Healthcare Indicators and the Poverty Nexus in Bangladesh: A Statistical Analysis

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To cite this article (APA): Khan, M. (2024). Healthcare Indicators and the Poverty Nexus in Bangladesh: A Statistical Analysis. International Business Education Journal, 17(1), 49–66. https://doi.org/10.37134/ibej.Vol17.1.5.2024

To link to this article: https://doi.org/10.37134/ibej.Vol17.1.5.2024

Abstract

This study examines the association between healthcare indicators and poverty in Bangladesh, utilizing data derived from the "World Development Indicators" from 2000 to 2021. The study employs the ARDL model for data analysis to investigate the short- and long-run dynamics between healthcare indicators and poverty. The results show that poverty significantly predicts healthcare indicators, including maternal mortality rates and access to essential healthcare services. The findings suggest that alleviating poverty and investing in healthcare infrastructure and services are crucial for improving health outcomes in Bangladesh. Policymakers and healthcare stakeholders in Bangladesh should prioritize healthcare indicators to monitor progress, identify gaps and challenges, and develop effective strategies to improve healthcare outcomes. The study underscores the need for a comprehensive and coordinated approach to addressing poverty and improving healthcare outcomes in Bangladesh.

Keywords:

Poverty, Healthcare Indicators, ARDL, Health Expenditure Per Capita (HEPC), Out-of-Pocket (OOP), Bangladesh

INTRODUCTION

Bangladesh, like many other rapidly developing nations, experiences significant disparities in terms of wealth and health (Gwatkin et al., 2007; OPHI, 2013; Sen, 1997; Ahmed, Romson, Petzold and Kabir, 2005). Both nationally and internationally, development and public health activities focus on reducing poverty and enhancing global health (Dhillon et al., 2012; Victora, 2003; WHO, 2007; WHO, 2008).

In many low-income nations' development programs, there is now recognition of the relationship between health and poverty. Many strategies have been implemented to lessen poverty, a persistent problem. According to earlier research on poverty reduction, most efforts are focused on entrepreneurship, financial sector development, financial education, and microfinance (Sengupta, 2013; Agbaeze & Onwuka, 2014; Aziz & Mohamad, 2016). The system of healthcare and poverty have emerged as two of Bangladesh's most significant economic difficulties despite the country's sustained economic development during the previous two years, except in 2020. As in many other emerging nations, poverty has always

Manuscript received Apr 30, 2023; revised Jan 3, 2024; published Apr 30, 2024

been a grave societal problem in Bangladesh. Extreme poverty and ill health are significantly associated.

Based on the initial results of the Household Income and Expenditure Survey (HIES) 2022, it has been observed that the poverty rate at the national level has exhibited a decline, reaching a value of 18.7 percent. The aforementioned numerical value is subsequently disaggregated into 20.5 percent for rural regions and 14.7 percent for urban areas, as reported by the HIES in 2022.

Health governance is a fundamental component of a robust healthcare delivery system. However, the health system in Bangladesh has been relatively overlooked and needs more effective implementation nationwide, resulting in limited access to healthcare services for individuals from low-income backgrounds (Karim & Alam, 2019). Bangladesh has demonstrated notable advancements in its Human Development Index (HDI). It has attained commendable outcomes in several health indicators, although grappling with obstacles such as poverty, overpopulation, corruption, and susceptibility to climate change (Ahmed & Yasmeen, 2016). Bangladesh, like other nations experiencing rapid development, encounters notable disparities in wealth and health, wherein poverty and disease are intricately interconnected. This relationship can potentially establish a detrimental cycle of deprivation, ultimately resulting in illness. Furthermore, the subsequent costs associated with illness can worsen the state of poverty (Herdman et al., 2016).

It should come as no surprise that poverty raises one's risk of being ill, yet this is just one aspect of the relationship between poverty and health. For instance, rural families are significantly more likely to fall into poverty due to insufficient health care. Currently, between 7 and 10 percent of Bangladesh's highly low-income households' income is spent on health care, a considerable burden by any standard (Huq, Al-Amin, Howlader, Kabir, 2015).

In most underdeveloped countries, healthcare is mostly financed through out-of-pocket (OOP) expenditures. According to Valentine and Collins (2015), households may face considerable financial vulnerability and even potential impoverishment due to the burden of substantial and unpredictable healthcare expenses.

Multidimensional poverty is linked to healthcare. The implications of poverty may be addressed, and the process of gaining access to quality healthcare could be sped up, with closer ties between the health and development agendas ((Herdman et al., 2016). Many international organizations and national governments aim to eradicate poverty or improve poor people's health. In many low-income countries, poverty-reduction policies currently serve as an essential framework for development aid. They are designed to prioritize interventions based on their impact on indicators of poverty-related outcomes, including health. However, there is still disagreement over the pertinent health indicators; this inquiry pertains to the conceptual delineations of poverty, the focal point on absolute or relative poverty, and the appropriate methodologies and sources for measuring and obtaining data on poverty.

Bangladesh reportedly had 0.84 doctors and 0.44 nurses per 1000 people. Healthcare costs now account for a significant portion of government spending and have taken over health policy and its metrics due to improvements in health indicators (WDI, 2020).

In their study, Herdman et al. (2016) investigated the association between poverty and delays in seeking pre-hospital care among individuals with acute febrile infections in Chittagong, Bangladesh. It has been determined that there is a correlation between multidimensional poverty and increased delays in healthcare seeking, and higher expenditure. Low-income households exhibited a decreased likelihood of seeking medical assistance from a certified healthcare professional while simultaneously displaying a higher tendency to

attribute any delays in seeking medical attention to financial constraints. The study emphasizes the importance of establishing more robust connections between health and development agendas to effectively address the repercussions of poverty and enhance accessibility to quality healthcare services.

Furthermore, an earlier study that used panel data discovered that the rise of government healthcare spending had distinct pathways in developing nations at various stages of economic development (UNICEF, 2010). One of the ongoing objectives of the Sustainable Development Goals (SDGs) is to enhance maternal health. The SDGs aim to achieve a maternal mortality ratio of less than 70 per 100,000 live births by the year 2030.

This study aims to analyze the effects of several healthcare factors on poverty, such as health expenditure per capita, out-of-pocket expenditure, GDP per capita growth, literacy rate, maternal mortality rates, and access to critical healthcare services. In addition, this study aims to look at the temporal trends and connections between poverty and healthcare indicators in Bangladesh, both over the short term and over the long term.

This study is significant for several reasons. To begin with, it provides valuable insights into the link between healthcare indices and poverty. In addition, the study identifies poverty as a significant predictor of poor healthcare outcomes. Furthermore, it highlights the need for poverty alleviation efforts and investments in healthcare infrastructure and services to improve health outcomes in the country. In conclusion, the study emphasizes the need for policymakers and healthcare stakeholders in Bangladesh to prioritize collecting and analyzing healthcare data to monitor progress, identify gaps and challenges, and develop effective strategies to improve healthcare outcomes.

To conclude, the study contributes to the ongoing efforts to address poverty and improve healthcare outcomes in Bangladesh by providing evidence-based recommendations and insights into the multifaceted association between poverty and health in the country.

LITERATURE REVIEW

Health economics debates frequently touch on the relationship between poverty and the healthcare system. The association between per capita health spending, out-of-pocket spending, and poverty has been the subject of several academic studies. The study of this connection often begins with the presumption that there is a direct, significant link between per capita health spending and poverty. Estimating the effect of health spending per capita on poverty for various eras and nations was the topic of several theoretical and empirical investigations.

Health Expenditure Per Capita (HEPC)

Gupta and Mitra (2004) conducted a study utilizing panel data for the Indian states to examine the potential connections between economic development, poverty, and health. Their findings suggest that while economic growth tends to reduce poverty, substantial improvements in health status are also necessary for poverty reduction. Health spending is a vital factor in more significant development and better health status, making it a crucial tool for policymakers. Unfortunately, their model did not include out-of-pocket expenses, which have a terrible impact on poverty.

Bangladesh made considerable strides by lowering its poverty rate from 40.0% to 31.5% between 2005 and 2010 (BSS, 2018). According to Van Doorslaer, Masseria, and Koolman's (2006) analysis, OOP increased the likelihood of poverty by 3.8% in 2000. The study documented a rate of 3.5% in the year 2010. This suggests that overall poverty decreased more rapidly (from 40.0 to 31.5%); Khan, Ahmed, & Evans (2017)'s observation only showed a modest decline in poverty attributable to OOP for healthcare. The study's findings would help the government's approach to financing healthcare as it tracks Bangladesh's progress towards achieving universal health coverage.

Fombad (2018) claims that South African businesses and communities that actively contribute to poverty need knowledge management solutions. More is needed to eradicate poverty than just increasing GDP. Investments in knowledge, however, will alter the perspectives of people experiencing poverty and encourage human flourishing.

GDP Per Capita Growth (GDPPCG)

Cruz and Ahmed (2018) examined how age structure changes in the population affected GDP per capita growth and poverty. In addition to addressing possible endogeneity between demography and development outcomes, various other econometric parameters and approaches are used to assess the impact of demographic shifts on economic growth and poverty reduction. Based on these findings, it is clear that countries may have a significant potential to improve their welfare by growing their per capita GDP and lowering their poverty rates while child dependency ratios are decreasing.

Life Expectancy at Birth (LEAB)

Life expectancy is one of the most important indices of the health of a population and the level of economic development in a nation. Improvements in welfare and health enhance life expectancy, contributing to a decrease in extreme poverty. People in nations with lower development and health indices have shorter life spans than those in wealthy countries. The average life expectancy is higher for developed area residents than those of low- and middle-income nations. Acemoglu and Johnson (2007) demonstrated a correlation between improved economic development (GDP/capita) and longer life expectancy.

The study by Mahumud, Rawal, Hossain, Hossain, and Islam (2013) examined the many determinants influencing life expectancy in Bangladesh. Eight frequently utilized indicators were used as independent variables to examine their significance in forecasting life expectancy. In contrast to previous research, the present study's findings indicate that most fundamental conventional components were insignificant. The investigation utilized significant elasticity estimates of factors other than GDP per capita and health expenditure per capita (HPEC). These findings have significant policy implications for Bangladesh, particularly in formulating and executing effective policy interventions to increase real per capita income and enhance investments in population management and healthcare. These aspects are undeniably vital for fostering social development and promoting overall welfare.

Lawanson, et al. (2021) conducted a study to investigate the relationship between life expectancy and economic growth, as well as the impact of poverty reduction. The goal was to determine the extent to which health contributes to growth and poverty reduction, and to identify the minimum level of health needed to counteract the negative effect of poverty on economic growth in Nigeria. The findings indicate that good health has a favorable impact on

economic growth and also helps to alleviate the negative impact of poverty on economic growth in Nigeria.

Out-of-Pocket Expenditure (OOPE)

Huq, Al-Amin, Howlader, and Kabir (2015) investigate how much out-of-pocket medical expenses influence Bangladeshi family spending habits and poverty. This survey found that around 29.2% of households spend more than 5% of their overall living expenses on healthcare facilities. Given that 25.5% of Bangladesh's population lives in extreme poverty, OOP healthcare costs may be prohibitive. The number of individuals living in extreme poverty has risen by 4.2% (5.8 million) due to healthcare costs. It has been hypothesized that rising healthcare costs for poor households will increase poverty prevalence and intensity over time. It is clear from this that inadequate health facilities and population status are significant contributors to the continuation of poverty.

Rashad and Sharaf (2015) empirically have shown that households in various spending quintiles are susceptible to catastrophic health costs to varying degrees. High OOP health costs generally push 6% of homes into a financial crisis. The quintile with the lowest income is more susceptible to catastrophic payments. The research showed that 7.4% of households were below the poverty level after accounting for healthcare costs. OOP health expenses contributed to the poverty of more than one-third of homes in the second quintile. Spending on OOP health has increased the poverty gap by 1.4%. OOP medical expenses in Egypt caused 1.4% more people to live in poverty and drove 6% of households into financial ruin. After accounting for healthcare costs, 7.4% of households were in poverty. Rural homes, those without health insurance, households where the head of the family did not hold a job, households with young children, and households with a member who had a chronic illness were more likely to experience catastrophic medical costs. In Egypt, anti-poverty initiatives should focus on homes at high risk of incurring catastrophic medical expenses.

Kumar et al. (2015) analyzed the influence of out-of-pocket medical expenses on poverty in China and India, focusing on socioeconomic disparities. The study utilized data from the World Health Organization's Study of Global Ageing and Adult Health (SAGE) survey, conducted from 2007 to 2010. Based on their research findings, it has been shown that OOPHE (Out-of-Pocket Health Expenditure) leads to poverty rates below the poverty line for around 7% and 8% of the populations in China and India, respectively. In both countries, the proportion is significantly higher when the household head has less education, the household has less wealth, the family lives in a rural area, or the patient receives inpatient care.

Yardim, Cilingiroglu, and Yardim (2010) observed that national health finance systems must be created to safeguard households from financial ruin by lowering direct out-of-pocket spending and providing individuals with access to treatments when required. Therefore, the long-term objective of the Turkish government should be to create prepayment systems, such as social health insurance, health care funding based on taxes, or a combination of prepayment systems. The study's findings, which indicate that some demographic groups may be at risk for catastrophic health payments, are anticipated to provide some light on the significance of this issue from the user's perspective.

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OOPHE (Out-of-Pocket Health Expenditure) leads to poverty rates below the poverty line for around 7% and 8% of the populations in China and India, respectively.

Literacy Rate (LITR)

According to Ali and Talukder (2010), the dynamics and multifaceted dimensions of poverty in Bangladesh are built on a complex structure. Similarly, in addition to socioeconomic variables like employment, location, income distribution, and education, natural disasters can contribute to poverty. Furthermore, poverty is both a cause and a consequence of literacy or education. Low national literacy rates are a direct reflection of extreme poverty. Despite recent economic development that has been the fastest in Bangladesh's history, the amount of poverty that has been reduced is relatively small, leaving a high degree of poverty.

Consequently, reducing poverty has been viewed as a significant economic problem. However, in addition to fiscal allocations and goals, a more substantial issue is developing a more profound knowledge of Bangladesh's poverty dynamics and multidimensional features. Therefore, Bangladesh's economy will soon face significant challenges in decreasing poverty, including speeding up economic growth to 7-8 percent a year, implementing solid economic policies to combat poverty, and bridging the income gap between the affluent and the poor.

In a study conducted by Graham, Fitzmaurice, Bell, and Cairns (2004), a significant association was discovered between the survival rates of women and their socioeconomic class, indicated explicitly by factors such as educational attainment, access to clean water, and the quality of sanitation facilities utilized.

The Number of Maternal Deaths (NMD)

The prevalence of maternal mortality exhibited a consistent upward trend, paralleling the increase in non-maternal mortality among women. One of the nations examined in this study, Indonesia, had a notable pattern whereby around 32-34% of maternal mortalities were observed among women in the lowest quintile of the population. In this nation, the poorest group had a 3- to 4-times higher risk of maternal mortality than the wealthiest. Their results, which used a novel methodology to demonstrate the size of the maternal mortality gap between the affluent and people experiencing poverty, should catalyze establishment and monitoring of development objectives pertinent to poverty.

However, the influence of health expenditure per person and out-of-pocket spending in Bangladesh has received very little research attention. Studies have considered the rise of the GDP per capita, maternal mortality rates, life expectancy at birth, and literacy rates. In conclusion, this paper contributes to the body of research by providing information on the correlation between OOPE health spending and health expenditure per capita. This subject needs to get more attention in Bangladesh.

Hypothesis Development

This study aims to show how aspects of the healthcare system, such as per capita healthcare spending, maternal fatalities, out-of-pocket expenses, and life expectancy at birth, affect Bangladeshi poverty. The null hypothesis states that there is no connection between poverty and the healthcare indicators. Moreover, we want to prove that there is a relationship between

them by rejecting the null hypothesis. If the null hypothesis is rejected, our research will be successful, and if it is not, then the research will not succeed.
More specifically,

H_1: Health expenditure per capita affects poverty

H_2: GDP per capita growth affects poverty

H_3: Life expectancy at birth affects poverty

H_4: Out-of-pocket expenditure affects poverty

H_5: The literacy rate affects poverty

H_6: The number of maternal deaths affects poverty

METHODOLOGY

The World Development Indicators (WDI, 2021) time series data for 2000 to 2021 were used in this study to measure the effect of healthcare indicators on poverty. The poverty headcount ratio is the dependent variable on the model used to assess the extent to which a country's population falls below the federal poverty line. The healthcare indicators include per capita health spending in current US dollars. Life expectancy at birth refers to the projected number of years that a newborn baby would live if the mortality rates observed at the time of its birth were to persist throughout its entire life. Estimates of current health expenditures encompass the costs associated with healthcare goods and services utilized each year and unreimbursed expenses. The latter refers to the proportion of out-of-pocket expenses concerning current health spending, expressed as a percentage. Direct household expenditures on health are considered out-of-pocket charges. The adult literacy rate refers to the proportion of individuals aged 15 years and older who can read, write, and comprehend a fundamental statement about their routine activities. Maternal deaths are defined as the death of a woman. Simultaneously, the individual in question is in a state of pregnancy or within 42 days after the conclusion of her pregnancy, irrespective of the duration or site of the pregnancy or how it was addressed, excluding instances resulting from inadvertent or incidental factors. The rise in GDP per capita is assessed through the computation of an annual percentage growth rate, using a consistent local currency as the benchmark for comparison. Aggregates are predicated on a fixed price of $2010 per unit. GDP per capita is calculated by dividing the midyear employed population by the gross domestic product.

This study examined how healthcare factors affected poverty using the ARDL model. Verifying the data's stationarity before doing a time series analysis is necessary. Unit root testing may be carried out using a variety of tests. However, the "Augmented Dickey-Fuller (ADF)" test (Dickey & Fuller, 1979) is one of the more commonly used ones. Whether or not the variables in this research are stationary must be determined. The "Autoregressive Distributed Lag (ARDL) model" Pesaran, Shin, & Smith (2001) must be used to determine how healthcare indicators affect poverty if time series are at I (0) and I (1) stationary. The unit root test yielded positive results in the study variables, demonstrating that all variables exhibit

stationarity at the first difference (I (1)). However, none of the variables display stationarity at the second difference (I (2)). The ARDL model, based on Ordinary Least Squares (OLS), is a powerful approach for modeling time series data characterized by non-stationarity and mixed-order integration orders. This unconstrained Error Correction Model (ECM) allows researchers to analyze and understand the relationships between variables in the short and long term.

Model Specification

The following general equation is presented as a means to explore and analyze the association among the factors being studied:

$$PR = f(HEPC, NMD, LEAB, OOPE, LITR, GDPPCG)$$

By adding a constant and an error term, the function is converted into the econometric model as follows:

$$PR=\beta_0 + \beta_1 HEPC + \beta_2 NMD + \beta_3 LEAB + \beta_4 OOPE + \beta_5 LITR + \beta_6 GDPPCG + \varepsilon_t \ldots\ldots\ldots \quad (1)$$

Where PR represents poverty as a dependent variable, healthcare indicators—HEPC measures health expenditure per capita; the number of maternal deaths (NMD), life expectancy at birth (LEAB), out-of-pocket expenditure (OOPE), literacy rate (LITR), and GDP per capita growth (GDPPCG)—are used as independent variables; β_0 is the constant; β_1 to β_6 are independent variable coefficients; and the error term, denoted as ε_t, represents the residual component in the model, where the subscript (t) indicates the temporal dimension.

ARDL Bounds Test

The study of the long-term relationship among the research variables involved using a bound test, wherein all the variables under consideration were held consistently. The study's research variables exhibit stationarity at the first difference. Hence, the ARDL limits test is considered the most suitable approach for ascertaining the presence of cointegration among two or more series. The present study employed the ARDL bound test model to examine the enduring association between the research variables:

$$PR=\beta_0 + \beta_1 HEPC + \beta_2 NMD + \beta_3 LEAB + \beta_4 OPPE + \beta_5 LITR + \beta_6 GDPPCG + \varepsilon_t \ldots\ldots\ldots \quad (1)$$

$$\Delta(PR)_t = \Psi_0 + \Psi_1 PR_{t-1} + \Psi_2 HEPC_{t-1} + \Psi_3 NMD_{t-1} + \Psi_4 LEAB_{t-1} + \Psi_5 OOPE_{t-1} + \Psi_6 LITR_{t-1} + \Psi_7 GDPPCG_{t-1} + \sum_{i=1}^{q} \beta_1 \Delta PR_{t-1} + \sum_{i=1}^{q} \beta_2 \Delta HEPC_{t-1} + \sum_{i=1}^{q} \beta_3 \Delta NMD_{t-1} + \sum_{i=1}^{q} \beta_4 \Delta LEAB_{t-1} + \sum_{i=1}^{q} \beta_5 \Delta OOPE_{t-1} + \sum_{i=1}^{q} \beta_6 \Delta LITR_{t-1} + \sum_{i=1}^{q} \beta_7 \Delta GDPPCG_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

In this equation, Δ stands for the difference operators, PR stands for poverty, HEPC measures health expenditure per capita, NMD stands for the number of maternal deaths, LEAB

stands for life expectancy at birth, OOPE stands for out-of-pocket expenses, LITR stands for literacy rate, and t-i stands for the Akaike information criterion's best choice of lags (Sakamoto, Ishiguro, & Kitagawa, 1986). The long-term association between certain factors is investigated. Since the research variables exhibit long-run relationships, both short- and long-run ARDL models are used. The following are the bound test's null and alternate hypotheses:

$$H_0: \Psi_i = 0; \; ; for\ all\ i = 1, 2, \dots, 7$$

$$H_1: \; \Psi_i \neq 0; for\ all\ i = 1, 2, \dots \dots, 7$$

The acceptance or rejection of the null hypothesis is contingent upon the F statistic. Pesaran, Shin, and Smith (2001) argue that a durable relationship between the research variables can be established when the computed F-statistics values surpass the upper bound in terms of significance. The determination lacks conclusiveness when the calculated F-statistic falls within the lower and upper bounds. A long-term link cannot be established if the computed F-statistics value is lower than the lower limit value.

ARDL Model

Pesaran, Shin, and Smith introduced the ARDL model in their works published in 1999 and 2001. The ARDL model has various advantages in comparison to other time series models. Haug (2002) suggests that the ARDL model can accommodate the utilization of short-term temporal data. The ARDL model can be employed if the series exhibits stationarity at I (0), I (1), or both. Both dependent and independent variables may employ various delays. The expected ARDL bound test results show that the study variables are cointegrated. It appears that the long-term ARDL model is as follows:

$$\begin{aligned}(PR)_t = \alpha_0 &+ \sum_{i=1}^{q} \sigma_1 (PR)_{t-1} + \sum_{i=1}^{q} \sigma_2 HEPC_{t-1} + \sum_{i=1}^{q} \sigma_3 NMD_{t-1} \\ &+ \sum_{i=1}^{q} \sigma_4 LEAB_{t-1} \\ &+ \sum_{i=1}^{q} \sigma_5 OOPE_{t-1} + \sum_{i=1}^{q} \sigma_6 LITR_{t-1} + \varepsilon_t \\ &+ \sum_{i=1}^{q} \sigma_7 GDPPCG_{t-1} + \varepsilon_t \dots \dots \dots . (3)\end{aligned}$$

The long-run variation of the study variables is denoted in the equation above by the symbol σ. First, the relevant delays were selected for each variable using the Akaike information criterion. The short-run ARDL model was then applied to the following error-correcting model:

$$\Delta PR_t = \alpha_0 + \sum_{i=1}^{q} \beta_1 \Delta PR_t + \sum_{i=1}^{q} \beta_2 \Delta HEPC_{t-1} + \sum_{i=1}^{q} \beta_3 \Delta NMD_{t-1} + \sum_{i=1}^{q} \beta_4 \Delta LEAB_{t-1} + \sum_{i=1}^{q} \beta_5 \Delta OOPE_{t-1} + \sum_{i=1}^{q} \beta_6 \Delta LITR_{t-1} + \varepsilon_t + \sum_{i=1}^{q} \beta_7 \Delta GDPPCG_{t-1} + \varepsilon_t \dots\dots\dots (4)$$

ECT, the "error correction term" specifying the pace of correction from disequilibrium and ranges from 0 to 1, and the short-run variance β, are used in equation (4). Any shock is altered so that the next time it occurs, equilibrium will be closer to what it was before the ECT has both statistical significance and a negative coefficient. Brown, Durbin, and Evans (1975) employed cumulative sum (CUSUM) and cumulative sum of squares (CUSMSQ) to assess the stability of the model. In order to study serial correlation, the "Breusch-Godfrey Lagrange Multiplier" was utilized. The Jarque-Bera, Breusch-Pagan-Godfrey, and "Autoregressive Conditional Heteroscedasticity" tests were used to assess whether there was heteroscedasticity. The Jarque-Bera test was also performed to look for any persisting normality. In the end, the Ramsey reset test was employed to confirm that the model met all necessary criteria.

RESULTS AND DISCUSSION

This section presents the results and discussion of this study in chronological order. Following is the first descriptive analysis based on the selected variables.

Table 1: Descriptive statistics of the selected variables

Statistics	PR	HEPC	OOPE	NMD	LEAB	LITR	GDPPCG
Mean	33.2500	21.6000	67.0500	9085.00	69.3200	55.8495	4.76000
Median	32.50000	19.5000	67.0000	8300.00	69.7000	55.1150	4.90500
Maximum	48.60000	44.0000	73.0000	15000.0	72.8000	74.7000	7.04000
Minimum	20.50000	8.00000	61.0000	4500.00	65.0000	43.2500	1.96000
Std. dev.	9.272909	11.8116	3.95334	3496.05	2.53567	11.3370	1.31866
Skewness	0.198522	0.50804	0.21888	0.47871	-0.3487	0.44664	-0.30988
Kurtosis	1.166237	1.95290	1.97380	1.91926	1.90698	1.80776	2.50405
Jarque-Bera	1.613806	1.77403	1.03726	1.73576	1.38148	1.84456	0.52504
Probability	0.446238	0.41188	0.59533	0.41677	0.50123	0.39757	0.76536
Sum	665.0000	432.000	1341.00	181700	1386.54	1116.99	95.2000
Sum Sq. Dev.	1633.750	2650.80	296.950	232.546	122.112	2442.02	33.0388
Observation	21	21	21	21	21	21	21

It is seen from Table 1 above that, on average, the national poverty rate was 33.25 percent. The maximum poverty rate was 48.60 percent in 2000, and the minimum poverty rate in 2019 was 20.50 percent. The poverty rate was consistently declining from 2000 until 2019. On average, life expectancy at birth was 69.32 years, where the maximum was 2019 at 72.8 years, and the minimum was 2000 at 65 years. The number of maternal deaths reached its maximum at 15000, and the minimum was in 2019 at 4900. On average, it was 9085. The number of maternal deaths has significantly declined from 2005 to 2019. Health Expenditure per capita was maximum at US $ 44, and the minimum value was US $8. Moreover, on average, it was $21.60. The literacy rate has consistently increased from 2000 to 2019. The average literacy rate was 55.84 percent. Furthermore, the maximum value of the literacy rate was 74.7% in 2019, and the minimum value was 43.25% in 2000. GDP per capita, on average, was at 4.76 percent. The maximum GDP per capita growth was 7.04 percent in 2019, and the minimum GDP per capita was 1.96 percent in 2019. Out-of-pocket expenditure was at its maximum at 73 percent in 2019, and the minimum was in 2000 at 61 percent.

Table 2 illustrates the correlation matrix, which is analyzed to show the relationship among variables. It was found that health expenditure per capita was negatively correlated with poverty. Statistically significant (-0.394), the number of maternal deaths is positively related to poverty, is also found to be statistically significant (0.486), meaning that if the number of maternal deaths changes positively, the poverty level will change positively. The poverty level is highly negatively correlated with life expectancy at birth, out-of-pocket expenditure, literacy rate, and GDP Per capita growth. They were all found to be statistically significant.

Table 2: Correlation matrix for selected variables

Variables	1	2	3	4	5	6	7
1. PR	1.000						
2.HEPC	-0.394*	1.000					
3. OOPE	-0.691*	0.754	1.000				
4. NMD	0.486*	-0.317	-0.921	1.000			
5. LEAB	-0.589*	0.933	0.928	-0.693	1.000		
6. LITR	-0.937*	0.784	0.768	-0.897	0.920	1.000	
7. GDPPCG	-0.836*	0.806	0.822	-0.866	0.847	0.773	1.000

** Correlation is significant at 1%., *Correlation is significant at 5%.

Table 3: Unit roots test

	Level			1st difference		
Variables	t-static	P value	Decision	t-static	P value	Decision
PR	−0.849081	0.7815	Non-Stationary	−4.76547	0. 00016	Stationary
HEPC	2.940876	1.0000	Non-Stationary	−3.41234	0. 02000	Stationary
NMD	−1.734985	0. 1164	Non-Stationary	−3.47654	0.0217	Stationary
OOPE	−1.990703	0.5626	Non-Stationary	−6.22354	0. 0001	Stationary
LEAB	−2.270524	0. 1914	Non-Stationary	−6.22354	0.00010	Stationary
LITR	0.434160	0. 9790	Non-Stationary	−4.14563	0.0056	Stationary
GDPPCG	−1. 234172	0. 6355	Non-Stationary	−3.56235	(0.01666)	Stationary

The results of Table 3 exhibit that the poverty rate (PR), health expenditure per capita (HEPC), number of maternal deaths (NMD), life expectancy at birth (LEAB), out-of-pocket expenditure (OOPE), literacy rate (LITR), and GDP per capita growth (GDPPCG) are non-stationary at the level. However, at the first difference, all variables became stationary. Since

all variables were found to be stationary at their first difference and there is no stationary at the level, move to the cointegration test.

Table 4. ARDL bounds test

F-Statistic= 10.10353		
level of significance	Lower Bound	Upper Bound
10%	1.75	2.87
5%	2.04	3.24
2.5%	2.32	3.59
1%	2.66	4.05
R-Squared =0.926226, Durbin Watson Stat = 2.600048		

The ARDL bound test was employed to analyze the enduring association between the time series under investigation in the study. Table 4 displays the outcomes of the F-statistics. Using F statistics, the cointegration is calculated. The research variables have a long-term association since the predicted F-statistic value of 10.10353 exceeds the upper bound for significance levels of 1%, 2.5%, 5%, and 10%.

Table 5: Diagnostic test

Diagnostic test statistics	Statistic value	χ^2(p-value)	Results
Breusch-Godfrey LM	1.028156	0.3106	No problem with serial correlations
Breusch-Pagan-Godfrey	10.54587	0.5682	There is no problem with heteroscedasticity.
Ramsey RESET test	2.035	0.2332	The model is specified correctly
Jarque-Bera	0.648237	0.721965	Residuals are normally distributed.

Table 5 displays the findings of many diagnostic statistics that were used to evaluate the consistency of the model. The Breusch-Godfrey LM test results indicate that serial correlation is satisfactory for the model. No one is revealed by the Breusch-Pagan-Godfrey study, which was used to determine whether heteroscedasticity was an issue. The model was tested to see if it was correctly specified using the "Ramsey RESET test," and the findings support this. The results of Jarque-Bera show that the residual of the suggested model is standard.

Table 6: ARDL estimation

Variable	Coefficient	t-statistic	P-value
HEPC	-0.115443	-2.16957	0.0275
Δ HEPC	-0.330100	-7.164115	0.0004
NMD	0.002020	14.48585	0.0000
ΔNMD	0.001387	6.900202	0.0005
OOPE	1.136536	5.683605	0.0013
ΔOOPE	0.177996	2.031987	0.0884
LEAB	-0.561507	-4.218098	0.0056
ΔLEAB	-1.0811232	-4.388453	0.0046
LITR	-0.386117	-4.309932	0.0050
ΔLITR	-0.000159	-0.002877	0.9978
GDPPCG	-0.371156	-1.616356	0.1571
ΔGDPPCG	-0.633569	-5.323259	0.0018
ECT (-1)	-1.149603	-11.89325	0.0000
R-squared		0.926226	

Table 6 displays the results of the ARDL estimator, which examines the impact of healthcare indicators on poverty. The initial column presents a list of variables, their short-run (Δ) and long-run values, and the corresponding error correction term (ECT) and R-squared values. The coefficient is shown in the second column, followed by the t-statistic in the third column and the p-value in the fourth column. Based on the findings of the ARDL estimation, it can be observed that there exists a negative relationship between Bangladesh's poverty levels and its per capita healthcare spending. Healthcare expenditure per capita has a robust negative impact, which means that a rise in health expenditure per capita by US $1 leads to a long-run run reduction of poverty by 0.115443% and a short-run run reduction of poverty by 0.330100%, which is statistically significant at 5% and 1% level of significance respectively. The findings in this regard are similar to Khan et al. (2017). Higher education levels are often associated with better health status, which has increased productivity and income.

Similarly, those with more significant health conditions had lower poverty rates. According to the Bangladesh National Health Account 1997–2020 report, 67% of the country's healthcare spending is covered by private persons, 23% by the public sector, and 10% by other sectors. While lobbying for ambitious healthcare coverage objectives, improved health financing, and financial pooling mechanisms for social safety, obtaining universal health coverage has emerged as a critical priority for global health policy during the past ten years. The average annual GDP per capita growth was 4.76 percent over the study period. There was an increasing trend of health expenditure per capita and decreasing changes in poverty in Bangladesh (Mohiuddin, 2020).

According to the study's findings on maternal mortality, an increase in the number of maternal deaths in Bangladesh by one will result in an increase in poverty of 0.002% over the long term and 0.001387% over the short time, respectively. These findings align with Ali and Talukdar (2010) and Greg and Karan (2004). Additionally, this outcome is statistically significant at the 1% level.

Statistics show that out-of-pocket spending has a favorable impact on poverty in Bangladesh. According to the study's results on out-of-pocket spending, a 1% rise raises poverty levels by 1.136536% in the long run and 0.177996% in the short term, respectively. The outcomes for out-of-pocket spending are comparable to those from past studies (Begum, 2014; Rahman et al., 2020; Da Silva et al.,2015). Using data from rural residents of low income, Hamid, Ahsan, and Begum (2014) discovered that 3.4% of persons fall into poverty due to out-of-pocket healthcare expenses.

The ARDL long-run and short-run projections also discovered an increase in life expectancy at birth of one year, which will cause a decrease in the poverty rate of 0.561507% and 1.0811232%, respectively. These decreases in poverty rates are significant at the 1% significance level. Cruz & Ahmed's (2018) and Mahumud, Rawal, Hossain, Hossain, and Islam's (2013) findings on life expectancy at birth are comparable.

The results indicated that the literacy rate in Bangladesh has a substantial negative influence on poverty and that for every 1% increase in literacy, poverty will drop by 0.386117% in the long run and by 0.000159% in the short run, which is not statistically significant. According to the preceding study's findings, the observed results follow a similar trend (Arini, Widaningrum, and Hadna, 2020).

According to GDP per capita growth results, a 1% rise in GDP per capita growth will reduce poverty in the long run by 0.371156% and in the short run by 0.633569%. However, it is statistically significant. According to Ali and Talunkder (2010), increasing Bangladesh by one will result in a rise in poverty of 0.002% in the long run and 0.001387% in the near

run. Additionally, this outcome is statistically significant at the 1% level. The study by Gupta and Mitra (2004) demonstrated reproducible findings.

The abbreviation "ECT" refers to error correction terminology, a metric used to assess the pace of adjustments. Based on the analysis of the collected data, ECT has a statistically significant and unfavorable effect. Based on the concept of the ECT term, it is seen that the correction of long-term imbalance amounts to a value of 114.9603%. Based on the R-squared value, it can be concluded that the regressors employed in this study explain 92.92% of the variability seen in the regression analysis. The model is adequately fitted when a p-value is computed for the F-statistic.

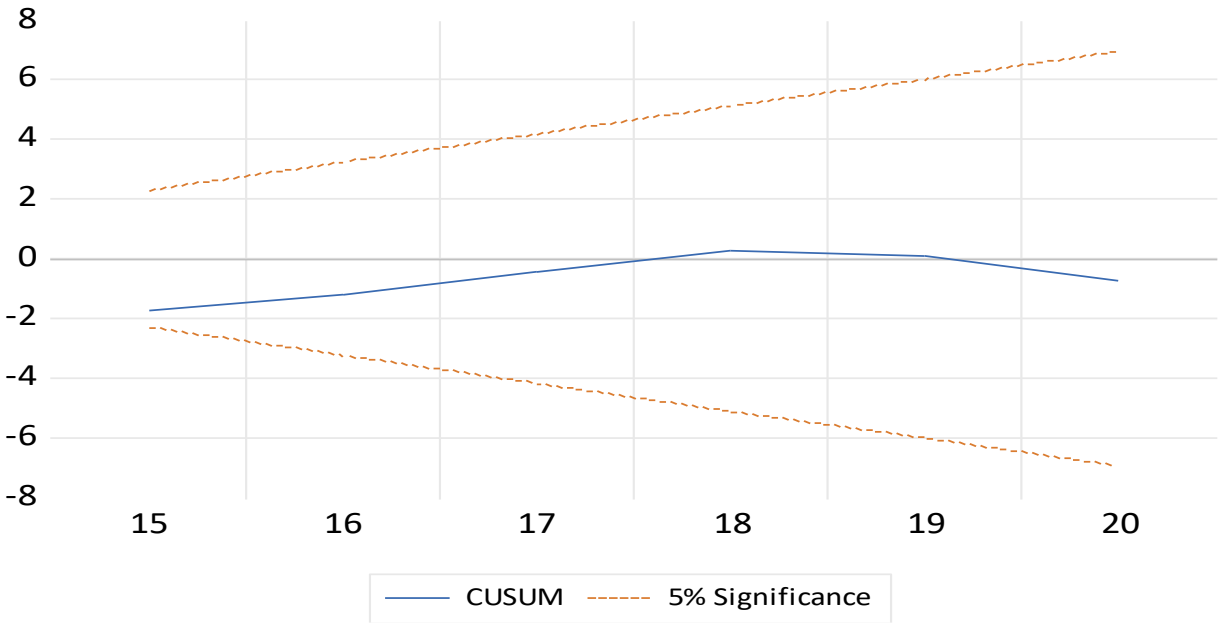

Figure 1: CUSUM test results

The CUSUM test employs Figure 1 for analysis. The stability of the coefficients is assessed through the utilization of the Cumulative Sum (CUSUM) method. The observation that the blue lines on both graphs are consistently positioned below the red lines indicates the stability of the coefficients. This conclusion aligns with the findings of the CUSUM analysis, which determined that the coefficients remain stable at a significance level of 5%. The graphs that have been examined provide evidence of the reliability of the models being utilized.

CONCLUSION AND RECOMMENDATIONS

This study examines the impact of healthcare indicators— health expenditure per capita, number of maternal deaths, life expectancy at birth, out-of-pocket expenditure, literacy rate, and GDP per capita growth on Bangladesh's poverty from 2000 to 2021. ARDL approach was employed to estimate the effects of the healthcare factors on poverty. The study's findings highlight the relationship between healthcare expenditure per capita, maternal mortality, out-of-pocket spending, life expectancy at birth, literacy rates, GDP per capita growth, and poverty in Bangladesh. Notably, increased healthcare expenditure per capita is associated with a poverty reduction, emphasizing the significance of investing in healthcare. Concurrently, addressing maternal mortality, promoting affordable healthcare access, enhancing life expectancy, raising literacy rates, and stimulating GDP per capita growth can all contribute to

poverty reduction. These findings align with prior research, underscoring Bangladesh's multifaceted nature of poverty.

To effectively combat poverty in Bangladesh, policymakers should prioritize a multifaceted approach. To begin with, increase healthcare expenditure per capita and work towards universal health coverage to ensure accessible and affordable healthcare for all citizens. In addition, focus on maternal healthcare improvements to reduce maternal mortality and alleviate poverty. Furthermore, implement policies to reduce out-of-pocket spending on healthcare while maintaining its positive impact on poverty. In addition, it promotes education to raise literacy rates and economic development to stimulate GDP per capita growth, ensuring that the benefits of economic growth are equitably distributed. In conclusion, continuously monitor and adjust policies to align with evidence-based research and achieve sustained poverty reduction and inclusive development.

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