes ALPHA-3 and their corresponding country name(<https://iban.com/country-codes>) so when drawing the map, the data can be located geometrically correctly on the map.
2. We merged our dataset with another dataset (https://meta.wikimedia.org/wiki/List_of_countries_byRegional_classification) that has country name and region.
3. Since data comes from a credible source, we double checked that there is no outlier or obviously wrong data.
4. The data has been pivoted so that each line shows the country name, time, the type of financing(Total, Compulsory, Out of pocket, and Voluntary) and measure(% of GDP and USD per person). Two other new calculated fields(percentage on GDP and US dollars / capita) were created using “IF” function so we can get two measures for each country from the pivoted table for creating both axis in the animated scatter plot.
5. A new calculated field(dynamic value) was created so that when using the filter to change the measure with different units(percentage/USD), the data can be correctly shown on the map with the correct units.

Exploratory Data Analysis



Exploratory Data Analysis

Initially we tried a choropleth map, a bar chart, and a line chart so that they could represent the geometric location, comparison between countries, and trend.



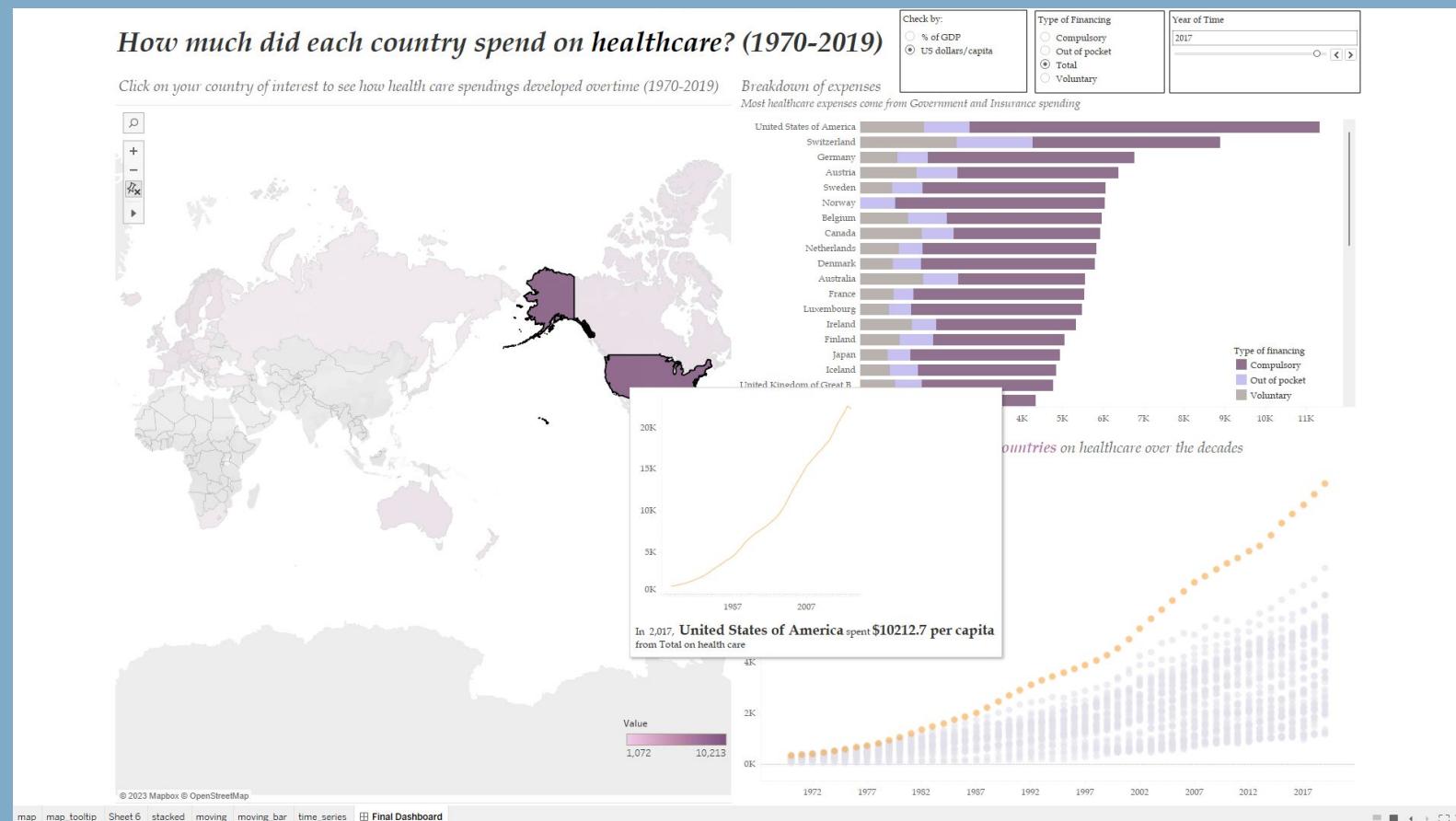
Improvement 1:

We found out that for each country, there are different types of financing, so we improved the bar chart to a stacked bar chart so that the graph could also present the difference between categories.

Besides the line chart that is used to show the trend, we also used dual axis so that each point can be clearly labelled.

Exploratory Data Analysis

However, we realized that the line chart looks messy if the audience don't interact with the graph, and one of our primary goals is to highlight the U.S. healthcare expenditure.



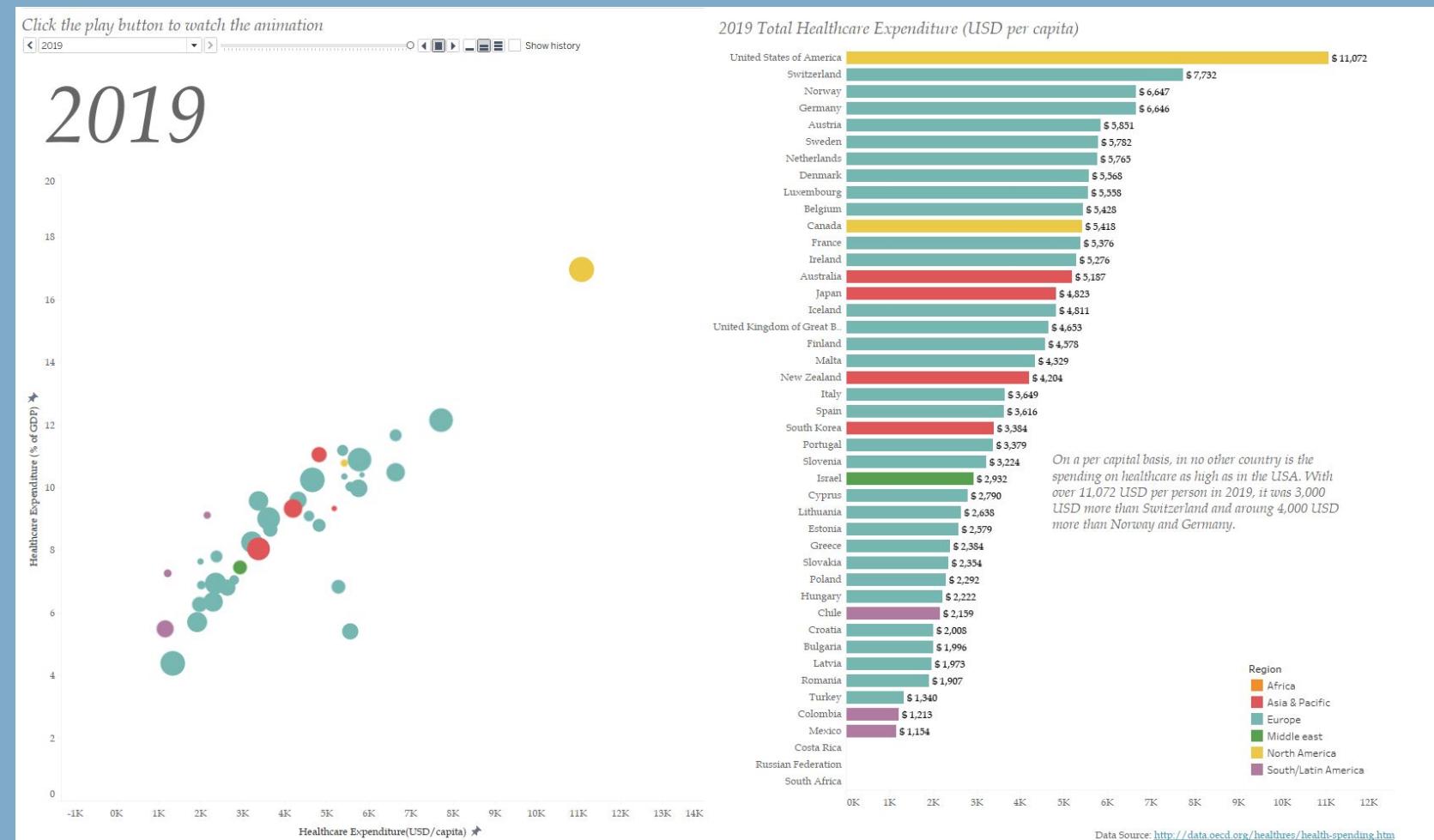
Improvement 2:

We used the bubble timeline chart to replace the line chart, and we combined the line chart with the map so that the audience can have a quick idea about the trend in each country.

U.S. is highlighted as yellow to clearly being marked.

Exploratory Data Analysis

Since there are three variables (time, measure, and financing type), a combination of animated scatter plot and bar chart is more engaging and can present all variables in a very clear way.



For example, the graph clearly shows that

- the U.S. spent more on healthcare, in terms of both USD and percentage of GDP.
- European countries spent more than South American countries in general.

Improvement 3:

We merged with another dataset so that we can have variable “region” in our dataset. By labelling countries with different colors according to their regions, we can see the region difference.

We labeled out the healthcare expenditure for each country in the bar chart because it's hard to know exact number when referring to the axis.

Data Transformation

1 . The data has been pivoted so that each line shows the country name, time, the type of financing (Total, Compulsory, Out of pocket, and Voluntary) and measure(% of GDP and USD per person). Two other new calculated fields (percentage on GDP and US dollars / capita) were created using “IF” function so we can get two measures for each country from the pivoted table for creating both axis in the animated scatter plot.

The image displays three separate calculated field dialog boxes from Tableau:

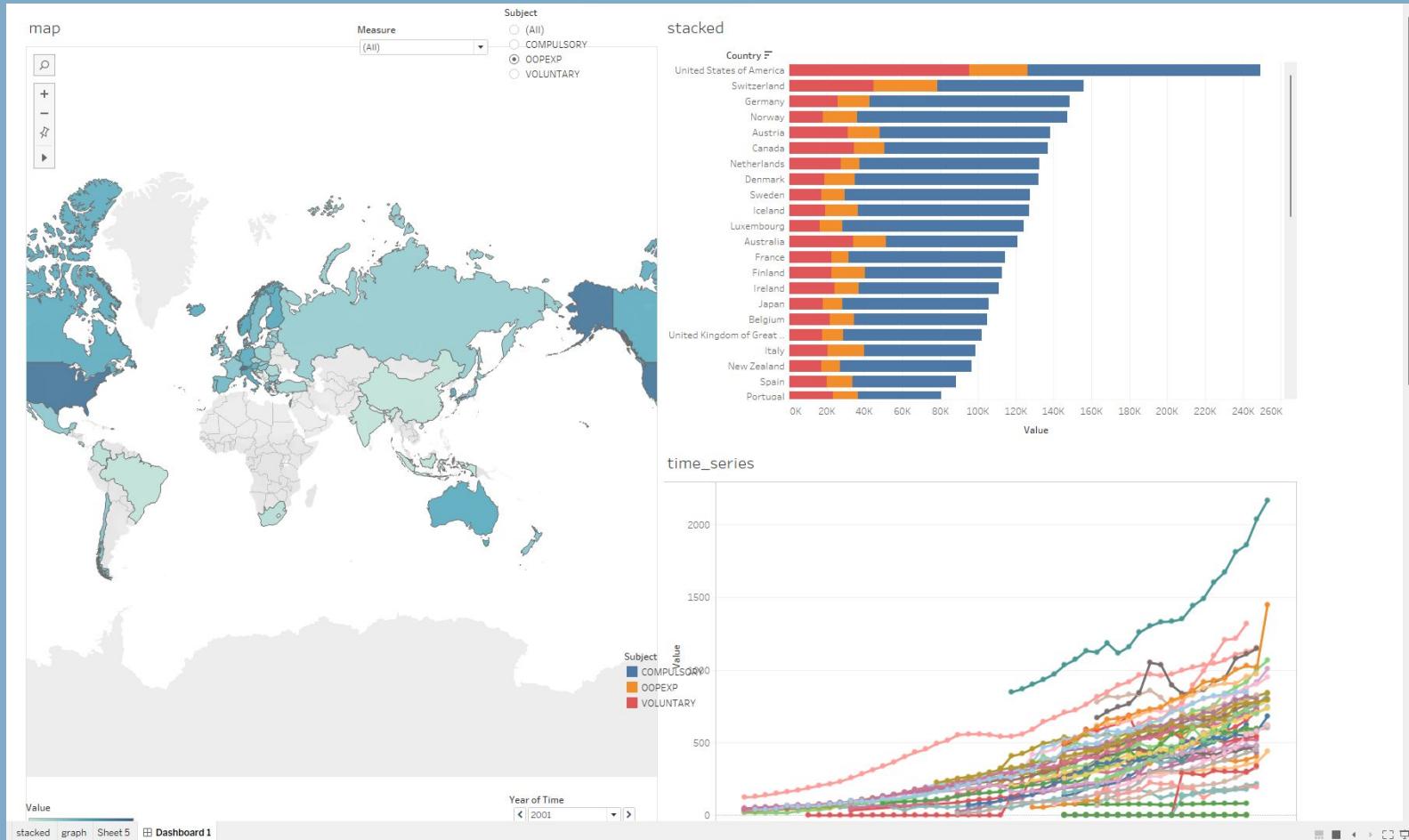
- percentage on GDP**:
Calculation: `IF [Measure] = 'PC_GDP' THEN [Value]
ELSE NULL
END`
Status: The calculation is valid.
Dependencies: 2 Dependencies
Buttons: Apply, OK
- US dollars/capita**:
Calculation: `IF [Measure] = 'USD_CAP' THEN [Value]
END`
Status: The calculation is valid.
Dependencies: 2 Dependencies
Buttons: Apply, OK
- dynamic value**:
Calculation: `IF [Measure] = "USD_CAP" THEN "$ " + LEFT(STR(ROUND([Value], 1)),
LEN(STR(INT([Value]))) + 2)
ELSEIF [Measure] = "PC_GDP" THEN LEFT(STR(ROUND([Value], 1)),
LEN(STR(INT([Value]))) + 2) + "%"
END`
Status: The calculation is valid.
Dependencies: 3 Dependencies
Buttons: Apply, OK

2 . A new calculated field(dynamic value) was created so that when using the filter to change the measure with different units(percentage/USD), the data can be correctly shown on the map with the correct units.

Design Evolution



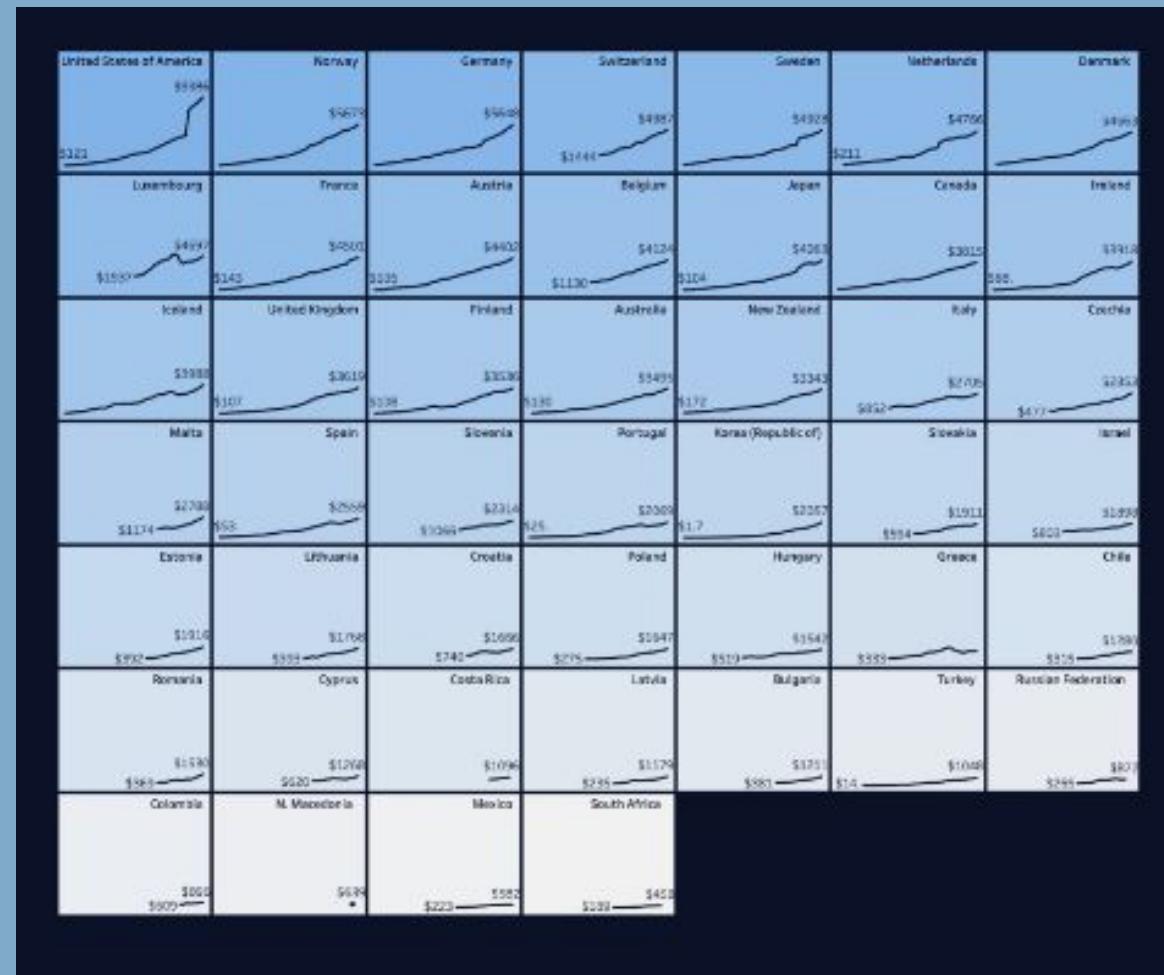
Design Evolution:



In general, we didn't deviate from our original plan. We kept building on what we had to improve our final dashboard.

team 3 first draft

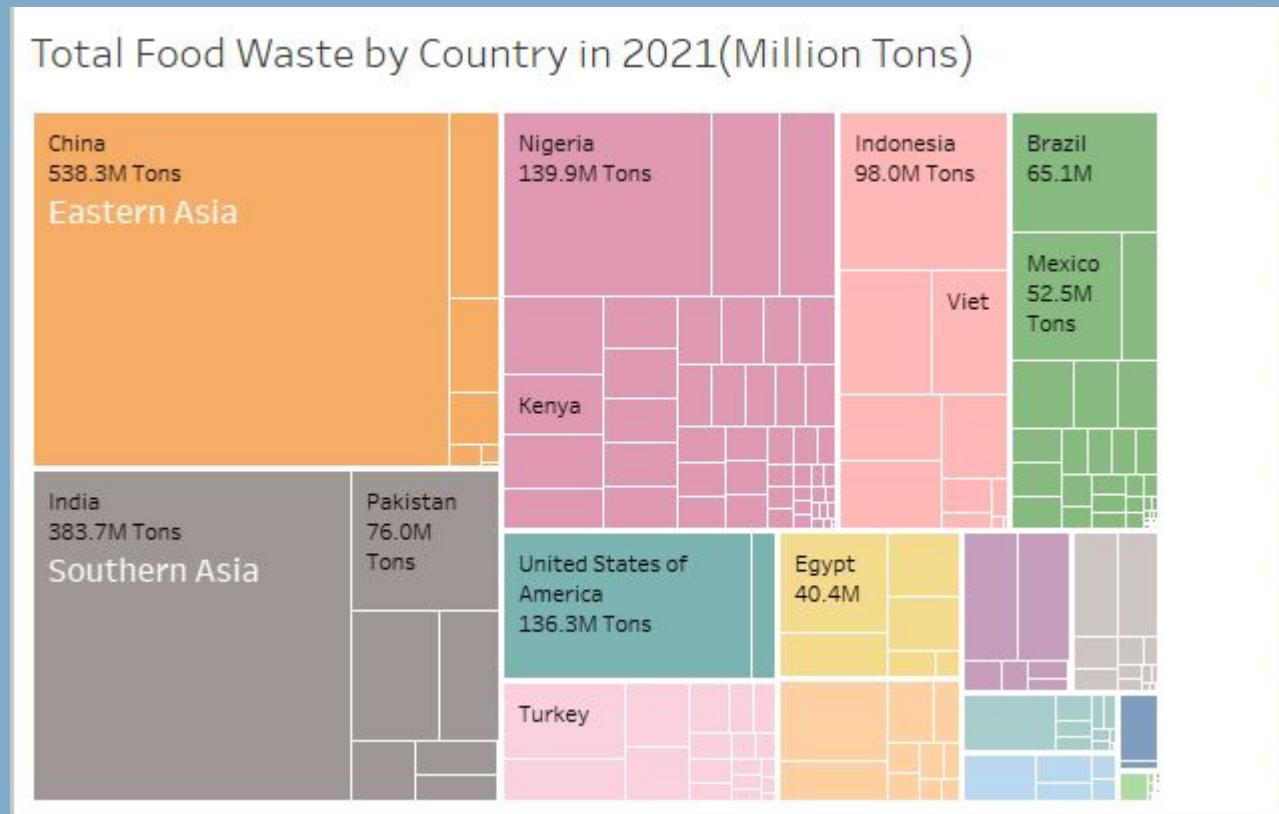
Design Evolution: Graphs that we considered (1)



We first considered having a graph that looks like this so that we could show the trend for every country.

However, it turns out that we have too many countries that will make the graph too small to look into details. Instead, we insert the trend line into the map and the audience can see it when they hover over to a specific country.

Design Evolution: Graphs that we considered (2)



We also considered using a tree map. However, tree maps are ideal for visualizing data that has a clear hierarchy, and when the total sum of all numbers has some meaning (in the graph, it's the total global food waste in one year).

In this case, when it comes to the healthcare expenditure in terms of percentage of GDP, the sum doesn't make sense.

Therefore, we simply used a bar chart that can clearly compare the difference, which is one of our goals of the graph.

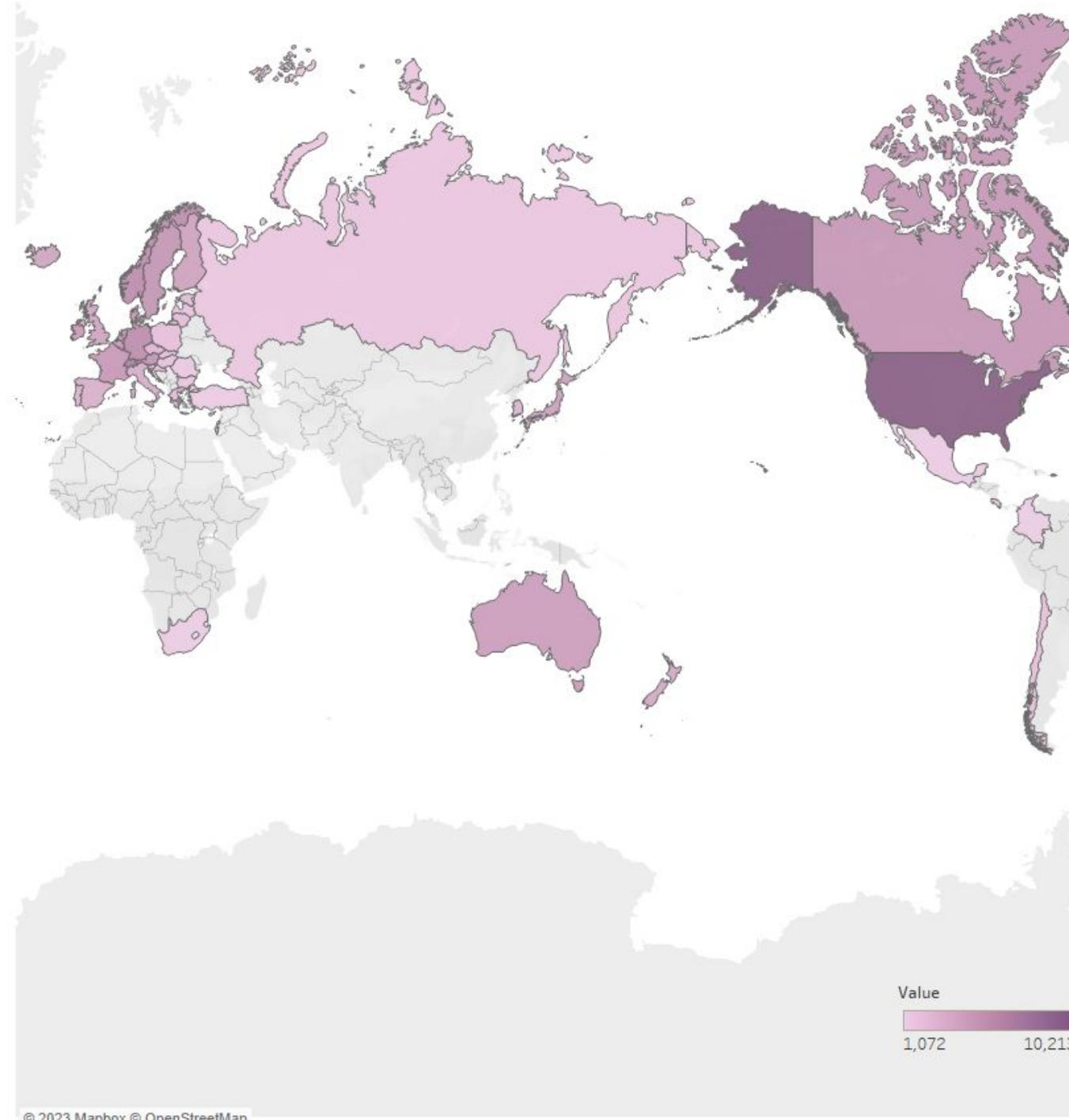
Implementation



Implementation: Part 1

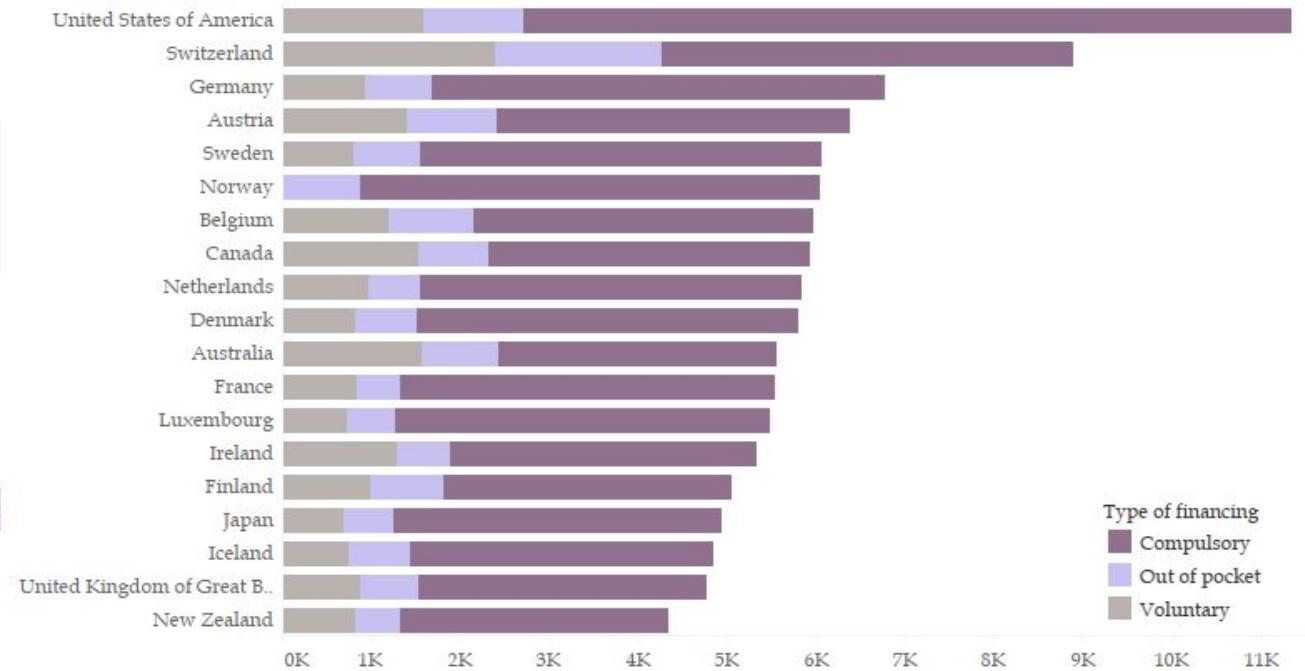
How much did each country spend on healthcare? (1970-2019)

Click on your country of interest to see how health care spendings developed overtime (1970-2019)

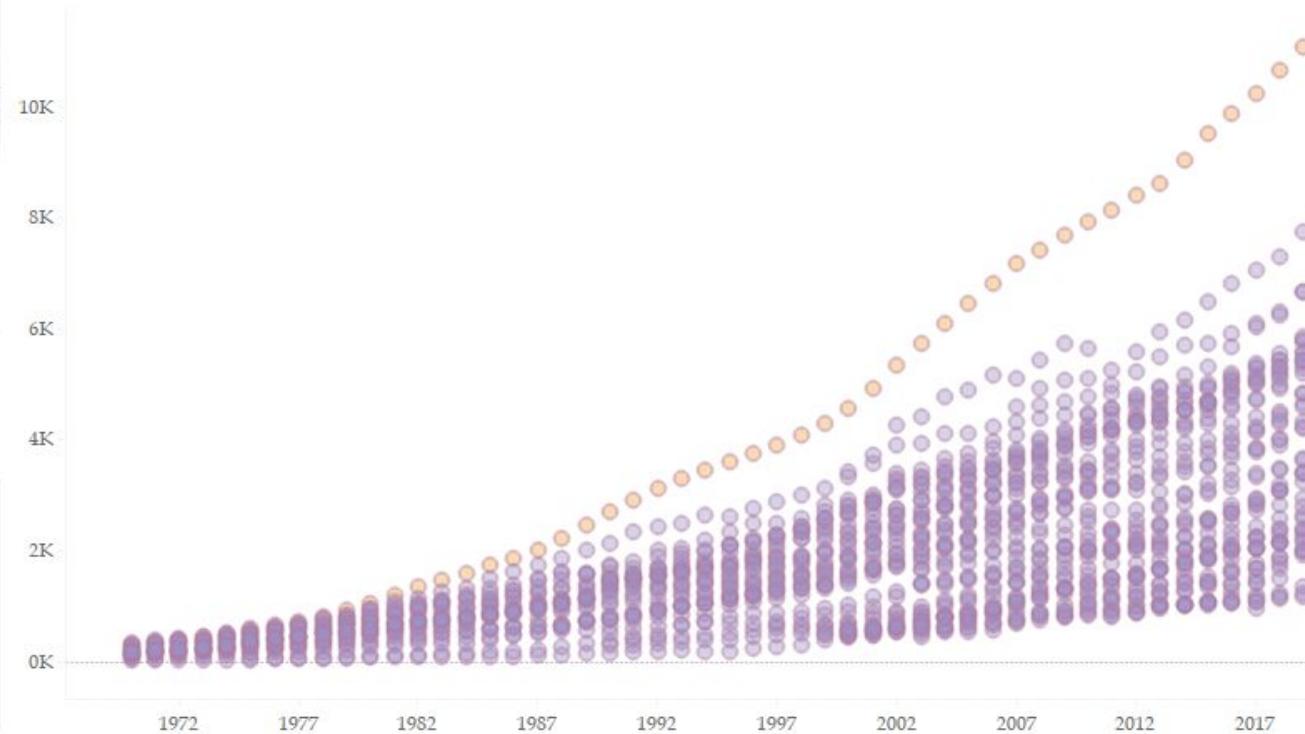


Breakdown of expenses

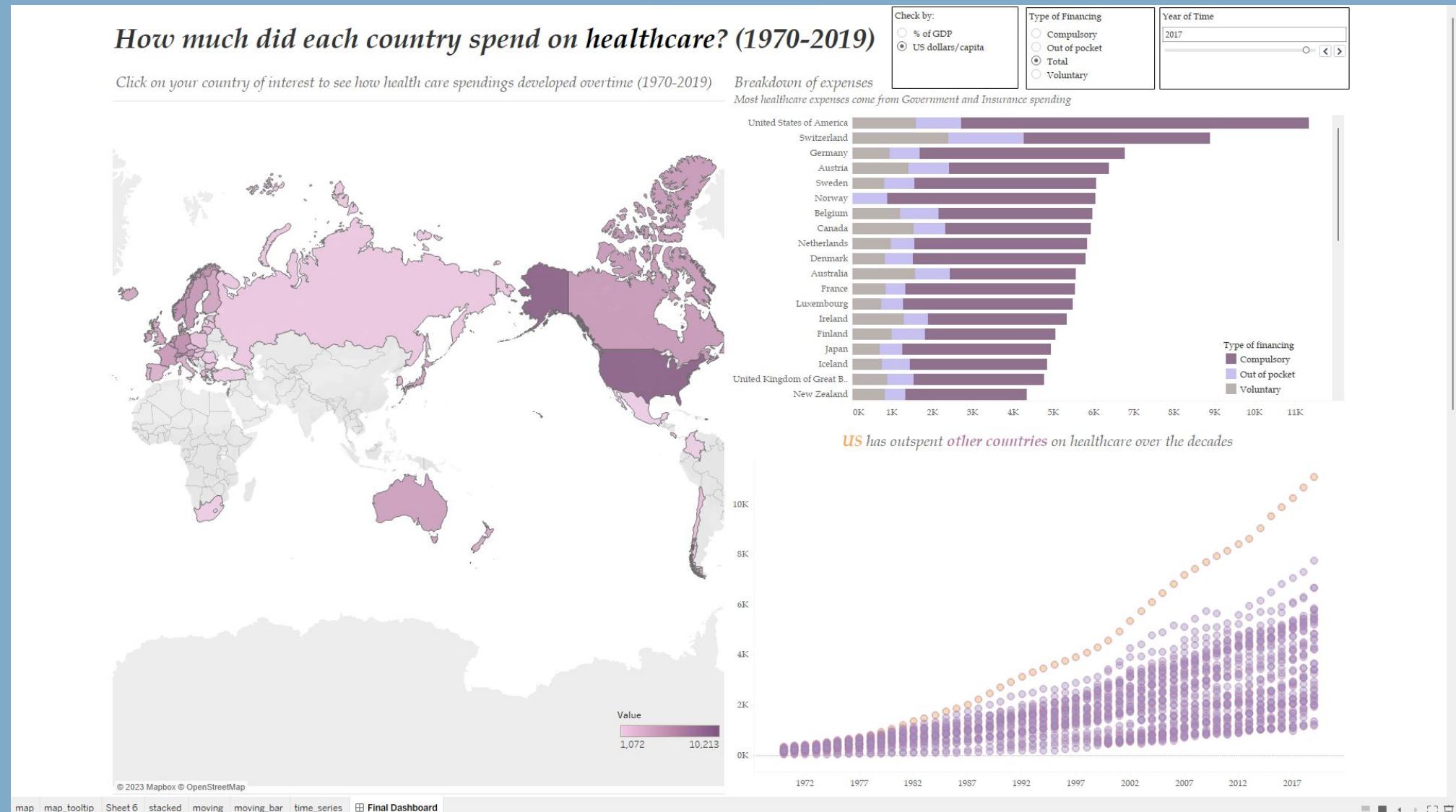
Most healthcare expenses come from Government and Insurance spending



US has outspent **other countries** on healthcare over the decades

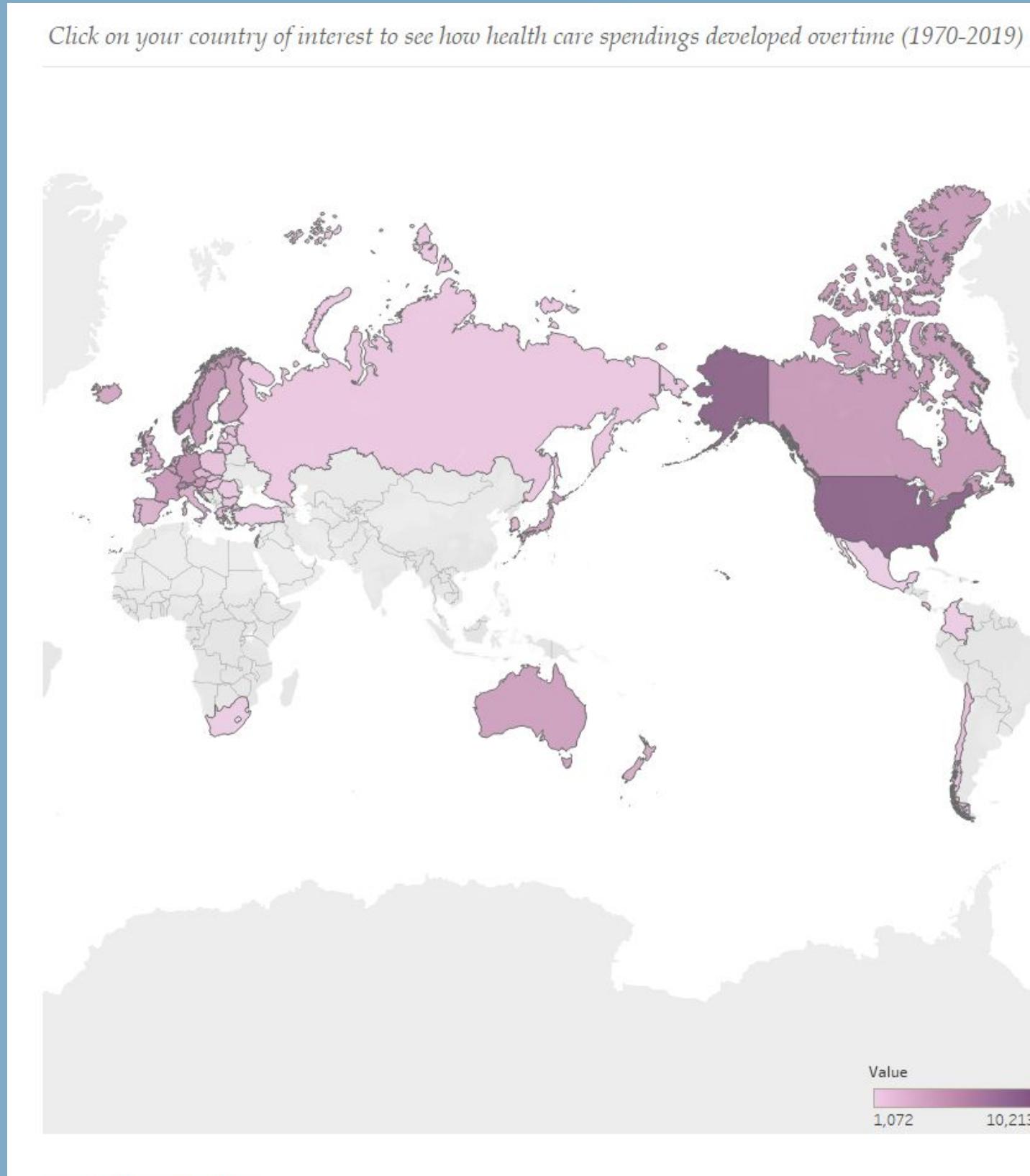


Implementation: Part 1



Part 1 aims at presenting the healthcare spending data across different countries and over the years by using a choropleth map, a stacked bar chart, a line chart, and a bubble timeline chart.

Implementation: Part 1- Choropleth Map



This choropleth map is designed to display health care spending data across different countries from 1970 to 2019.

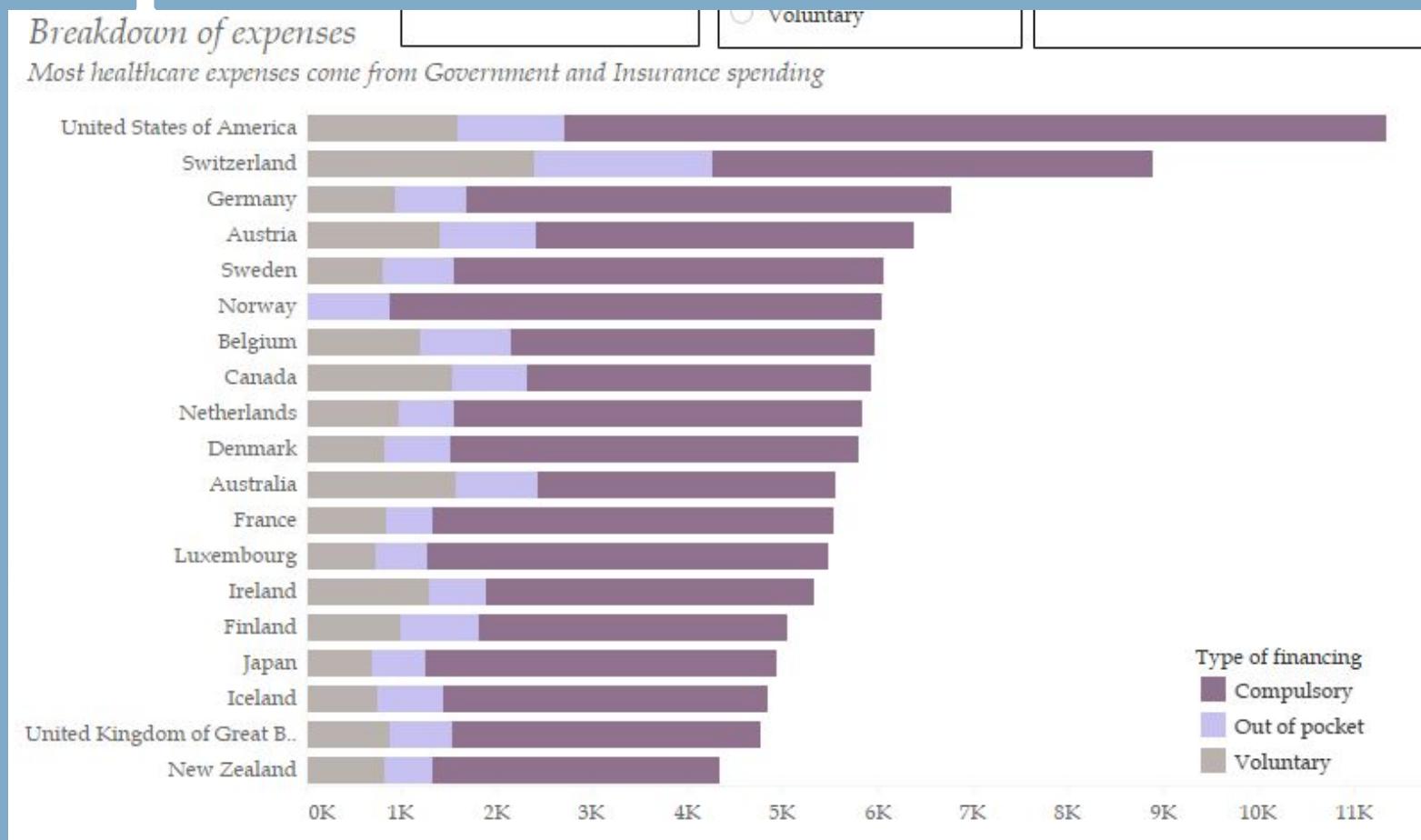
It allows users to engage with the data by clicking on their country of interest to see a detailed view of how healthcare spending has changed over time.

The map uses shades of a single color to represent the range of values, with darker shades typically representing higher values.

Filter Options:

1. Year (1970-2019)
2. Measure(Percentage of GDP or USD per capita)
3. Type of Financing(Total, Compulsory, Out of pocket, and Voluntary)

Implementation: Part 1 -Stacked Bar Chart



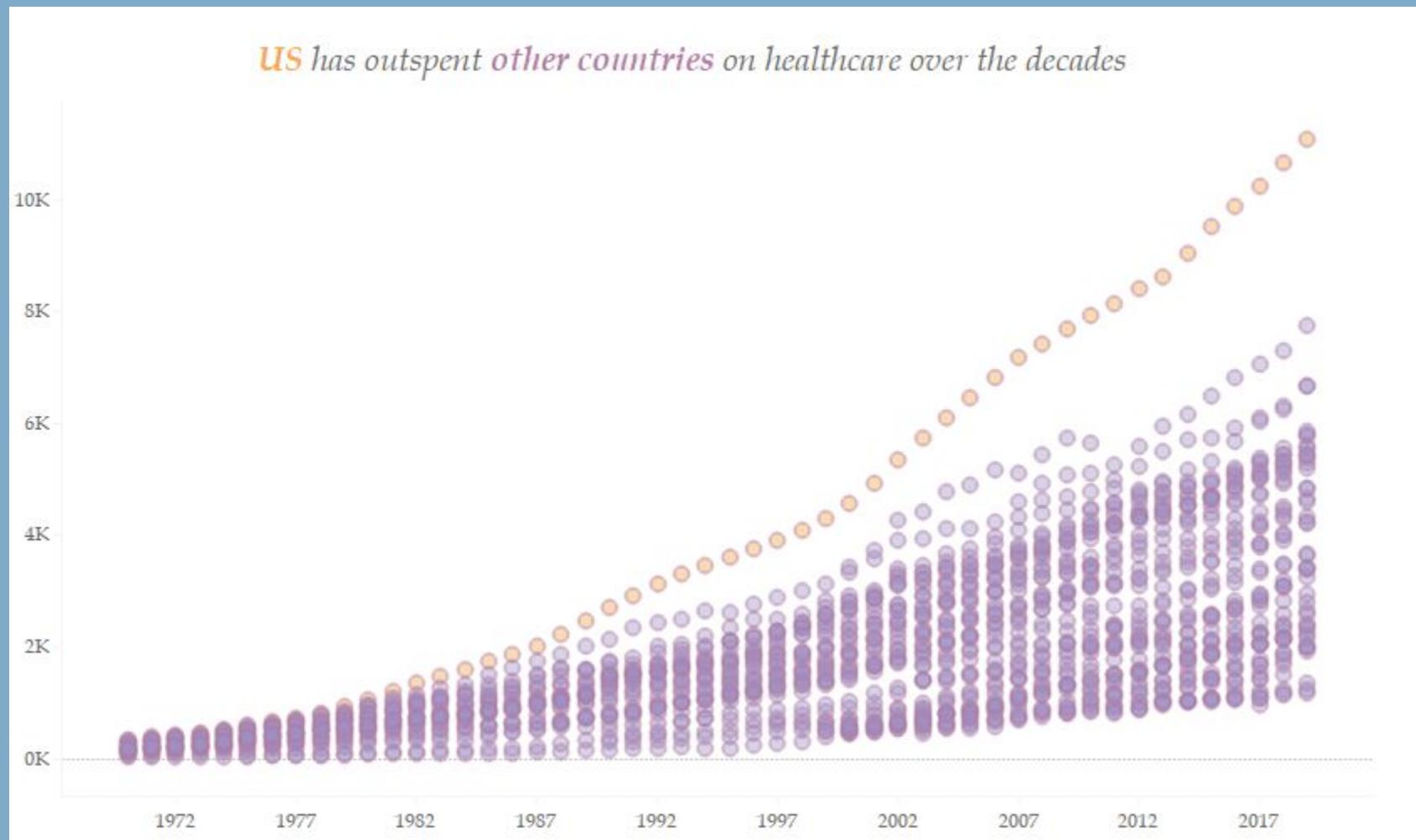
This is a stacked bar chart that displays the breakdown of healthcare expenses for various countries, with the data categorized by the type of financing: compulsory, out-of-pocket, and voluntary spending.

The intent of this chart is to compare healthcare financing structures across different countries. Each bar represents a country, and the length of each bar indicates the total healthcare expenditure. The expenditure is further divided into colored segments representing different financing types.

Filter Options:

1. Year (1970-2019)
2. Measure(Percentage of GDP or USD per capita)
(Shown on the left side)

Implementation: Part 1 -Bubble Timeline Chart



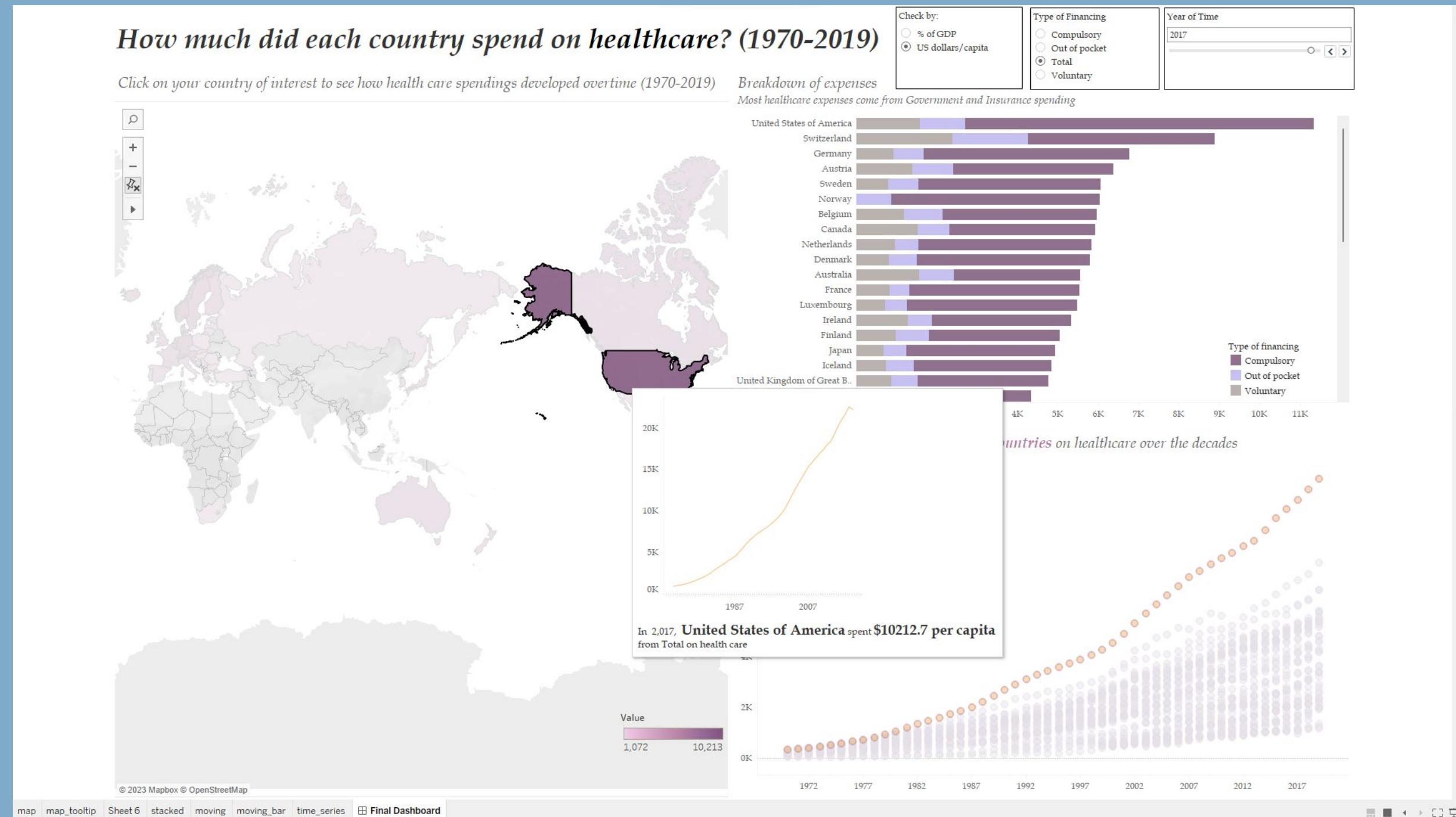
The x-axis of the chart denotes year, and the y-axis represents healthcare spending, in US dollars or as a percentage of GDP (filter). The vertical position of each bubble corresponds to the amount spent on healthcare, while its horizontal position corresponds to the year.

The density and color of the bubbles could represent different countries or different levels of spending, with the chart highlighting that the United States has outspent other countries on healthcare over the decades.

Filter Options:

1. Measure(Percentage of GDP or USD per capita)
2. Type of Financing(Total, Compulsory, Out of pocket, and Voluntary)

Implementation: Part 1-Interactions



When hovering over a country on the map, it shows a simple trend line of the health expenditure of a specific type or measure (filters) over the years.

It also shows in which year, which country spent what amount or percentage of GDP from which financing type on health care.

At the same time, the bubble timeline chart of the corresponding country is highlighted, which shows more detailed information.

Implementation: Part 1-Interactions

How much did each country spend on healthcare? (1970-2019)

Click on your country of interest to see how health care spendings developed overtime (1970-2019)

Breakdown of expenses

Most healthcare expenses come from Government and Insurance spending

Check by:

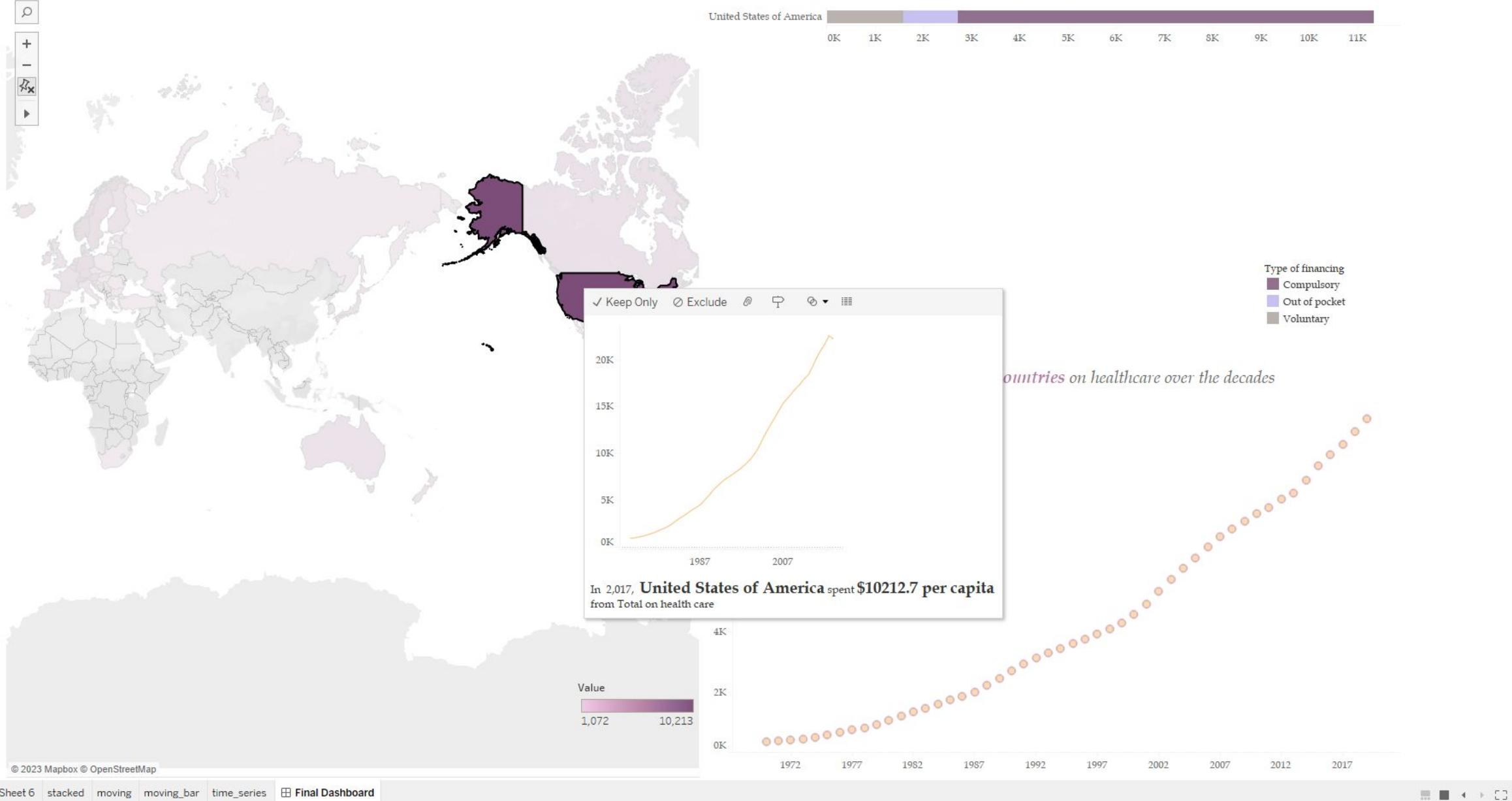
- % of GDP
- US dollars/capita

Type of Financing

- Compulsory
- Out of pocket
- Total
- Voluntary

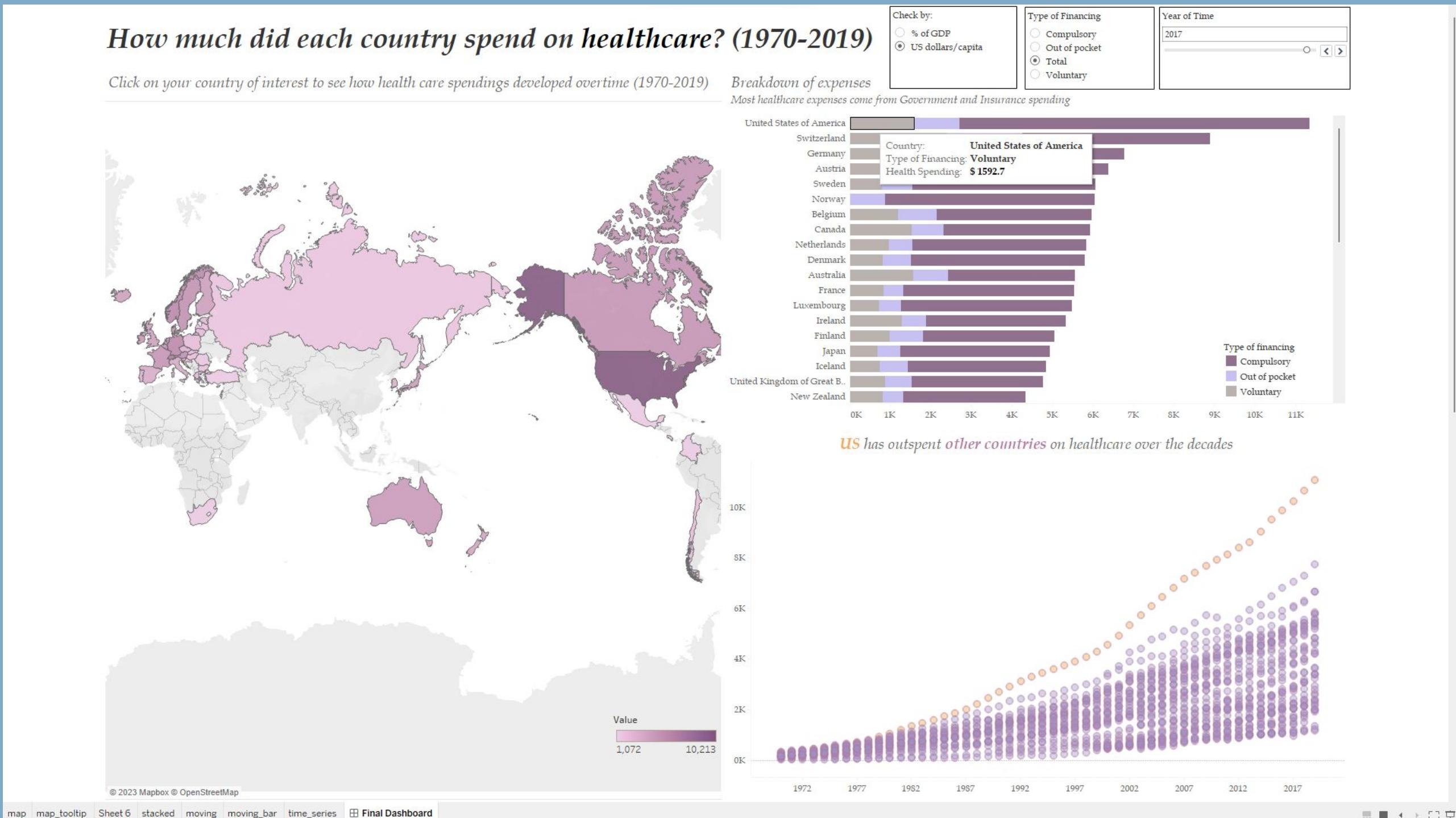
Year of Time

2017



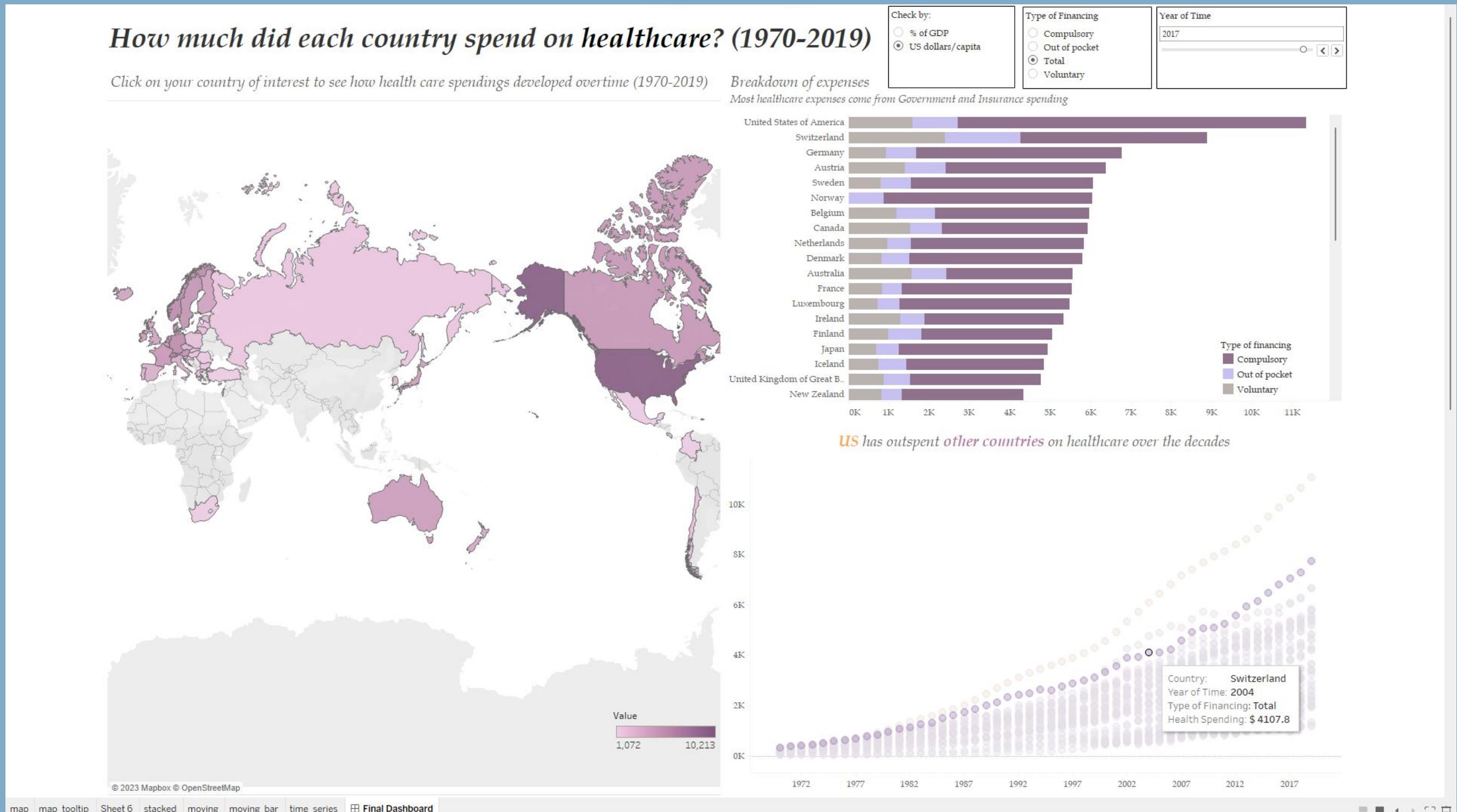
When clicking a country(or countries), the stacked bar chart and timeline chart will show that country with more detailed information.

Implementation: Part 1-Interactions



When hovering over a category on a country on the stacked bar chart, it shows the country name, type of financing, and specific health care spending.

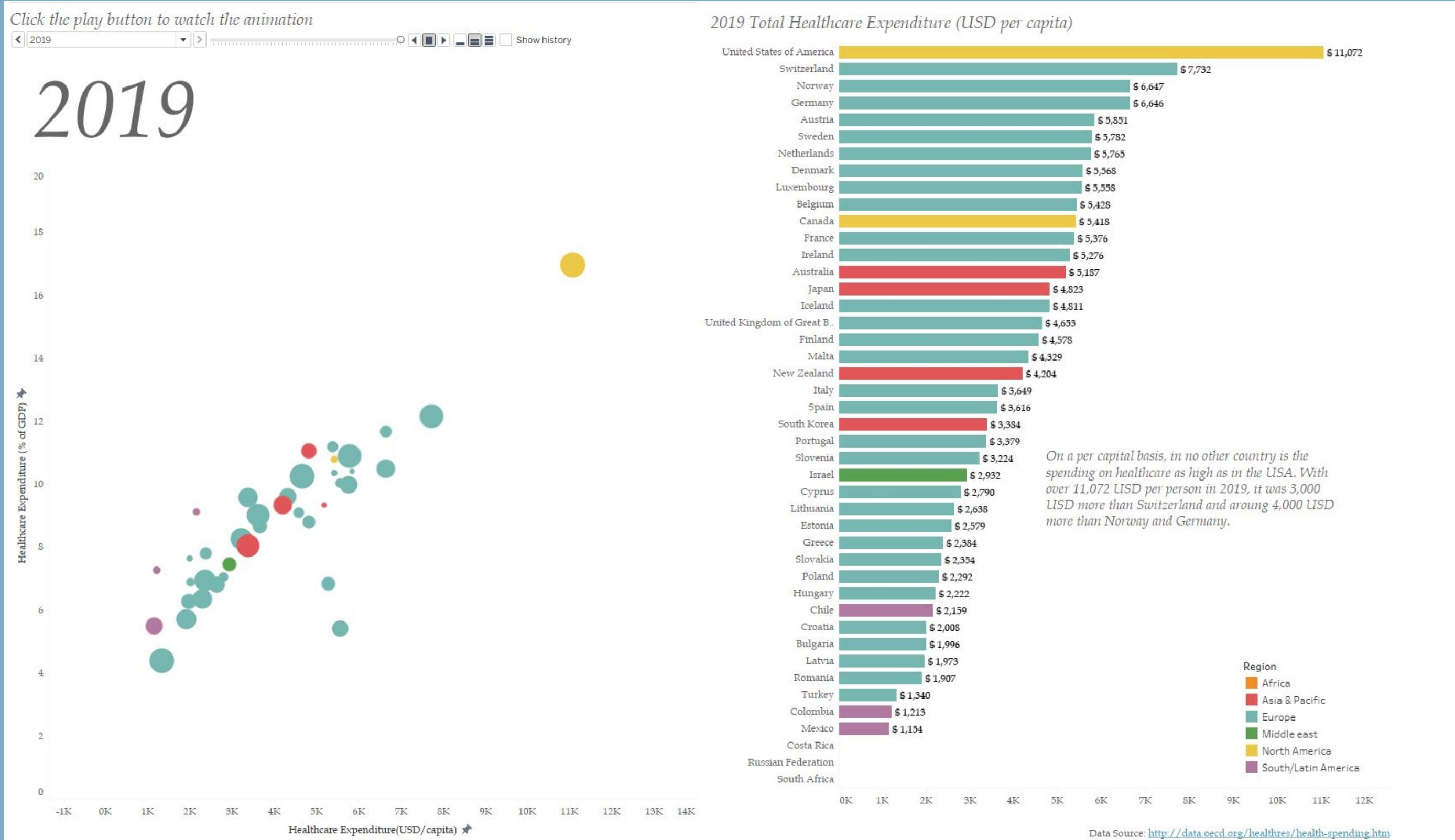
Implementation: Part 1-Interactions



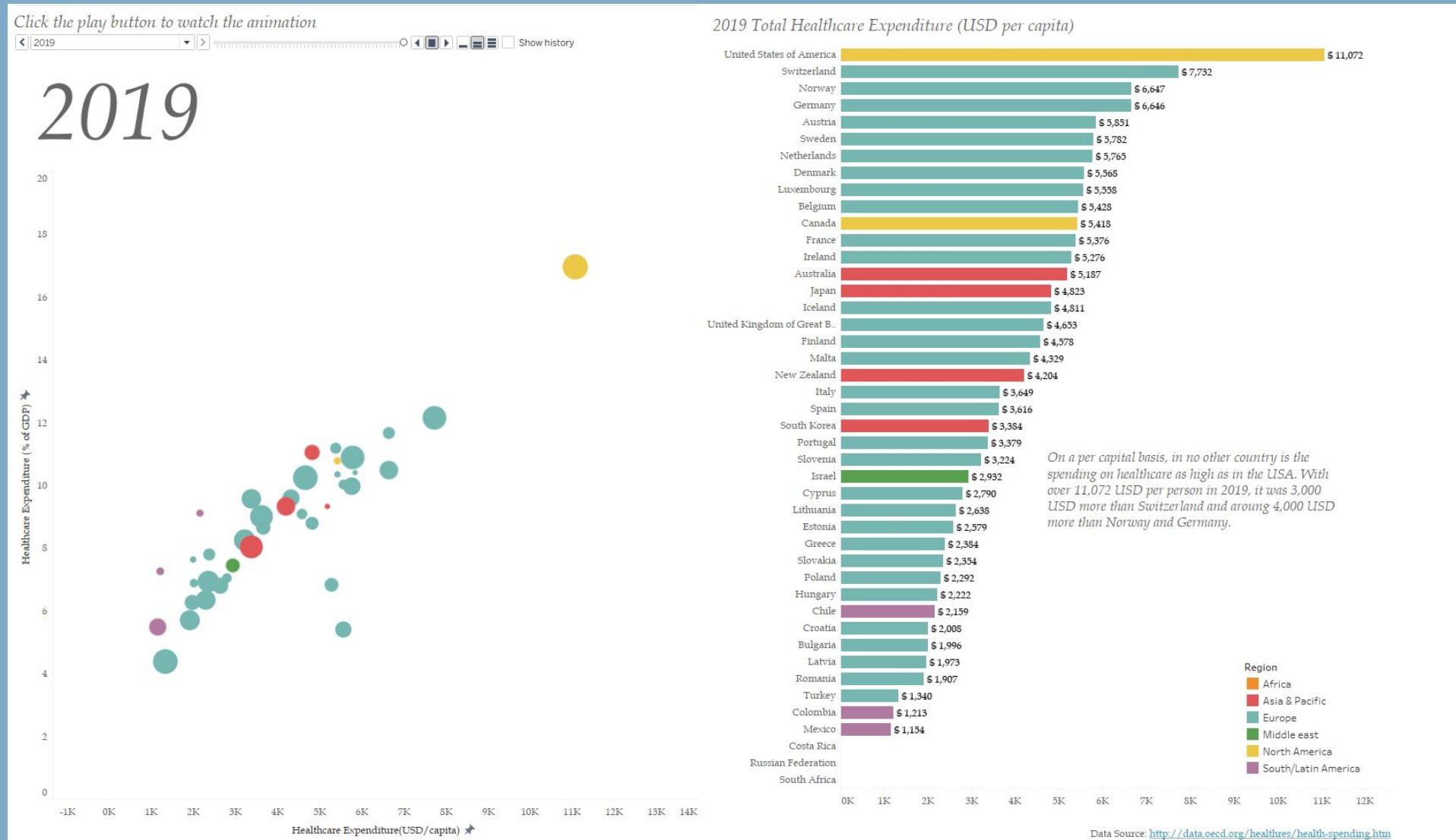
When hovering over a point on the bubble timeline chart, it shows the country name, year, the type of financing, and health care spending.

It also highlights the trend of the chosen country over the years.

Implementation: Part 2

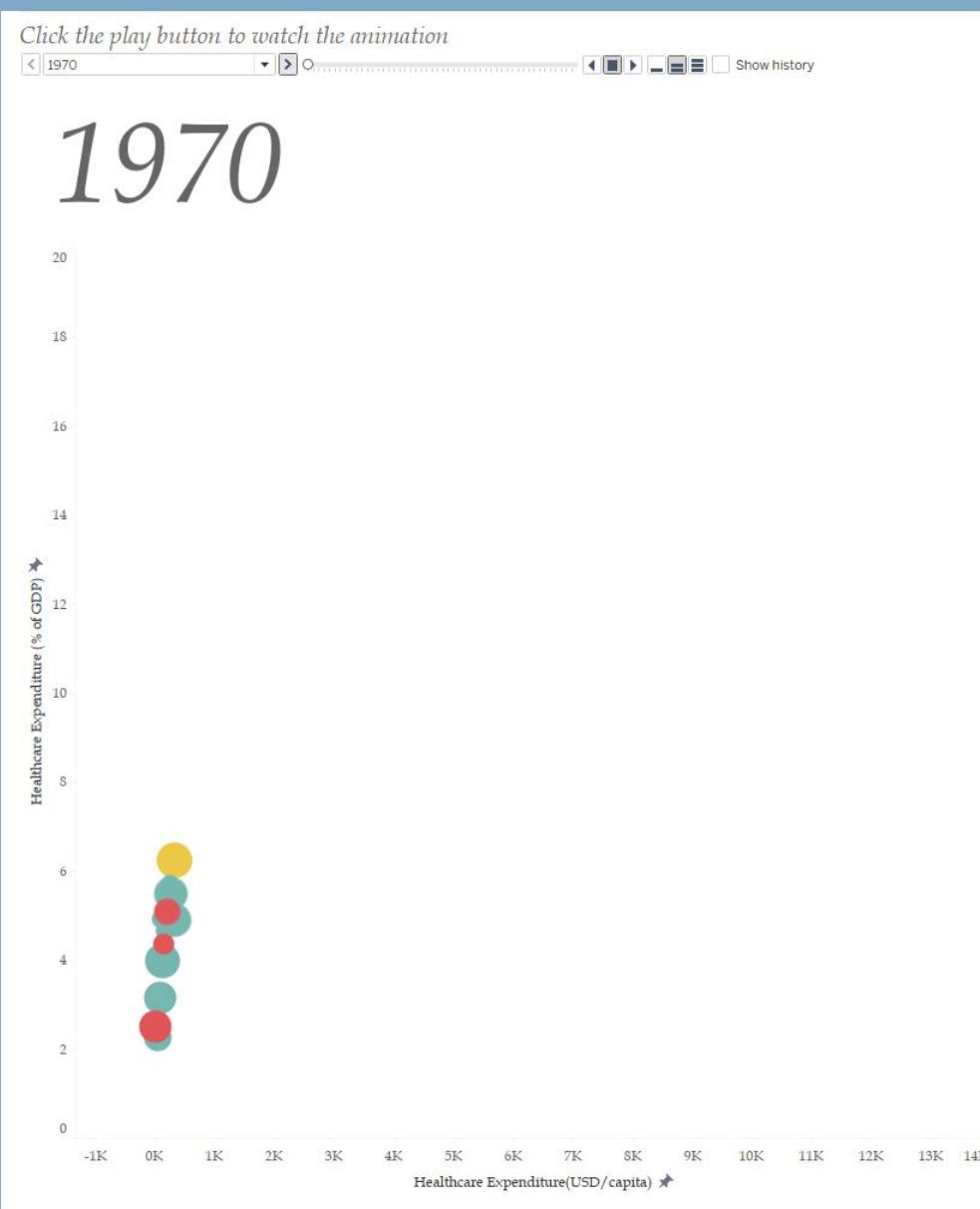


Implementation: Part 2

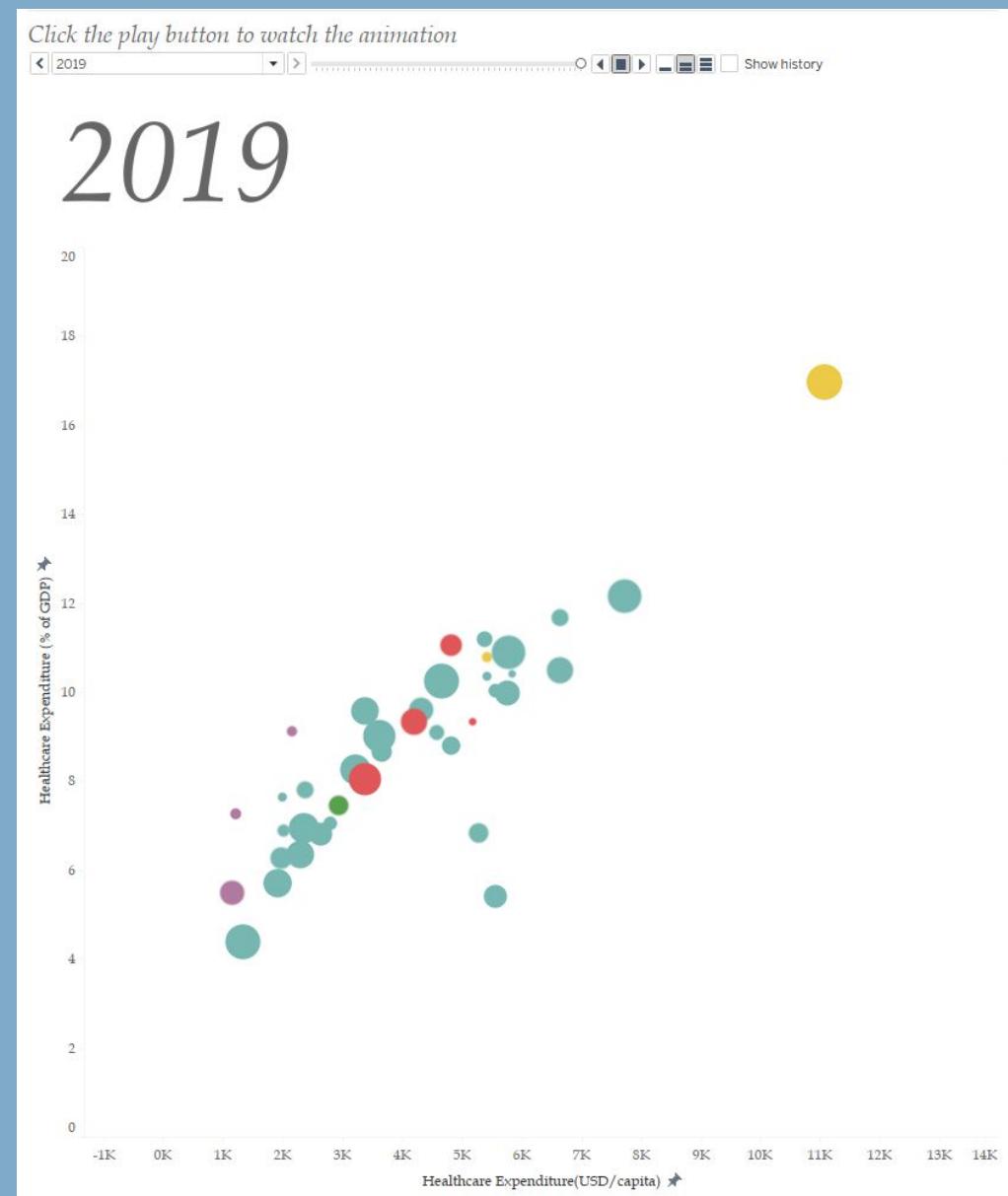


Part 2 aims at presenting the trend of healthcare spending across different countries and over the years using a more interesting and attractive combination of animated scatter plot and a bar chart that will change over time.

Implementation: Part 2 - Animated Scatter Plot



Start



End

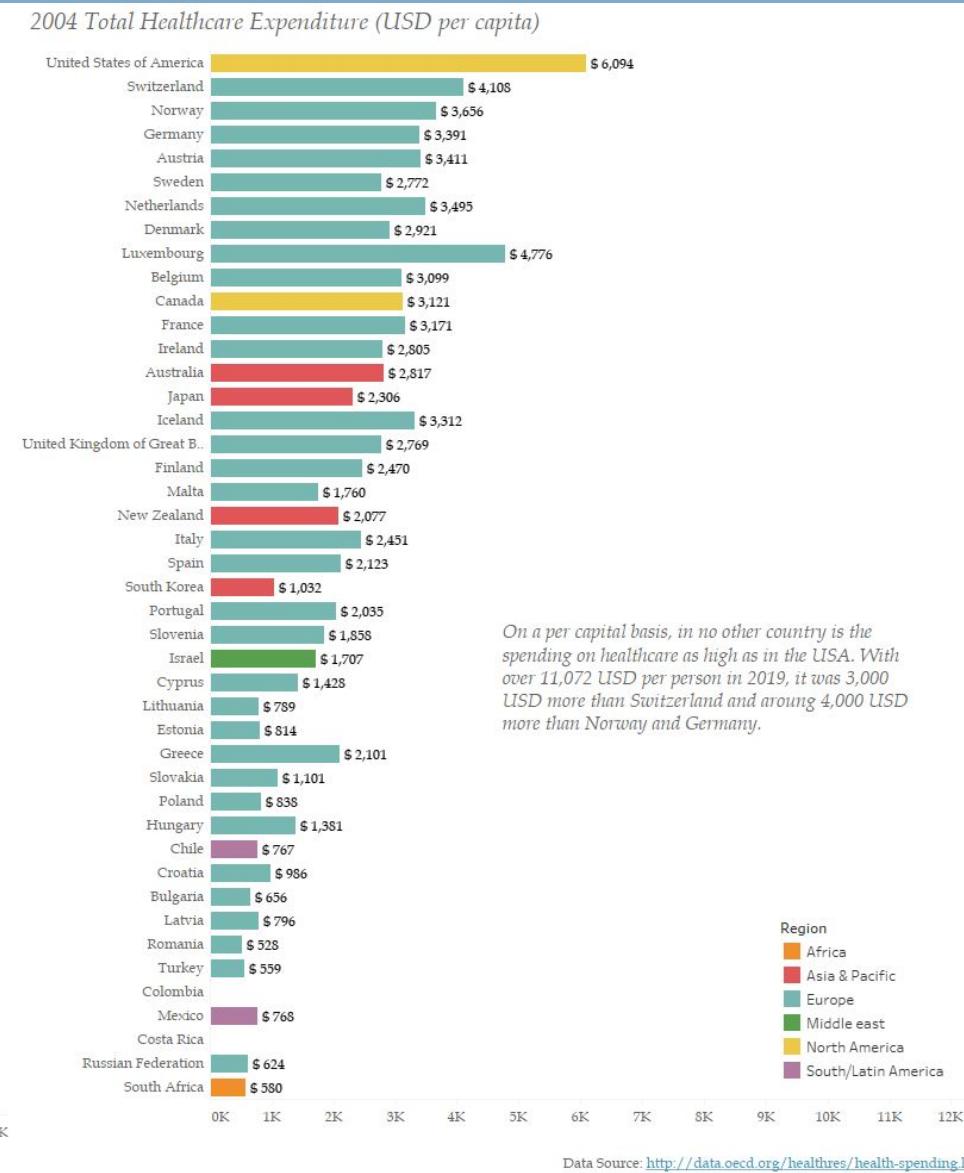
This is a scatter plot that changes over time using the page shelf, so it automatically shows the plot in every year.

Y axis is percentage of GDP, and x axis is the USD per capita. The size of the circle represents the amount of healthcare expenditures.

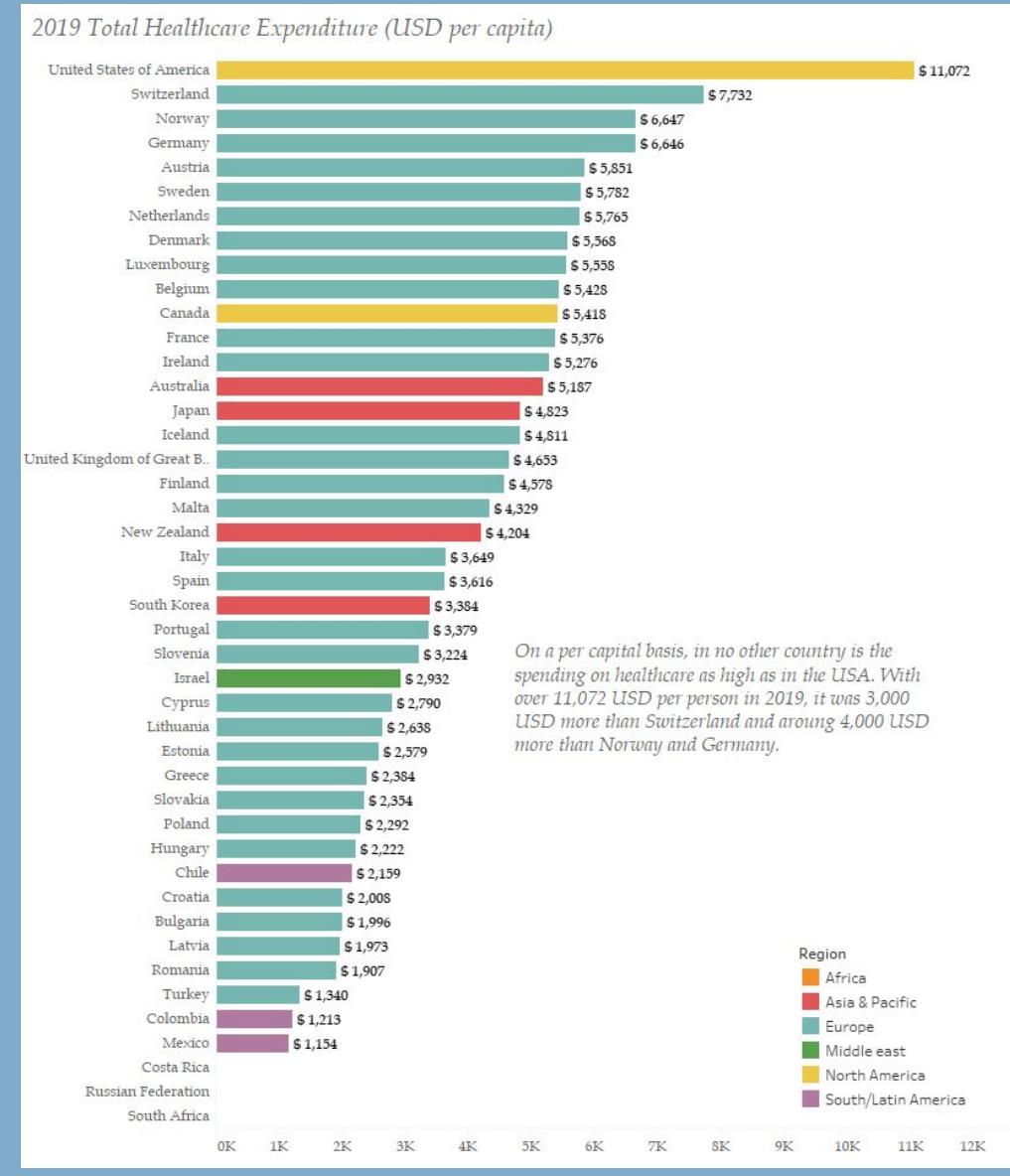
Countries are colored according to their regions

When hovering over a point, it shows the country name, region, year, amount of healthcare expenditure in terms of USD per capita and percentage of GDP.

Implementation: Part 2 - Animated Bar Chart



Start



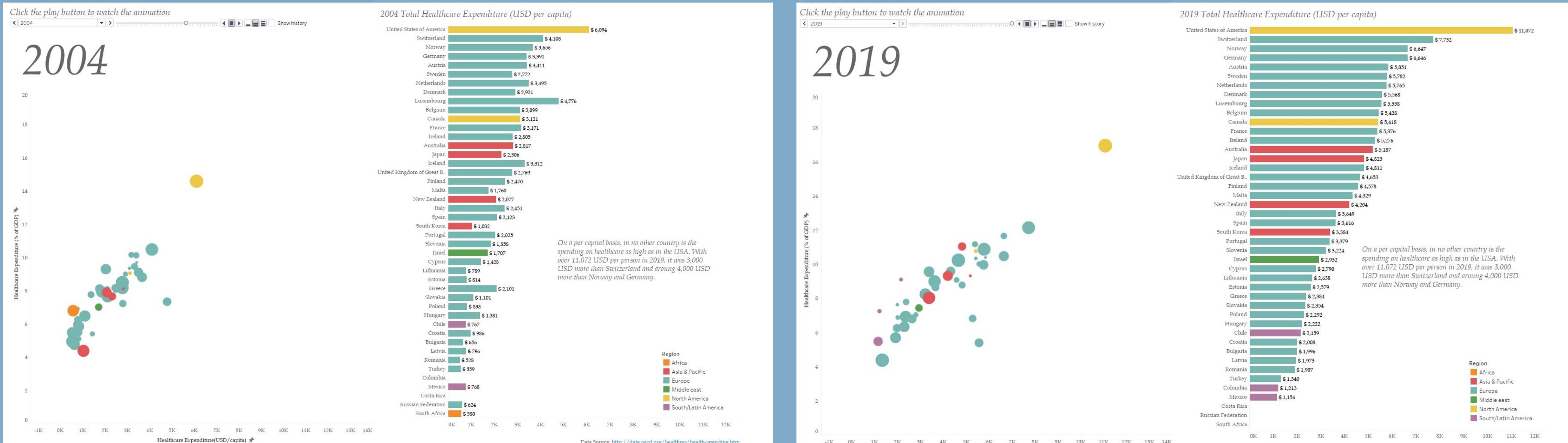
End

This is a bar chart that changes over time using the page shelf, so it automatically shows the plot in every year.

Y axis shows different countries, and x axis is the USD per capita.

When hovering over a bar, it shows the country name, year, amount of healthcare expenditure in terms of USD per capita.

Implementation: Part 2 - Interactions



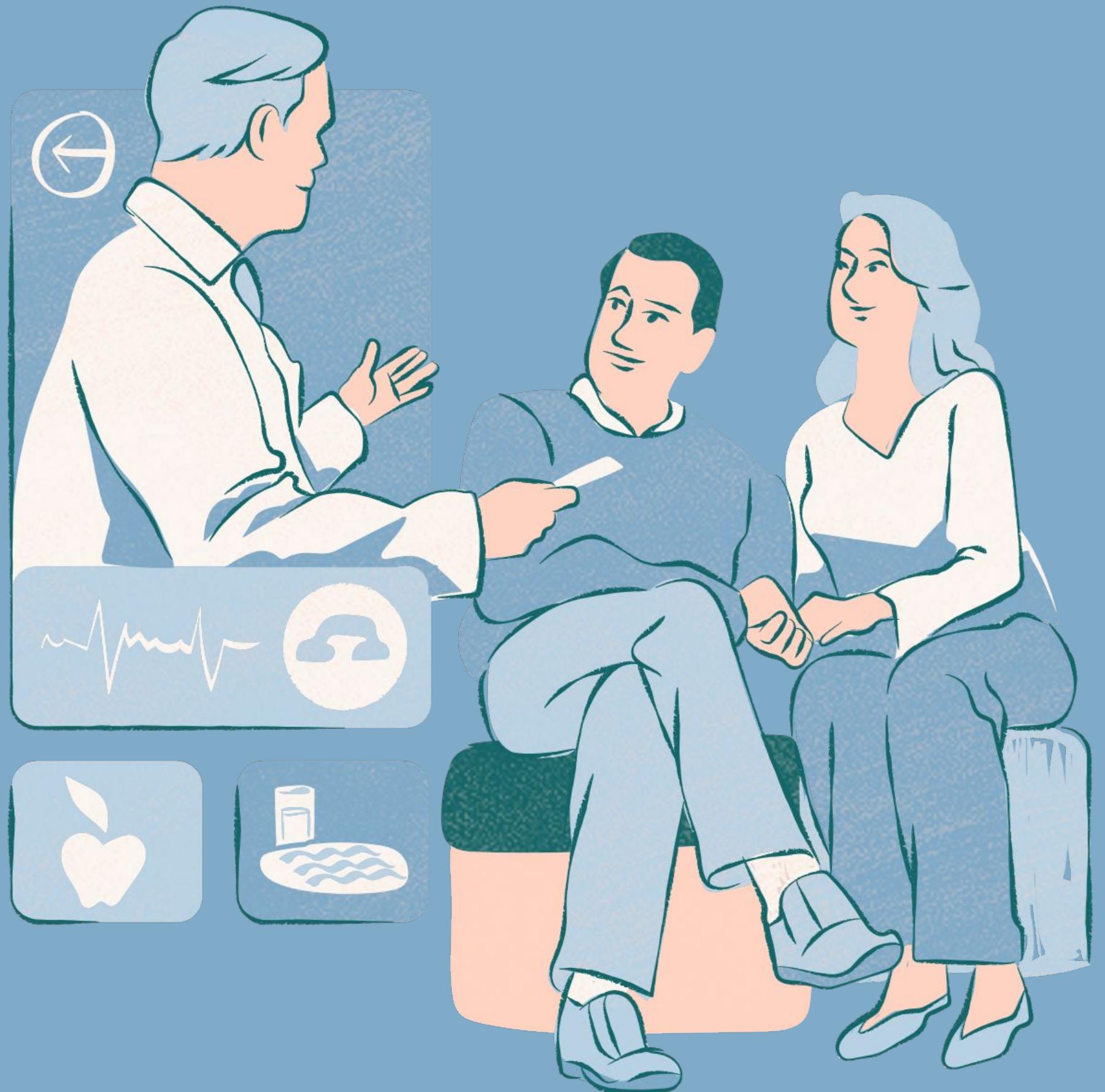
Using the play button, these two charts will automatically show the data in every year.

Insights & Self Evaluation



Insights and learning outcomes:

1. In general, the healthcare spending increased over the year for most of the countries in terms of both USD per capita and percentage of GDP.
2. In general, North American, European, and Asian/Pacific countries spent more on healthcare.
3. U.S. spent the most on healthcare over the years in both USD per capita and percentage of GDP
4. In general, South American countries spent less on healthcare compared to countries in other regions.



Self Evaluation:

We believe that our dashboard answers most of the key questions we wanted to resolve at first. In terms of graph design and functionality, our dashboard exceeded our expectations by incorporating the line chart in the map, building a moving scatter plot and bar chart, and including highlight actions. Each graph is clearly labelled and correctly highlighted if needed, and presents the ideas in an efficient way.

Things we could improve:

1. We didn't have data after 2019, which we could use them to consider the influence of Covid.
2. We could improve on the moving bar chart so that it sorts descendingly according to the value every year, so we could see the change in rank over the years. We had this idea but we couldn't achieve this technically.
3. We could have classified countries in terms of income level, so that we could find the correlation between income level and healthcare expenditure.

Thank you!

