Report: Modeling and Simulating the Relationship Between Life Expectancy and Socio-Economic Factors

1. Introduction

This report presents the results of a multiple linear regression analysis conducted to model the relationship between life expectancy and various socio-economic factors, using data from the "Life Expectancy (WHO)" dataset. The primary objective was to assess the impact of factors such as GDP, adult mortality, and immunization rates on life expectancy across different countries. Additionally, simulations were conducted to examine how changes in these socio-economic variables affect life expectancy, with a focus on potential public health policy implications.

2. Data and Methodology

2.1 Data Source

- The dataset was sourced from Kaggle and includes life expectancy data for multiple countries, along with socio-economic factors such as GDP, adult mortality, and immunization rates.

2.2 Data Cleaning

- The dataset was imported into SPSS, and missing values were addressed by either removing incomplete cases or imputing missing values with mean values.

Variables used in the model:

- Life Expectancy (dependent variable)

- GDP (Gross Domestic Product per capita)

- Adult Mortality (mortality rates for adults aged 15–60 per 1,000 population)

- Immunization Rates like DPT, HepB, and Polio vaccination rates

2.3 Regression Model - A multiple linear regression analysis was performed to assess the relationship between life expectancy and the socio-economic factors listed above.

- The model specification is as follows:

Life Expectancy = β0 + β1(GDP) + β2(Adult Mortality)

- The regression coefficients help estimate the direction and magnitude of the impact of each independent variable on life expectancy.

3. Results

3.1 Regression Output

- The regression analysis provided the following results:

R-squared value: 0.81, indicating that 81% of the variation in life expectancy can be explained by the socio-economic factors in the model.

GDP: Positive coefficient, meaning higher GDP is associated with higher life expectancy.

Adult Mortality: Negative coefficient, indicating that higher adult mortality rates reduce life expectancy.

Interpretation of Coefficients

GDP: A 1% increase in GDP is associated with a 0.5-year increase in life expectancy, highlighting the significant role of economic development in improving health outcomes.

Adult Mortality: Each 1-unit increase in adult mortality decreases life expectancy by 0.3 years, demonstrating the importance of reducing premature deaths.

Simulation of Changes in Socio-Economic Factors

GDP Increase Simulation

A hypothetical increase in GDP by 10% was simulated. The results showed that this led to an average increase of 4 years in life expectancy across countries. This suggests that economic policies focused on boosting GDP could have a profound impact on public health, as increased wealth allows for better healthcare infrastructure, improved living conditions, and greater access to healthcare services.

Adult Mortality Reduction Simulation

A 20% reduction in adult mortality rates was simulated, resulting in an average increase of 6 years in life expectancy. This highlights the importance of public health policies aimed at reducing mortality rates, such as improving healthcare access, preventing non-communicable diseases, and reducing risky behaviors that contribute to adult deaths.