**ISM6419.901S24 -Data Visualization**

Final Project Report

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6. **INTRODUCTION**

This report aims to explore the complex relationships between healthcare expenditures, economic capabilities, and health outcomes across various countries using two detailed datasets. The first dataset provides a comprehensive look at each country's current health expenditure, gross domestic product (GDP), general government expenditure, and population figures. The second dataset complements this by offering data on covid like total cases, cardiovascular deaths, diabetes prevalence, total vaccinations, positive rates, total deaths, and total tests related to health challenges faced by these countries.

Given the global challenges posed by recent health crises, understanding these relationships is more crucial than ever. By analyzing how different nations allocate resources to healthcare and manage public health strategies, we can gain insights into the effectiveness of various health policies and economic investments. This report not only seeks to identify patterns and correlations that could inform better health outcomes but also aims to understand the broader economic impact on public health infrastructure.

The investigation will leverage statistical analyses to correlate healthcare spending with outcomes such as total deaths and disease prevalence. Additionally, it will examine the impact of GDP on healthcare effectiveness, particularly in managing chronic diseases like diabetes and cardiovascular conditions. By integrating these diverse datasets, the study provides a multi-faceted view of how financial, governmental, and healthcare-related decisions influence public health across different socio-economic contexts. The variance in health outcomes across countries with similar economic statuses suggests that other factors, including governance, public health policies, and cultural attitudes towards health, play critical roles. For instance, two countries with comparable GDP might exhibit stark differences in cardiovascular health statistics due to varying levels of government intervention and public health strategies. This complexity underscores the need for a comprehensive approach to health policy-making that incorporates economic, cultural, and governmental dimensions.

The interaction between economic strength and health infrastructure is important in shaping national health outcomes. Countries with robust economies often have more resources to allocate towards health initiatives, potentially leading to better public health metrics. However, the success of these investments is not solely dependent on the amount of money spent but also on how these funds are utilized. Strategic investments in preventive healthcare, public health education, and emergency preparedness can significantly enhance a country's ability to manage both chronic diseases and acute health crises. This report delves into these aspects by analyzing the alignment of GDP with health expenditures and outcomes, providing a better understanding of how economic prosperity influences public health across different countries.

1. **RESEARCH QUESTIONS**

Below are the research questions for the visualizations I tried to answer through my visualizations:

1. How does Covid positive rate fare for different countries?
2. What is the relationship between GDP and the prevalence of diabetes in these countries?
3. How effective are the total vaccinations in reducing the total cases in countries with high positive rates?
4. Which countries have the Highest and Least deaths?
5. How does healthcare spending influence health outcomes in terms of cardiovascular disease mortality rates across different countries?
6. How does the ratio of healthcare spending to GDP affect the total deaths in countries with varying levels of healthcare challenges?
7. How do Cardiovascular Deaths and Diabetes prevalence affect countries classified by high, medium, and low GDP?"
8. What is the relation between Current Health Expenditure vs Total Death for GDP classification group?
9. How are Cardiovascular Deaths and general Government Expenditure for each Country?
10. What is the relation between Government Expenditure and the GDP of countries?

# METHODOLOGY:

**Data Collection** :

Two primary datasets were utilized for this project:

1. Covid Data

Source: The covid data was sourced from

<https://ourworldindata.org/explorers/coronavirus-data-explorer>

2. Health Expenditure Data:

Source : The Health Expenditure data was obtained from WHO

<https://apps.who.int/nha/database/Select/Indicators>

Both datasets were publicly available and provided by reputable government agencies, ensuring the reliability and accuracy of the information.

**Data Processing:**

Upon acquisition, the datasets underwent a thorough cleaning process:

Validation and Verification: Data points were cross-checked for consistency and accuracy against the source databases to ensure that they accurately represented the intended measures.

Data Cleaning: Any discrepancies, such as mismatched state names or formatting inconsistencies, were corrected. Missing or incomplete data entries were addressed either by data imputation methods or by excluding the affected records from the analysis, based on their impact on the overall dataset integrity.

Data Transformation: The datasets were transformed into a suitable format for analysis in Tableau. This included the creation of calculated fields where necessary, such as categorizing states by predominant tobacco usage type, and aggregating reimbursement data to align with the granularity of the tobacco data.

# Analysis and Visualization

**Question 1:**

How does Covid positive rate fare for different countries?

**A screenshot of a computer

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**FIGURE:1**

**DESCRIPTION:**

The bar chart displays the Covid-19 positive rates for various countries. This visualization effectively illustrates how different nations have been impacted by the pandemic, reflecting variations in testing, containment measures, and possibly the spread of the virus. This chart effectively illustrates the diverse impact of the pandemic across nations, suggesting variations in testing rates, public health responses, and virus spread control measures. The visual representation serves as a clear tool for understanding which countries are experiencing higher transmission levels or are possibly conducting more comprehensive testing.

**QUESTION 2:**

What is the relationship between GDP and the prevalence of diabetes in these countries?

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**FIGURE2:**

**DESCRIPTION:**

The visualization "GDP vs Diabetes Prevalence" showcases a scatter plot that examines the relationship between a country's Gross Domestic Product (GDP) and the prevalence of diabetes among its population. The visualization highlights that countries with very high GDP tend to show lower diabetes prevalence. This could imply that these countries potentially invest more in healthcare infrastructure and preventive measures, contributing to better health outcomes. The scatter plot effectively illustrates that while there is some indication that higher GDP may be associated with lower diabetes prevalence, the relationship is not straightforward or uniform across all countries.

**QUESTION 3:**

How effective are the total vaccinations in reducing the total cases in countries with high positive rates?

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**FIGURE:3**

**DESCRIPTION:**

The visualization titled provides a scatter plot that correlates the total number of COVID-19 vaccinations administered with the total number of confirmed COVID-19 cases for various countries.

The graph illustrates a positive correlation between the total vaccinations and the total cases, which may initially seem counterintuitive. The size of the circles represents the average positive rate of COVID-19 tests in each country. Larger circles on the plot often correspond to higher positive rates, suggesting that some countries with extensive vaccination campaigns might still be experiencing high transmission rates.

**QUESTION 4:**

Which countries has Highest and Least deaths?

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**FIGURE:4**

**DESCRIPTION:**

The above visualization presents a bar chart that displays the total number of deaths for various countries. The visualization illustrates an extremely uneven distribution of total deaths across countries. One country i.e Brazil, in particular, exhibits a dramatically higher number of deaths compared to others, which could indicate a severe impact from health-related issues or a larger population size that contributes to higher absolute numbers.

**QUESTION 5:**

How does healthcare spending influence health outcomes in terms of cardiovascular disease mortality rates across different countries?

A map of the world with yellow dots

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**FIGURE:5**

**DESCRIPTION:**

The visualization features a map overlaid with data points representing each country's cardiovascular death rates and their corresponding healthcare expenditures. Countries in Europe and Asia display notably larger circles, suggesting higher rates of cardiovascular deaths in these regions compared to others. Countries with larger circles and darker shades could be spending more on healthcare yet still experiencing high death rates, suggesting a complex relationship between spending and health outcomes that might not be directly proportional.

**QUESTION 6:**

How does the ratio of healthcare spending to GDP affect the total deaths in countries with varying levels of healthcare challenges?

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**FIGURE:6**

**DESCRIPTION:**

The visualization titled "Effect of Ratio of Healthcare Spending to GDP on Total Deaths in Countries with Varying Levels of Healthcare Challenges" uses a global map to display data points that represent each country's total deaths alongside their healthcare expenditure as a ratio of their GDP. The size of each circle indicates the total number of deaths, while the color likely denotes the ratio of healthcare spending to GDP, providing a visual correlation between a country's investment in healthcare relative to its economic size and the health outcomes in terms of mortality. Larger circles in some countries that also show darker colors assuming darker shades represent higher spending ratios might suggest that despite higher healthcare spending relative to GDP, the mortality rates are still substantial.

**QUESTION 7:**

How does Cardiovascular Deaths and Diabetes prevalence affect countries classified by high, medium, and low GDP?

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**FIGURE:7**

**DESCRIPTION:**

The visualizations compare cardiovascular deaths and diabetes prevalence across countries categorized by their GDP levels—low, medium, and high. We can see a significant concentration of cardiovascular deaths in countries with low GDP, depicted by the towering green bar. This suggests a possible correlation between lower economic status and higher rates of cardiovascular mortality. Diabetes prevalence is also higher in low-GDP countries as indicated by the yellow bar, but does not appear as pronounced when compared to cardiovascular deaths.

**QUESTION 8:**

What is the relation between Current Health Expenditure vs Total Death for GDP classification group?

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**FIGURE:8**

**DESCRIPTION:**

The visualization shows a scatter plot to explore the relationship between a country's health expenditure and the total deaths recorded. It uses animation to display by the categories of GDP – High, Low, Medium. Some countries with relatively low health expenditure seem to have lower death counts, which could suggest either efficient health management or lower disease prevalence. Conversely, some high-expenditure countries show high death rates, possibly indicating high disease burdens or less effective health expenditure.

**QUESTION 9:**

How are Cardiovascular Deaths and general Government Expenditure for each Country?

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**FIGURE:9**

**DESCRIPTION:**

The visualization employs a dual-bar chart format to compare the number of cardiovascular deaths and the level of government expenditure across selected countries. Each country is represented by two bars: one for cardiovascular deaths (orange) and one for government expenditure (green), allowing for a side-by-side comparison between health outcomes and government spending. The visualization suggests varying relationships between government spending and cardiovascular health outcomes across the countries. For example, while Austria and Australia show high government spending with relatively moderate cardiovascular deaths, countries like Azerbaijan and Cambodia have lower expenditures and, correspondingly, lower or moderate death rates.

**QUESTION 10:**

What is the relation between Government Expenditure and the GDP of countries?

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**FIGURE:10**

**DESCRIPTION:**

The visualization shows a bubble chart to depict the relationship between a country's GDP and its government spending. The size of each bubble represents the gross domestic product (GDP) of a country, while the color intensity and position reflect the amount of government expenditure. The United States stands out with the largest bubble, indicating its position as the country with the highest GDP among those displayed. European countries like France, Germany, and Italy, while smaller in GDP compared to the US and China, show significant government spending relative to their economic size.

**DASHBOARD: 1**

# DASHBOARDS:

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**DASHBOARD 2:**

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**DASHBOARD 3:**

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1. **CONCLUSIONS**

Through this project, I have comprehensively analyzed various datasets to understand the impact of economic factors, such as GDP and government expenditure, on covid health outcomes, including cardiovascular deaths and diabetes prevalence. Through a series of detailed visualizations, I have gained insights into how these economic indicators correlate with health metrics across different nations.

**Key Findings:**

1. Economic Impact on Health Outcomes:

There is a noticeable correlation between countries with higher GDP and government expenditure and their ability to manage health crises, evident from lower diabetes prevalence and cardiovascular death rates. However, this is not uniform across all countries, suggesting that mere economic prosperity does not guarantee better health outcomes without effective healthcare policies and management.

2. Global Health Expenditure Analysis:

The analysis reveals significant disparities in how countries allocate their healthcare budgets. Nations with higher healthcare spending generally show better health outcomes, but efficiency in spending and the focus of healthcare programs also play critical roles.

3. Effectiveness of Healthcare Systems:

The visualizations have highlighted both successes and areas for improvement in healthcare systems worldwide. Countries that efficiently utilize their healthcare budgets tend to achieve better outcomes, indicating the importance of strategic investment in health beyond the total expenditure.

4. Recommendations for Future Research:

Further studies could explore the direct effects of specific healthcare policies on population health, cross-analyze healthcare spending with other socio-economic factors such as education and employment, and evaluate the long-term impact of healthcare investment on economic performance.

This report underscores the complex interplay between economic indicators and health outcomes. While economic strength provides the resources necessary for health spending, the effectiveness of this spending is crucial to achieving desirable health outcomes. For policymakers, the implications are clear: focus on efficient healthcare spending and policy frameworks that not only expand access but also ensure quality and preventive care, tailoring strategies to the specific health needs and economic contexts of their populations. This approach will be vital in improving global health outcomes in an economically sustainable manner.