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CHARTERED 1693

Out-of-Pocket Healthcare Expenditure in Relation to Quality of Healthcare

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Executive Summary

- Research investigating the impact of out-of-pocket healthcare costs on healthcare outcomes, as well as the factors influencing these costs.
- The Global Country Information Data Set 2023 serves as the data set for evaluating these factors, sourced from an annually-updated global information set available on Kaggle, encompassing every country worldwide.
- Assuming the primary variable, out-of-pocket healthcare expenditure, takes into account all healthcare expenditure, including people with and without insurance.
- Notable Finding 1: Analysis reveals a negative correlation between patient healthcare expenditure and life expectancy, suggesting that as healthcare expenditure rises, life expectancy tends to decline.
- Notable Finding 2: Examination of infant and maternal mortality rates in relation to patient healthcare expenditure reveals that as healthcare spending increases, both infant and maternal mortality rates also rise.
- Notable Finding 3: The analysis of total tax rates in relation to healthcare expenditure indicates that countries with the lowest patient healthcare expenditure tend to have the highest rates of "low" tax rates. This suggests that lower healthcare costs are associated with lower tax burdens.
- Notable Finding 4: Investigation into the number of physicians per thousand people in relation to patient healthcare expenditure reveals that countries with the lowest healthcare expenditure costs tend to exhibit higher physician-to-population ratios.
- Notable Finding 5: Analysis of Gross Domestic Product (GDP) in relation to patient healthcare expenditure reveals that countries in the lowest healthcare expenditure brackets exhibit the highest GDP levels.
- A limitation is that the data for healthcare expenditure variable doesn't take into account if patients have insurance.
- To enhance the research, an equation could be fitted to the data with healthcare expenditure as the dependent variable.

Overview

Healthcare is universally recognized as costly; however, often those who need it the most lack access to adequate healthcare. Identifying the shortcomings of the current system lays the foundation for finding a better system. My research aims to evaluate the impact of out-of-pocket healthcare costs on healthcare outcomes and their relationship with factors potentially improving healthcare. The data set facilitates a comparison between out-of-pocket healthcare costs and life expectancy, mortality rates (infant and maternal), as well as physicians per thousand, total tax rates, and GDP.

1. How do out-of-pocket healthcare costs impact the outcome of health care (life expectancy, mortality rates (infant and maternal))?
2. How are out-of-pocket healthcare costs affected by factors that may improve health care (physicians per thousand, total tax rate, GDP)?

Data Source and Assumptions

My data set, the "Global Country Information Data Set 2023," is sourced from Kaggle and provided by user Nidula Eligiriyewithana and is compiled from various sources by the data set creator. It is distributed under a Creative Commons International 4.0 License, and is annually updated, with the latest being in August 2023. I consider this data set credible due to its up-to-date data, and through personal cross-verification. For analysis purposes, I assume that out-of-pocket healthcare expenditure encompasses all healthcare spending, regardless of insurance coverage or other factors.

Data Cleaning Process

To clean the data, I selected relevant variables, renamed them if necessary, removed extraneous characters like '%' or '$,' and converted all variables to integers. Null values were removed. New variables were created to categorize entries of Health_expenditure_%, Total_Tax_Rate_%, and Physicians_per_Thousand into "Low", "Mid", and "High" for visualization purposes.

During exploratory data analysis (EDA), a negative linear relationship between out-of-pocket healthcare expenditure and life expectancy emerged, suggesting increased expenditure does not tend to improve health outcomes. Further analysis revealed a slightly negative correlation between physicians per thousand and healthcare expenditure, indicating factors improving healthcare may not increase patient costs.

Notable Findings

Finding 1. The first notable observation pertains to the relationship between healthcare expenditure and life expectancy. Figure 1 and Table 1 show that lower life expectancies, on average, seem to correspond with higher healthcare costs. This may suggests that countries with higher healthcare expenses typically have lower healthcare quality. See Figure 1 and Table 1

Finding 2. The second finding explores infant and maternal mortality rates in relation to healthcare expenditure. Infant mortality rates are deaths per 1,000 children born. Maternal mortality rates are deaths per 100,000 births. A positive correlation is observed and Table 2 sees a rising mean value for both as health expenditure increases, suggesting that countries with higher out-of-pocket expenses experience more deaths associated with childbirth. See Figures 2 and Table 2

Finding 3. The third observation examines the relationship between total tax rate and out-of-pocket healthcare expenses. In Figure 3, the "High" tax rate category constitutes the highest percentage of the "High" healthcare expenditure category. In Table 3, a rising mean is seen as healthcare percentage increases. This indicates a link between high taxation and elevated out-of-pocket healthcare costs. See Figures 3 and Table 3

Finding 4. The fourth finding examines the correlation between the number of physicians per 1,000 people and patient healthcare expenditure. In Figure 4, 54% of countries with a high density of physicians fall into the "Low" category for healthcare expenditure, compared to 33% in the "Mid" category and 13% in the "High" category. In Table 4, mean healthcare expenditure decreases as physicians increase. See Figures 4 and Table 4

Finding 5. The fifth finding links a country's GDP with out-of-pocket healthcare expenditure. As seen in Figure 5.1 and Table 5, lower out-of-pocket expenses correspond to higher GDP's. This suggests that individuals in less affluent countries may face a larger burden of healthcare costs. Notably, high GDP outliers often fall within low to mid healthcare expense brackets. See Figures 5 and Table 5

Limitations

A limitation of the primary variable, out-of-pocket healthcare expenditure, is lack of information regarding if there are national healthcare systems and whether the data includes both insured and uninsured individuals. This omission overlooks a crucial aspect of healthcare accessibility and equity across a population. Additional data on this issue would allow for an important disparity to be examined. Additionally, a limitation in the research regards lack of combination of the independent variables. To enhance this project, an equation could be fit to the data with healthcare expenditure as the dependent variable. This would allow for examination of interacting factors.

Data Visualizations and Tables

Figure 1. How Out-of-Pocket Healthcare Expenditure Impacts Life Expectancy

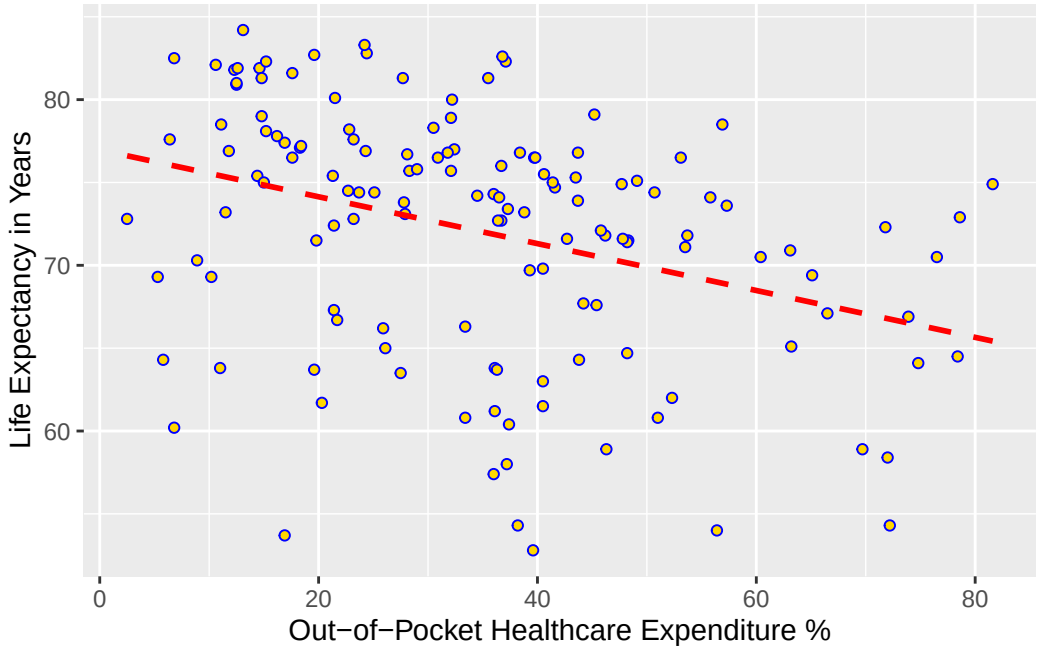

Table 1. Out-of-Pocket Healthcare Expenditure and Life Expectancy

Health Expenditure Group	Mean Life Expectancy (Years)
0% - 10%	71.00000
10% - 20%	76.63571
20% - 30%	73.73333
30% - 40%	71.19375
40% - 50%	70.77391
50% - 60%	69.68000
60% - 70%	66.98333
70% - 80%	65.48750
80% - 90%	74.90000

Figure 2. How Out-of-Pocket Healthcare Expenditure Impacts Mortality Ratio

Table 2. Out-of-Pocket Healthcare Expenditure and Mortality Rates

Out-of-Pocket Healthcare Expenditure	Mean Maternal Mortality Ratio	Mean Infant Mortality Ratio	Range Maternal Mortality Ratio	Range Infant Mortality Ratio
Low	95.54237	14.87797	2 - 661	1.7 - 65.7
Mid	193.96923	24.16154	2 - 1140	2.3 - 84.5
High	266.33333	39.26667	17 - 917	11 - 75.7

Figure 3. Out-of-Pocket Healthcare Expenditure and Total Tax Rate Percentage

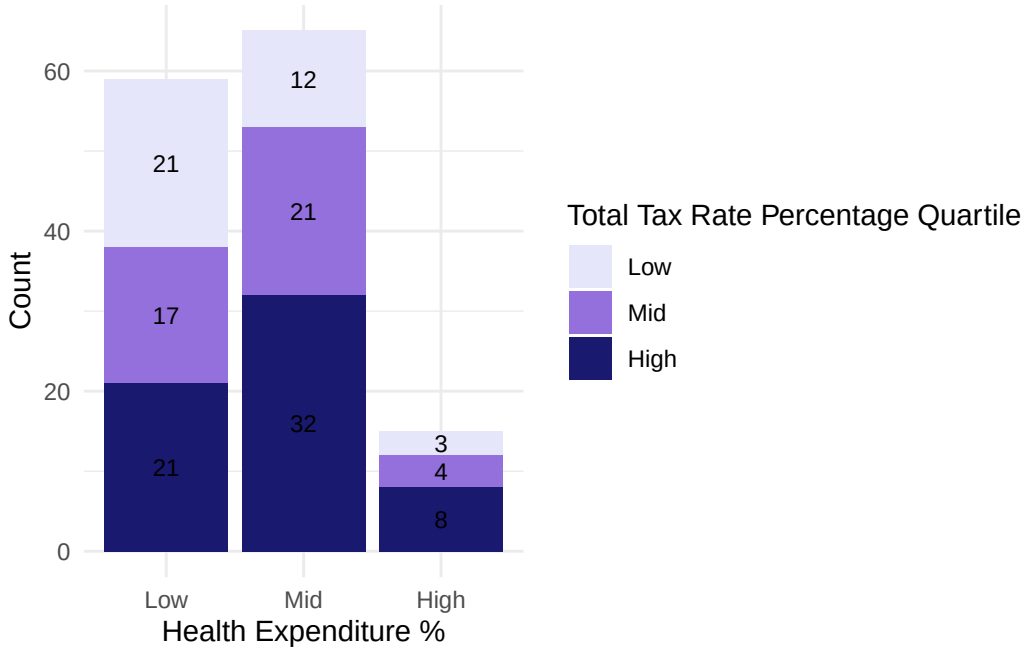

Table 3. Out-of-Pocket Healthcare Expenditure and Total Tax Rate

Out-of-Pocket Healthcare Expenditure Range	Mean Tax Rate	Median Tax Rate	Range Tax Rate
Low	37.73729	36.6	8.5 - 106.3
Mid	42.22615	41.3	9.9 - 73.3
High	57.31333	41.8	22.6 - 219.6

Figure 4. Out-of-Pocket Healthcare Expenditure and Physicians Per Thousand

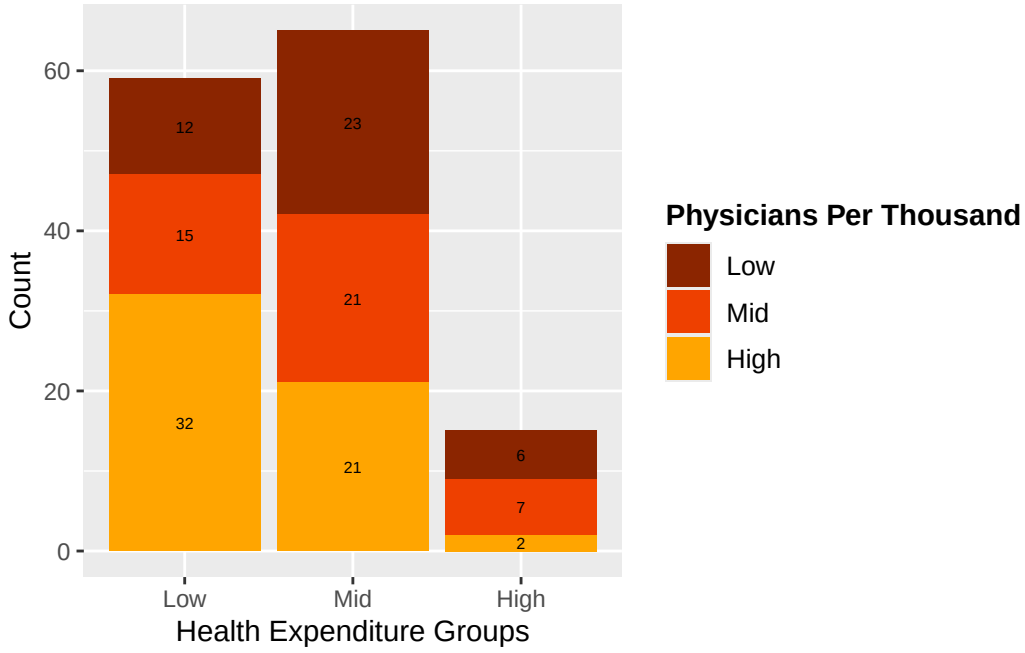

Table 4. Out-of-Pocket Healthcare Expenditure and Physicians Per Thousand

Physicians Per 1,000 Quartiles	Mean Out-of-Pocket Healthcare Expenditure (%)	Median Out-of-Pocket Healthcare Expenditure (%)	Range Out-of-Pocket Healthcare Expenditure (%)
Low	38.76829	38.2	5.3 - 78.4
Mid	38.30233	36.7	2.5 - 76.5
High	28.87636	24.4	6.8 - 81.6

Figure 5. GDP as a Function of Out-of-Pocket Healthcare Expenditure

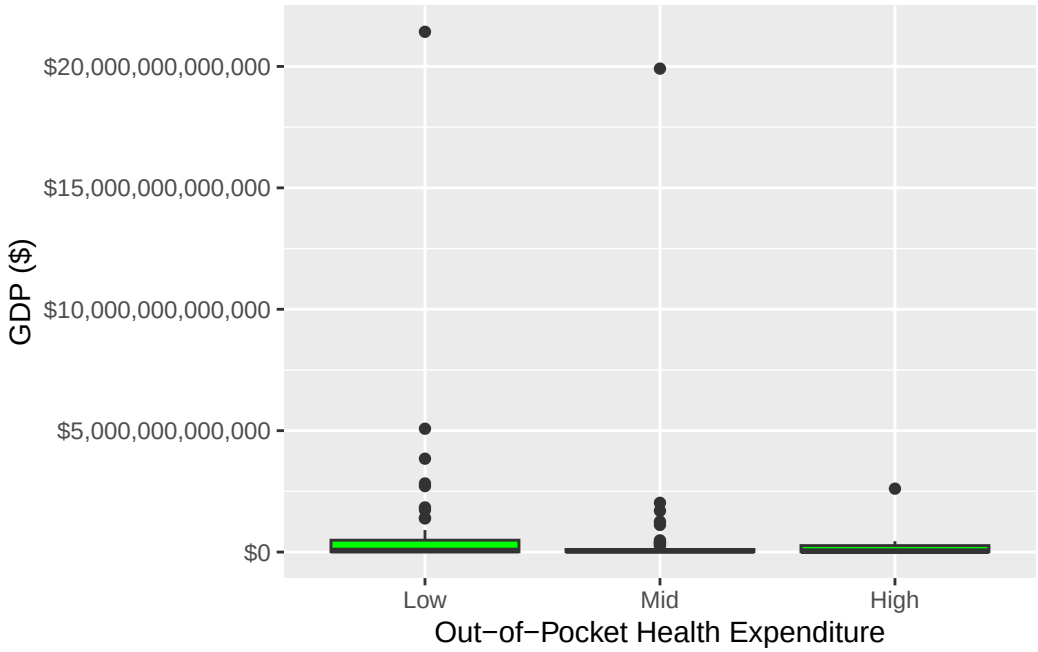

Table 5. Out-of-Pocket Healthcare Expenditure and GDP

Out-of-Pocket Health Expenditure (%)	Mean GDP ($)	Median GDP ($)	Range GDP ($)
Low	850396535196	63177068175	825385185 - 2.14277e+13
Mid	474410607672	47319624204	1340389411 - 1.991e+13
High	277125733138	38760467033	1185728677 - 2.611e+12