

COS30045

DATA VISUALIZATION

Chronic Diseases and Risk Factors

Process Book

Link: 105017157-student.infinityfreeapp.com

Mohamed Usaidh Abdul Razzaq – 105017157 – Group 25

Introduction

Background and Motivation

Chronic diseases are a global health concern, leading to a significant increase in hospitalization and mortality rates worldwide. Conditions such as asthma, diabetes, cardiovascular diseases, and cancer have wide-reaching impacts on individuals and healthcare systems, highlighting the importance of understanding trends and risk factors associated with these diseases. This project focuses on visualizing these trends, specifically targeting chronic disease hospital admission rates across countries. The objective is to present this data through intuitive, interactive visualizations that can support data-driven decisions and public health initiatives.

Purpose of the Visualization

The aim of this visualization project is to offer stakeholders—including public health officials, policymakers, and the public—an accessible platform for exploring the trends and impacts of chronic diseases globally. Through interactive visualizations, users can investigate hospitalization rates, survival trends for cancer, and risk factors (e.g., alcohol, tobacco, obesity) by country. This data-driven approach encourages users to identify high-burden areas and potential risk factors, guiding targeted interventions and informed policymaking.

Key Questions Addressed

1. **What are the hospitalization rates for chronic diseases across different countries?**
 - This question is explored through a global map visualization, enabling comparisons of hospitalization rates by country and disease type.
2. **How do diseases like asthma, diabetes, and heart diseases affect populations in different geographic regions?**
 - Using interactive buttons, users can toggle between diseases to observe their geographic spread and intensity, with darker colours indicating higher rates of hospital admissions.
3. **How can this data inform public health interventions and policy adjustments?**
 - Additional charts (e.g., cancer survival rates, risk factors like alcohol and tobacco consumption) allow users to contextualize hospitalization data with other relevant health statistics, facilitating a comprehensive understanding of chronic disease trends.

Data

Data Sources

The primary dataset utilised in this project is derived from the **OECD Health Statistics Database** and provides comprehensive data on hospital admissions related to chronic diseases such as asthma, diabetes, heart diseases, and hypertension. Additional data sources include metrics for key health risk factors—alcohol consumption, tobacco usage, and obesity levels—essential for understanding the lifestyle impacts on chronic disease prevalence. Cancer survival data, reflecting outcomes for various cancer types by country, offers insight into healthcare effectiveness and trends in patient survival.

Processed Data Overview

- **Average Alcohol Consumption** (avg_alcohol_consumption.csv): This dataset contains the average litres of alcohol consumed per person annually across various countries. It allows the analysis of alcohol's contribution to chronic disease trends, as excessive consumption is a known risk factor.
- **Average Obesity Levels** (avg_obesity.csv): Represented as a percentage of the population, this dataset highlights obesity prevalence across countries. Obesity is linked to an increased risk of diseases like diabetes and cardiovascular conditions, making it a vital factor in visualising global health risks.
- **Average Tobacco Consumption** (avg_tobacco_consumption.csv): This dataset tracks tobacco consumption, measured in grammes per person, providing insights into smoking's impact on public health. High tobacco consumption is associated with various chronic conditions, including lung cancer and heart disease.
- **Cancer Survival Data** (cancer_survival_data.csv): This file includes cancer survival rates from 2004 to 2014 across different countries and cancer types (e.g., lung, colon). It allows users to explore trends in healthcare outcomes and assess advancements in treatment over time.
- **Chronic Disease Admissions and Mortality Rates** (chronic_disease_admissions_mortality_2010_2020.csv): A key dataset tracking hospital admissions and mortality rates for chronic diseases between 2010 and 2020. It includes conditions such as asthma, diabetes, and heart diseases, enabling temporal comparisons of admission and mortality trends.
- **Diabetes Admissions in 2020** (diabetes2020.csv): This dataset captures hospital admission rates for diabetes across countries in 2020, providing a snapshot of the disease's prevalence and healthcare burden on a global scale.
- **Heart Failure Admissions in 2020** (heart_failure2020.csv): Hospital admissions for heart failure and hypertension are recorded for 2020, offering data on the impact of these cardiovascular issues on different countries.
- **Chronic Disease Mortality Rates** (mortality_data.csv): This dataset records mortality rates associated with chronic diseases by country. It highlights the varying mortality

risks across regions and enables comparisons among diseases like asthma, diabetes, and cardiovascular conditions.

- **Asthma Admissions in 2020** (asthma2020.csv): Reflects hospital admissions due to asthma by country, allowing exploration of this condition's prevalence and associated healthcare requirements.

Data Processing

Each dataset underwent specific preprocessing steps to ensure consistency and compatibility across visualisations:

1. **Standardisation of Country Codes:** All country names were standardised to a uniform format compatible with the GeoJSON mapping data used for visualisation, ensuring a smooth integration with the world map.
2. **Data Cleaning and Transformation:** Missing or inconsistent values were addressed by either removing or filling them with standard placeholders. For instance, countries with missing values in alcohol or tobacco consumption were excluded from those specific visualisations to maintain data integrity.
3. **Time Frame Selection:** Data was filtered to focus on the year 2020, ensuring a consistent basis for comparison across datasets. Historical data, such as cancer survival rates from 2004-2014, was included to highlight progress in healthcare over time.
4. **Encoding Conventions:**
 - **Quantitative Data:** Admission and mortality rates are quantified as rates per 100,000 inhabitants, allowing for normalised comparisons between countries with different population sizes.
 - **Categorical Data:** Risk factors (e.g., alcohol, tobacco consumption) are presented using categorical encodings, such as colour-coded donut charts, to differentiate consumption levels by country.

Data Types and Encoding

- **Quantitative Data:** Hospital admission rates, survival rates, and mortality rates form the quantitative data basis for this project. For instance, in the chronic disease admission data, higher hospital admission rates are encoded in darker colours on the world map, making high-burden areas visually distinguishable.
- **Categorical Data:** Health risk factors like alcohol and tobacco use are displayed in donut charts, with colours representing various levels of consumption. For instance, countries with higher alcohol consumption are visually distinguished from those with lower rates, making it easy for users to identify lifestyle risk factors.

This processed data enables clear and comparative insights into chronic diseases and health risk factors across different countries, supporting the visualisation's objective of aiding public health decision-making.

Visualization Designs

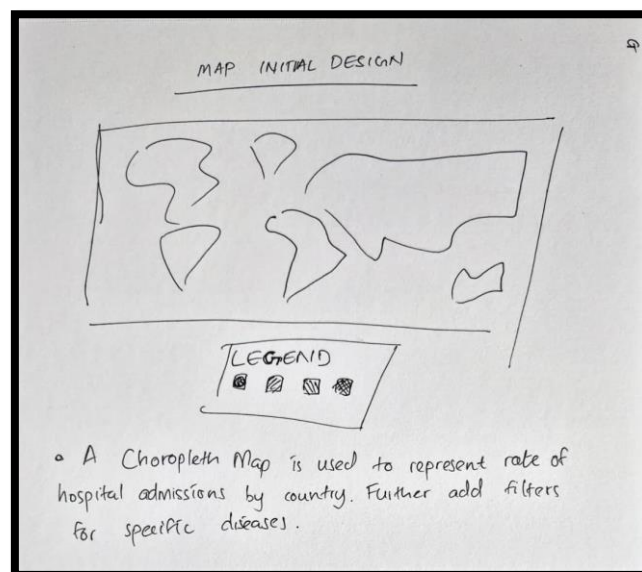
The visualisation design process focused on making complex health data accessible and engaging. By combining interactive maps, charts, and user-friendly features, the design provides users an intuitive, insightful platform to explore global chronic disease data.

Design Process

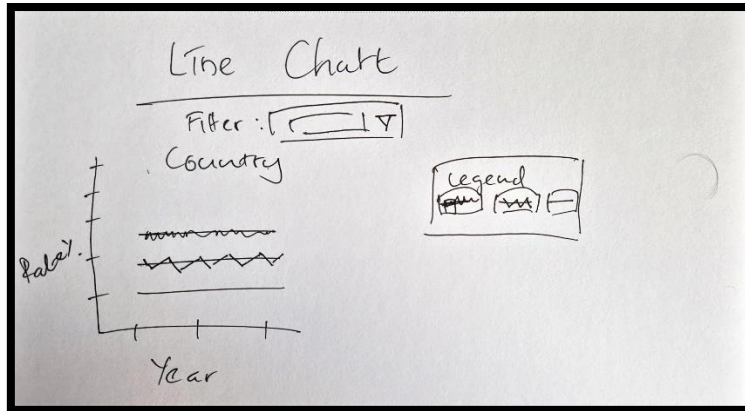
The design process began with initial sketches to establish the overall layout and functionality. Each component was visualised as part of a cohesive, user-centred layout that enables users to explore disease data by country, compare risk factors, and examine survival and mortality trends.

1. Initial Sketches

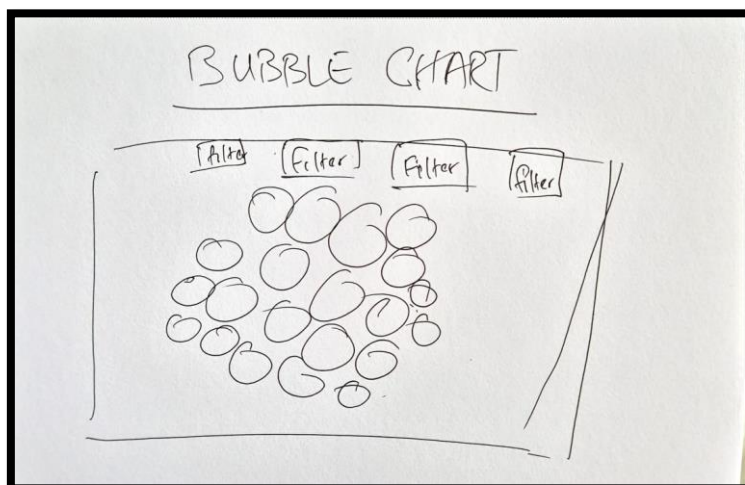
- The project began with sketches that mapped out key elements, including:
 - **Global Map:** The central map allows toggling between diseases (e.g., asthma, diabetes), with each country's colour representing its hospital admission rate for the selected disease.



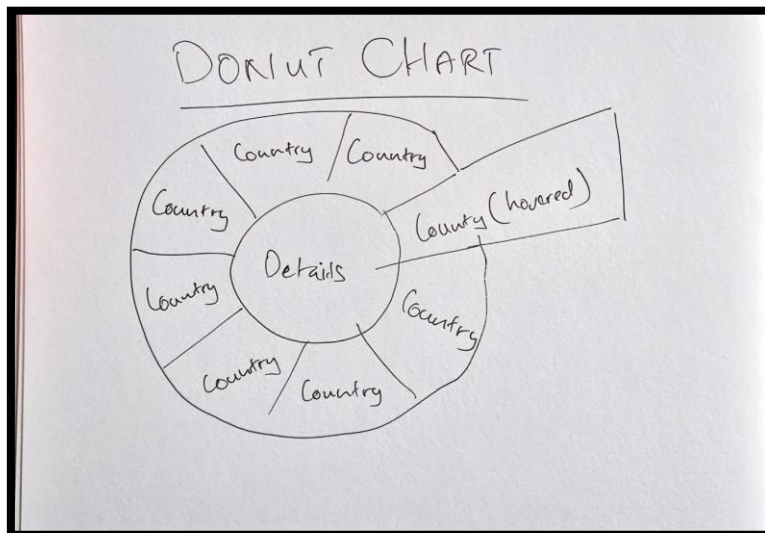
- **Cancer Survival Line Chart:** A line chart was designed to show survival rates for various cancer types by country over time, allowing users to assess healthcare progress or challenges.



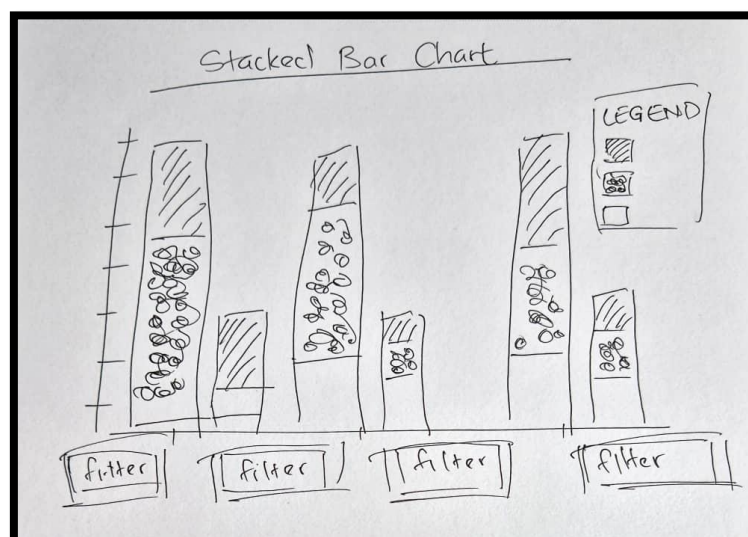
- **Bubble Chart:** Mortality rates for chronic diseases are displayed as bubbles, with sizes representing mortality rates and colours distinguishing different diseases. This visualisation enables a quick assessment of the scale of each disease's impact across countries.



- **Donut Charts for Health Risk Factors:** Each donut chart represents one health risk factor (e.g., alcohol consumption, tobacco use) with country-specific segments. Hover details provide more in-depth information for each country.



- **Stacked Bar Chart:** This chart compares hospital admissions and mortality rates for various chronic diseases, offering users a side-by-side view of each condition's healthcare impact.



Prototyping and Iteration

Feedback and testing guided several refinements for visual clarity and interactivity:

- **Colour Scheme Adjustment:** Colour gradients on the map were simplified to clearly distinguish hospitalisation rates.
- **Tooltips:** Interactive tooltips display data specifics on hover, providing extra information without overwhelming the visualisation.
- **Toggle Buttons:** Clear buttons allow users to switch between diseases on the map, as well as filter by disease in the stacked bar chart, simplifying user interaction.

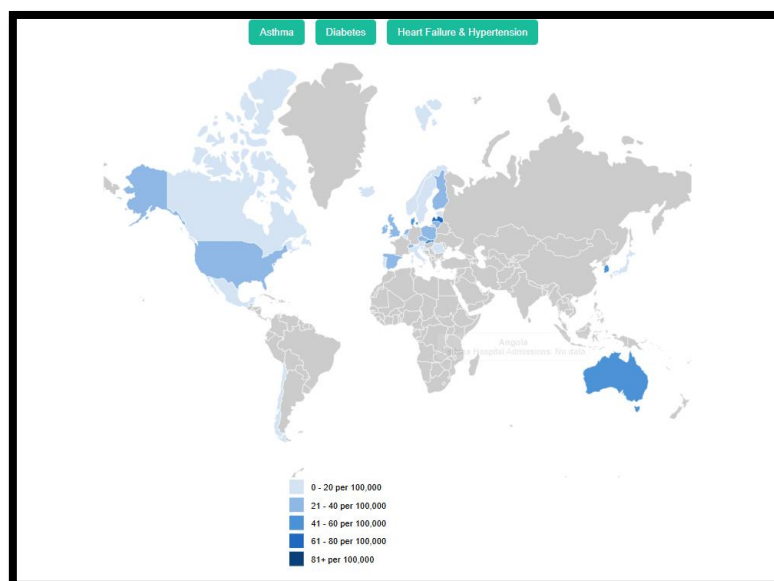
Design Guidelines and Justification

The design follows key data visualisation principles:

1. **Clarity:** A simplified colour scheme and clearly labelled elements support easy interpretation.
2. **Simplicity:** Each chart serves a specific purpose without unnecessary detail, enhancing usability.
3. **Accessibility:** The design is colourblind-friendly and responsive across devices, making it accessible to diverse users.

Justification of Visualisation Choices

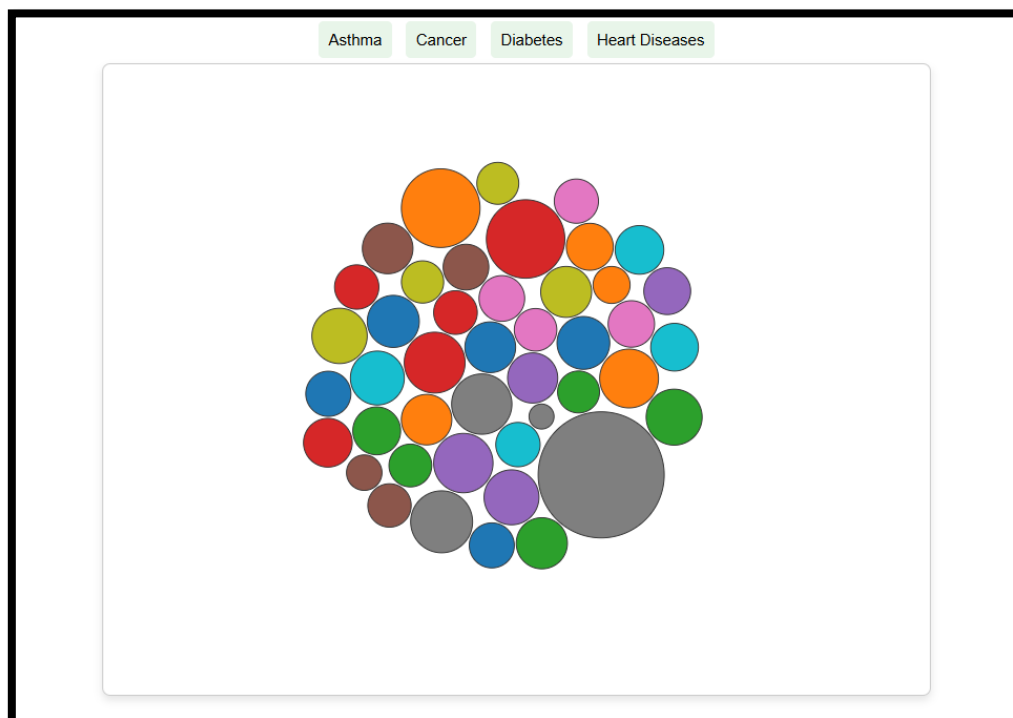
1. **World Map:** The central map offers a comprehensive view of hospitalisation rates by country, with toggles to explore specific conditions like asthma or diabetes. Colour intensity indicates admission rates, enabling users to identify high-burden regions.



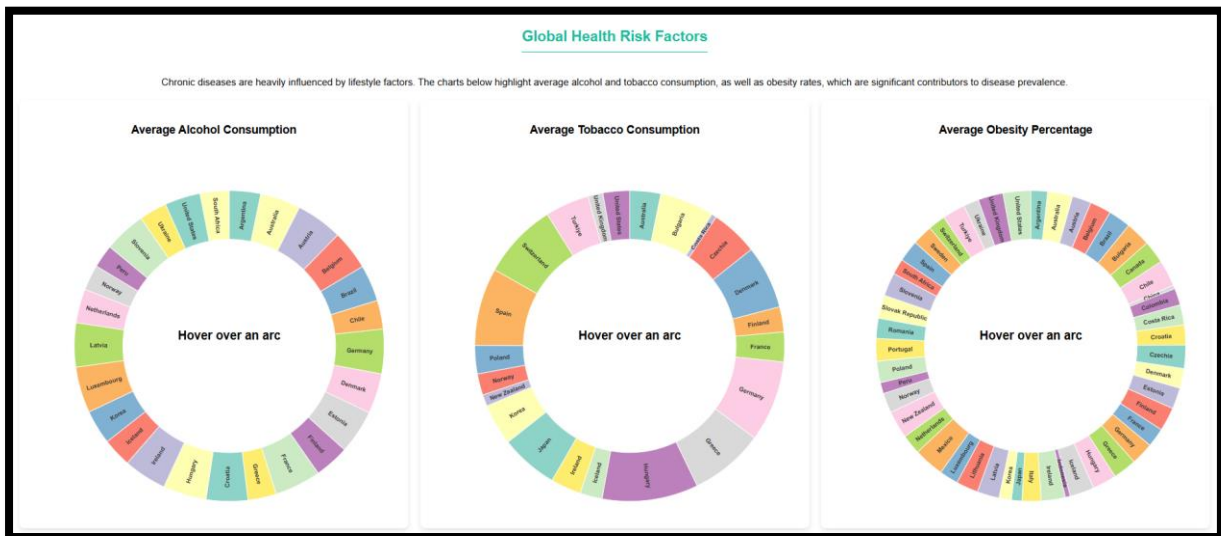
2. **Cancer Survival Line Chart:** This line chart tracks cancer survival rates by year, helping users observe trends over time for specific cancers by country. The line format is ideal for showing temporal changes, with each cancer type represented by a distinct colour.



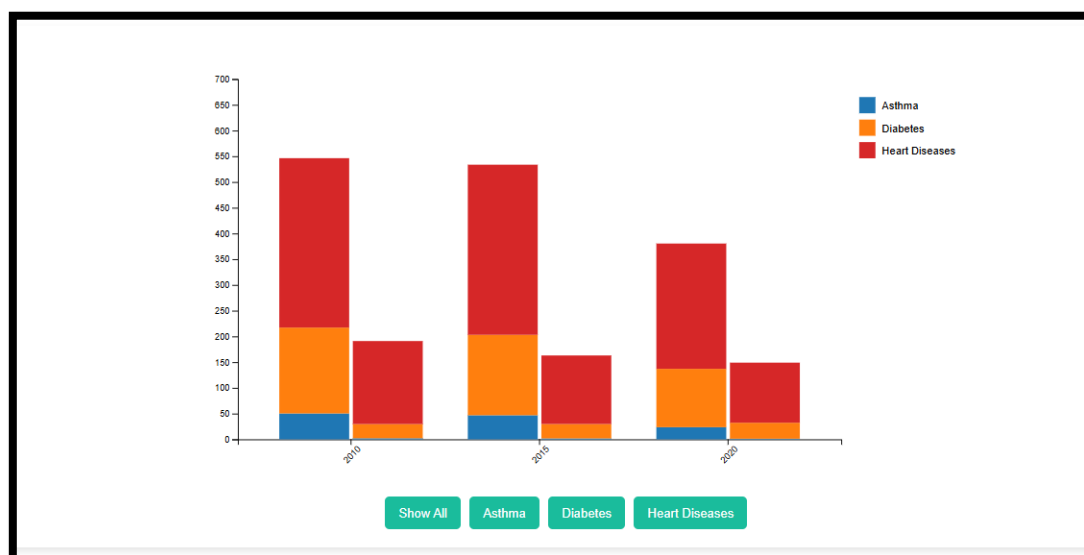
3. **Bubble Chart:** The bubble chart visualises mortality rates by chronic disease for each country. Bubble size represents mortality rates, and users can filter by disease to focus on specific conditions. The chart provides a clear view of each disease's impact, highlighting countries with the highest rates.



4. **Donut Charts for Health Risk Factors:** These donut charts illustrate lifestyle risk factors (e.g., alcohol consumption, tobacco use). Each segment represents a country, and hover details display specific data values, making it easy to compare risk factors across regions.



5. **Stacked Bar Chart:** The stacked bar chart allows users to compare hospital admissions and mortality rates for various chronic diseases. Each bar is divided into segments for admissions and mortality rates, making it easy to analyse the healthcare impact of each disease. Filter buttons let users focus on specific conditions, and hover effects provide precise data for each segment.



Each visualisation element was designed to highlight different facets of chronic disease data, from hospitalisation and survival rates to lifestyle-related health risks. Together, these visualisations form an informative platform that empowers users to explore, interpret, and compare chronic disease data globally.

Website

The website was developed to provide an engaging, informative, and user-friendly interface for exploring chronic disease data across countries. Using a blend of HTML, CSS, JavaScript, and D3.js, the site offers interactive visualisations, responsive design, and intuitive navigation. Each feature was meticulously designed to enhance accessibility, interactivity, and data clarity.

Coding Practice

1. **Front-End Development:** The website structure was built using HTML5, ensuring semantic organisation for accessibility and SEO optimisation. CSS was used extensively for styling, with a responsive grid layout to adapt seamlessly across devices, from desktops to mobile screens.
2. **Interactive Visualisation with D3.js:** D3.js was the core library used to create dynamic, data-driven visualisations. Each chart (e.g., world map, line chart, bubble chart) was implemented with D3, allowing for real-time updates and smooth transitions based on user interactions. JavaScript functions were carefully written to manage data filters, tooltips, and interactive elements like buttons and toggles, making the visualisations highly responsive.
3. **Modular Script Organisation:** The codebase is organised into modular JavaScript files, each responsible for a specific visualisation or functionality (e.g., world_map.js, bubble_chart.js). This modular approach enhances maintainability, allowing each component to be easily updated or debugged without affecting the entire project.

Interactivity

1. **Global Map with Disease Toggles:** The central world map is the primary visualisation, offering a global view of chronic disease hospitalisation rates. Interactive buttons are positioned alongside the map, allowing users to toggle between diseases like asthma, diabetes, and heart diseases. Upon selection, the map updates dynamically to reflect hospitalisation rates for the chosen disease, with colours indicating severity.
 - **Hover Tooltips:** When users hover over a country on the map, a tooltip appears, displaying the country name and the specific hospitalisation rate for the selected disease. This feature provides immediate access to detailed information without overwhelming the visualisation.
2. **Interactive Line, Bubble, Donut, and Stacked Bar Charts:**
 - **Line Chart (Cancer Survival Rates):** Users can select specific countries from a dropdown menu to view cancer survival rates over time. The chart updates to show the selected country's data, enabling comparisons of survival rates across different cancer types.
 - **Bubble Chart (Chronic Disease Mortality Rates):** This chart uses bubbles of varying sizes to represent mortality rates for different diseases by country. Users can filter the chart by disease, allowing focused analysis on specific conditions (e.g., asthma, heart disease). Hovering over a bubble displays country-specific mortality information for that disease.

- **Donut Charts (Health Risk Factors):** Donut charts present lifestyle-related risk factors such as alcohol and tobacco consumption, and obesity rates. Each chart is segmented by country, and hovering over a segment displays the exact value for that country, enabling easy comparison of risk factors.
- **Stacked Bar Chart (Hospital Admissions and Mortality Rates):** This chart provides a comparative view of hospital admissions and mortality rates for several chronic diseases. Filter buttons allow users to select a specific disease, updating the chart to display admissions and mortality data accordingly. Hovering over each bar segment reveals exact figures, helping users understand the healthcare impact of each disease.

3. Navigation and Layout:

- **Fixed Navigation Bar:** A fixed top navigation bar with links to sections such as Overview, Global Impact, Disease Trends, and Risk Factors allows users to jump quickly between different parts of the website. The navigation bar is also designed to remain accessible as users scroll, enhancing ease of use.
- **Smooth Scrolling:** Smooth scrolling effects are added to create a seamless user experience as users navigate through the different sections. The transitions are fast but smooth, contributing to an intuitive navigation flow.

Aesthetic Design

1. **Colour Scheme:** The website uses a palette of greens and blues, chosen for their association with health and well-being. This choice helps create a professional and trustworthy appearance, ideal for a data-driven health project. Each visualisation element (e.g., map, charts) is designed with colour schemes that aid clarity without causing visual overload.
2. **Responsive Layout:** The website is fully responsive, built on a flexible grid layout that automatically adjusts to different screen sizes. Key adjustments include stacking interactive elements vertically for mobile users, resizing charts to fit smaller screens, and maintaining legibility on tablet and mobile devices.
3. **Accessibility:**
 - **Colourblind-Friendly Design:** Colours were selected with accessibility in mind, ensuring they are distinguishable for colourblind users. High-contrast text and background colours help maintain readability across all sections.
 - **Keyboard Navigation:** All interactive elements, such as buttons, toggles, and dropdowns, are accessible via keyboard navigation. This feature improves accessibility for users with disabilities, allowing them to explore the website without relying on a mouse.
4. **Consistency and Readability:**
 - **Font and Spacing:** A sans-serif font was chosen for readability, with ample line spacing to prevent crowding. Each visualisation has clearly labelled axes, legends, and titles, ensuring users can interpret data accurately.

- **Section Headers and Descriptive Text:** Each section is clearly labelled, and descriptions accompany each visualisation, guiding users on how to interpret the data presented. Descriptive text explains each visualisation's purpose and relevance, providing context and enhancing the overall user experience.

5. **Aesthetic Enhancements:**

- **Hover and Click Effects:** Hover effects were added to interactive elements like buttons, icons, and chart segments. Subtle changes in colour and size provide users with visual feedback, enhancing engagement.
- **Icons and Visual Cues:** Disease-specific icons were added for each toggle button, allowing users to quickly recognise the disease they're viewing on the map or in charts. Visual cues, such as enlarged bubble sizes or highlighted segments in charts, draw attention to significant data points.

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