***Incidence of Tuberculosis, Health expenditure and Health Outcomes among SAARC Countries, Panel Data Analysis***

**Aim**

The aim of this study to explore and compare the tuberculosis trends, health expenditure and infrastructure among SAARC Countries (Pakistan, Bhutan, India, Sri Lanka, Nepal, Bangladesh, Maldives) from 2005 to 2015 by using indictors of health status and socio-economic development.

**Methodology**

Data on countries population size and other indicators were collected from the World development indicators from 2005 to 2015 of SAARC countries (World Bank Data). The SAARC countries include Pakistan, Bhutan, India, Sri Lanka, Nepal, Bangladesh, Maldives, Afghanistan but Afghanistan were removed from analysis due to data inconsistency, missing data and measurement error. The data consists of 14 variables in which 10 are independent variables and 4 are dependent variables, description of these variables are given below: -

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| 1. GDP per capita, PPP (constant 2021 international $) = (Its GDP divided by midyear population, adjusted for purchasing power parity, why this 🡪*its shows average income of the country citizens considering cost and inflation).* |
| 1. Domestic general government health expenditure (% of GDP) = (Its proportion of a country’s gross domestic product spent by the government on healthcare services. *🡪 As it shows how much the government spent on health care service)* |
| 1. Domestic private health expenditure (% of current health expenditure) = (It’s the share of total health expenditure that is funded by private entities, such as households, corporations, and non-profits. *🡪 Its good clue that shows equitable access and balance between public and private roles in healthcare.* |
| 1. Out-of-pocket expenditure (% of current health expenditure) = (It’s the percentage of total healthcare costs paid directly by individuals at the time-of-service use. *🡪 As it represents the financial burden on individuals).* |
| 1. Hospital beds (per 1,000 people) = (It’s the number of hospital beds available per 1,000 individuals. *🡪 measure of health system capacity).* |
| 1. Physicians (per 1,000 people) = (Its number of medical doctors, gp and specialists per 1,000 population. *🡪 It indicates the availability of healthcare professionals).* |
| 1. People using at least basic sanitation services (% of population) = (The proportion of people using improved sanitation facilities not shared with other households. *🡪It’s one of the major determinants of public health and hygiene).* |
| 1. People using safely managed drinking water services (% of population) = (It’s the % of the population with access to clean drinking water that is available on premises, when needed, and free of contamination. *🡪 it shows Access to clean water is crucial for preventing waterborne diseases.)* |
| 1. Mortality rate, infant (per 1,000 live births) = (It shows the number of infants dying before reaching one year of age, per 1,000 live births. *🡪 it represents the population health and healthcare quality).* |
| 1. Life expectancy at birth, total (years) = (It’s the average number of years a newborn is expected to live, assuming mortality patterns remain constant. *🡪 Good estimator for health status).* |
| 1. Death rate, crude (per 1,000 people) = (It’s the total number of deaths in a year per 1,000 people in the population. *🡪 it shows the mortality situation in a country).* |
| 1. Incidence of tuberculosis (per 100,000 people) = (The estimated number of new TB cases per 100,000 people per year. *🡪 Good estimator for infectious disease control).* |
| 1. Literacy rate, adult total (% of people aged 15 and above) = (It’s the percentage of people aged 15 and above who can read and write a short, simple statement about their life. *🡪 Its importance in health behavior, its role impact in health status).* |
| 1. Labor force participation rate, female (% of female population ages 15-64) (modeled ILO estimate) = (It’s the proportion of women aged 15–64 who are working or actively looking for work. *🡪It reflects women’s empowerment and economic engagement).* |

STATA 17, version is used for statistical analysis.

**Commands and Step by step guide.**

First, I used global macros to store the file path for the efficiency purpose, then used the drop in command to omit the extra empty rows that include the world development indicator dataset notes. Secondly, the destring along with force and replace, to convert the string to numeric, while overwriting the original variables as well as encode command were used to convert string variables into numeric labels and gen was used to generate new variables and numlabel, add were utilized to add numbers and labels for efficiency in interpreting and output efficiency purpose. Tab command was used for displaying the frequency table especially to check number of observations availability per variable before reshaping.

Reshape wide and long were used for better visual analysis, wide format for each column in year and long format where each row has unique observation (i.e. country year indicators), then variables were renamed by rename command, gen command along natural logs were used for generating new variable to avoid skewness, stabilize variance (log/log model. Regression as we different entities in different time like different countries in different years, so panel data set would be the most optimum choice, xtset country year used to set panel data set where country set as panel identifier and year used as a time variable.

There are 3 more variables that are generated and used as proxy. Health infrastructure that’s the proxy of health system infrastructure/ supply side capacity by composite of no. of physicians and hospital beds, likewise Health access generated by subtracting GDP and OPP as proxy of access to care, affordability and last female empowerment by composite of female labor and literacy as a proxy.

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| **Table 1 Regression Output** | | | | |
| **Independent Variables** | **Model 1: Incidence of Tuberculosis (l\_Inci\_tb)** | **Model 2: Life Expectancy at Birth (l\_LEB)** | **Model 3: Crude**  **Death Rate (l\_CDR)** | **Model 4: Infant Mortality Rate (l\_IMR)** |
| **l\_gener\_health\_exp** | 0.010 (0.019) | -0.032 (0.022) | 0.124 (0.087) | -0.009 (0.031) |
| **l\_privat\_health\_exp** | 0.390\* (0.154) | 0.005 (0.179) | 0.365 (0.696) | -0.193 (0.250) |
| **l\_gdp\_capita** | 0.002 (0.142) | 0.412\* (0.165) | -1.056804 | -0.366 (0.231) |
| **l\_hosp\_beds** | -0.011 (0.025) | -0.050 (0.029) | 0.188 (0.113) | -0.048 (0.040) |
| **l\_fem\_lab\_force** | 0.034 (0.061) | 0.100 (0.071) | -0.493 (0.276) | -0.098 (0.099) |
| **l\_liter\_adult** | -0.068 (0.066) | -0.023 (0.077) | 0.036 (0.300) | -0.107 (0.108) |
| **l\_OPP** | -0.332\*\* (0.127) | -0.139 (0.148) | 0.311 (0.576) | 0.087 (0.207) |
| **l\_saf\_drinking\_water** | 0.100 (0.129) | -0.086 (0.150) | 0.656 (0.587) | -0.081 (0.211) |
| **l\_Bas\_sanit** | -0.111 (0.152) | 0.154 (0.177) | -0.668 (0.689) | -0.478 (0.247) |
| **l\_phy** | -0.002 (0.052) | -0.103 (0.060) | 0.462 (0.235) | -0.0147 |
| **Constant** | 5.219\*\* (1.299) | 0.660 (1.510) | 14.994\* (5.885) | 10.044\*\*\* (2.112) |
| **Observations** | 19 | 19 | 19 | 19 |
| **R-squared** | 0.828 | 0.976 | 0.952 | 0.998 |
| **Adjusted R-squared** | 0.381 | 0.914 | 0.828 | 0.994 |
| \*\*\* p<.01, \*\* p<.05, \* p<.1 | |  |  |  |

Table 1. From Model 1 its can be seen that private health expenditure and out pocket expenditure are significant. A 1% increase in private health expenditure is associated with a ***0.39%*** increase in the incidence of tuberculosis. A 1% increase in out-of-pocket payments (OPP) is associated with a ***0.332%*** decrease in tuberculosis incidence. While from the 2nd model, A 1% increase in GDP per capita is associated with a ***0.412%*** increase in life expectancy.

**Table 2 Regression Output**

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| l\_IMR | Coef. | | St.Err. | t-value | | p-value | [95% Conf | | Interval] | | Sig |
| l\_female\_empower | -0.287 | | 0.154 | -1.87 | | 0.095 | -0.635 | | 0.061 | | \* |
| l\_access\_health | -0.055 | | 0.129 | -0.43 | | 0.68 | -0.347 | | 0.237 | |  |
| l\_health\_infra | -0.161 | | 0.094 | -1.71 | | 0.122 | -0.374 | | 0.052 | |  |
| l\_CDR | -1.972 | | 0.628 | -3.14 | | 0.012 | -3.392 | | -0.553 | | \*\* |
| l\_Inci\_tb | 2.53 | | 0.875 | 2.89 | | 0.018 | 0.551 | | 4.508 | | \*\* |
| l\_LEB | -7.872 | | 1.838 | -4.28 | | 0.002 | -12.03 | | -3.714 | | \*\*\* |
| Constant | 28.452 | | 9.024 | 3.15 | | 0.012 | 8.038 | | 48.867 | | \*\* |
|  | | | | | | | | | | | |
| Mean dependent var | | 3.682 | | | SD dependent var | | | 0.729 | |
| R-squared | | 0.98 | | | Number of obs | | | 19 | |
| F-test | | 74.422 | | | Prob > F | | | 0 | |
| Akaike crit. (AIC) | | -103.57 | | | Bayesian crit. (BIC) | | | -96.959 | |

Table 2. Its Evident A 1% increase in female empowerment is associated with about a ***0.287%*** decrease in infant mortality. A 1% increase in the crude death rate is associated with about a ***1.972%*** decrease in infant mortality. A 1% increase in tuberculosis incidence is associated with a ***2.53%*** increase in infant mortality. A 1% increase in life expectancy at birth is associated with a ***7.872%*** decrease in infant mortality.

**Figure 1 Female empowerment**

A graph of a number of women

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From Fig 1. It can be seen from the graph countries that are most playing role in empowering women are Maldives, Bhutan, Sri Lanka and least were Pakistan.

**Conclusion**

This study provides a comprehensive panel data analysis of health status, expenditure, and infrastructure across SAARC countries from 2005 to 2015, with a focus on tuberculosis incidence and related health outcomes. Higher private health spending was associated with increased TB incidence, while GDP per capita improved life expectancy as GDP per capita positively impacted life expectancy, reflecting the broader role of economic development in improving population health. Female empowerment significantly reduced infant mortality, emphasizing its public health importance. Strengthening health infrastructure and ensuring equitable access to care are crucial. As this analysis shows disparities among countries, guidelines from UNCIEF, WHO and UN women can be followed to solve these issues.

***(Note :- this is more intuitive as there is less observations remained at the end of whole analysis due to which variance is higher, so can’t be applied to whole population)***