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Estimating the Health Production Function: A National-Level Study of Bangladesh

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ABSTRACT

Health is a fundamental human right and a crucial determinant of human capital formation, exerting a significant influence on economic growth and development. This study empirically examines the health production function at the national level in Bangladesh, using 50 years (1975-2024) of secondary data from the Bangladesh Bureau of Statistics and the World Bank. A multiple regression model is applied to identify the critical determinants of health status, with Ordinary Least Squares (OLS) estimation. Since this study uses time-series data, it applies diagnostic tests for stationarity, multicollinearity, and autocorrelation before estimating the OLS model. The results reveal that literacy rate, employment rate, access to safe drinking water, availability of physicians, and per capita health expenditure are positively associated with life expectancy at birth, a measure of the health status of people at the national level. Conversely, the poverty headcount ratio demonstrates a negative relation with life expectancy. The findings highlight the importance of adopting a comprehensive policy framework to improve public health outcomes. Providing quality education, integrating health awareness campaigns, and implementing targeted healthcare subsidies are crucial steps toward improving the national health status. Given the relationship between health status and economic progress, a strategic focus on inclusive healthcare policies and equitable resource allocation is imperative for fostering sustainable development in Bangladesh..

Keywords: *Bangladesh, economic growth, health production function, life expectancy, ordinary least squares, poverty*

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INTRODUCTION

The population of Bangladesh exceeds 169 million and continues to grow at an annual rate of 1.1% (Kiron and Islam, 2023). Health is a basic component of human capital and a key determinant of economic performance. Endogenous growth theories emphasize that investment in health enhances productivity and contributes significantly to long-term economic growth (Romer, 1994). Consequently, health economics has emerged as an important field of study, recognizing health not only as a basic human right but also as a productive asset essential for national development. A healthy population is more productive, participates more actively in the labor market, and contributes more effectively to economic and social progress. In this sense, health is an "economic engine" that underpins sustainable growth and development.

The health production function framework conceptualizes health as an output produced by a combination of medical inputs (e.g., healthcare services and expenditures) and non-medical determinants such as income, education, lifestyle, and environmental conditions, with life expectancy at birth commonly used as a key aggregate measure of this output, the model treats health as a durable capital stock that individuals and societies invest in through healthcare utilization and health-enhancing behaviors, implying that improvements in these inputs reduce mortality and thereby increase longevity (Grossman, 1972). At the macro level, empirical applications of the health production function often use life expectancy at birth as the dependent variable because it summarizes age-specific mortality patterns and reflects the cumulative impact of health system performance and socioeconomic development (Preston, 1975). Thus, within the health production framework, life expectancy at birth is the observable outcome of the interaction between healthcare inputs and broader socioeconomic factors, making it a central indicator for evaluating the effectiveness of health policies (Wagstaff, 2002).

Empirical evidence strongly supports the link between health and economic growth. Nordhaus (2002) estimates that health improvements accounted for half of the economic development of industrialized countries over the last century. Barro (1991) shows that a 10% increase in a country's life expectancy is associated with a 0.3-0.4 percentage-point increase in annual economic growth. Similarly, the World Health Organization (WHO) reports that a 28-year difference in

life expectancy between a typical low-income and a typical high-income country account for a 1.6 percentage-point difference in annual economic growth rates.

Moreover, Hemsley et al. (2020) found that when one focuses on reducing child mortality rates, public health system improvements do affect mortality rates, with lower mortality when more health facilities are available. Similarly, Rayhan et al. (2019) estimated the health production function. They found that health expenditure per capita, education, access to improved water sources, and urbanization positively affect life expectancy. In contrast, the food production index was found to be statistically significantly negative in South Asian countries. In addition, Shaw et al. (2005) examined data from OECD member countries for 1960-1999 to identify factors that determine life expectancy and found that per capita use of pharmaceuticals, vegetables, fruits, and butter positively affected life expectancy, while tobacco and alcohol consumption negatively affected it. Moreover, Kabir (2008) found that most of the important factors in determining life expectancy are not statistically significant, and that income, education, nutritional status, and public health measures have an impact only in less developed countries. In addition, Mehraban et al. (2016) estimated the production function of direct health care services, which revealed that the significant elasticity coefficients for active beds, physicians, nurses, and bed restoration interval were 0.835, 0.073, 0.0273, and -0.199, respectively.

Despite limited resources, Bangladesh has made notable progress in health outcomes over the past five decades. Life expectancy increased from 46.57 years in 1971 to 73.29 years in 2022, while adult, infant, and maternal mortality rates declined substantially (World Bank, 2022). Access to safe drinking water expanded rapidly, and the number of physicians per person increased over time, although it remains low relative to population size. Per capita health expenditure also rose from USD 8.56 in 2000 to USD 110 in 2021, yet total health spending remains modest at about 2.27% of GDP. These trends indicate significant improvements in health outcomes alongside persistent structural constraints in healthcare financing and service delivery.

A substantial body of literature has examined the determinants of health status using the health production function framework. Studies employing Ordinary Least Squares (OLS), such as Fayissa et al. (2013), Hemsley et al. (2020), Shaw et al. (2005), and Rayhan et al. (2019), highlight the roles of education, healthcare resources, income, and environmental factors. Other studies have applied instrumental variable techniques or alternative econometric models to address endogeneity and measurement issues (Brunello et al., 2016; Mehraban and Raghfar, 2016). While these studies provide valuable insights, much of the existing evidence is either cross-country or region-specific, limiting its direct applicability to Bangladesh's national context.

Although Bangladesh has achieved considerable health gains, systematic national-level empirical studies estimating the health production function over a long-time horizon remain scarce. Existing research is often fragmented, uses limited time spans, or focuses on selected indicators rather than a comprehensive set of socioeconomic, environmental, and healthcare variables. This gap restricts a clear understanding of the relative importance of key health inputs in shaping population health outcomes at the national level. Against this backdrop, the present study aims to estimate the health production function for Bangladesh using 50 years of national-level data. Specifically, it seeks to identify the key determinants of life expectancy by integrating socioeconomic, healthcare, and environmental factors within a unified empirical framework. By doing so, the study contributes to the literature by providing robust evidence to inform health and development policy in Bangladesh and similar developing-country contexts.

MATERIALS AND METHODS

Health is a basic component of human resource development, and human resource development theories emphasize its importance in increasing individuals' productivity. Smith and Dunt (1992) suggest the following outline for the health production function:

$$HO = f(M.E) \quad (1)$$

The health production function developed by Smith and Dunt (1992), shown in Equation (1), postulates the relationship between medical and non-medical input combinations and the resulting output. As a result, health production relies on non-medical, socioeconomic, financial, and physical elements in addition to the healthcare system and its resource input (Polcyn et al., 2023). Arawomo et al. (2018) used the health production function in its general form, as proposed by Smith and Dunt (1992), to examine the dynamic linkages among economic development, energy consumption, and life expectancy at birth in SSA economies.

Empirical model

This section follows the footsteps of previous papers by Fayissa and Gutema (2005), Rayhan et al. (2019), and Kulkarni et al. (2016), which adopt Grossman's (1972) model and Smith and Dunt's health production function (1992). Analysis of health production at the macro level can offer significant insights into the most efficient way to allocate resources to improve countries' overall health status. To estimate the health production function, this study used macro-level data spanning 50 years. The dependent variable in the health production function is the population's health status, measured by life expectancy at birth, which is specified as a function of economic, social, and environmental factors (Rayhan et al., 2019; Kulkarni et al., 2016). Common indicators of population health include mortality, infant mortality, morbidity, and life expectancy, with life expectancy among the most widely adopted measures of overall health status (Howlader, 2014). In social science research, life expectancy at birth is widely used as a measure of national health status because it provides a comprehensive, comparable, and outcome-based indicator that captures the cumulative effects of mortality patterns across all age groups. Scholars such as Preston (1975) demonstrated the strong association between national income levels and life expectancy, highlighting its sensitivity to economic development, while Sen (1993) emphasized longevity as a core component of human capability and well-being. Additionally, life expectancy forms one of the three key dimensions of the United Nations Development Programme Human Development Index, underscoring its central role in evaluating social progress beyond income alone. Because it reflects the combined influence of healthcare systems, education, nutrition, sanitation, inequality, and public policy, life expectancy serves as a robust macro-level proxy for population health in empirical models.

The study by Fayissa et al. (2005) used literacy rate, health expenditure, per capita GDP, and the food production index as explanatory variables in a health production function at the national level. Physician per person, employment rate, and poverty were chosen as explanatory variables by the study of Hemsley et al. (2020) and Mehraban & Raghfar (2016). In addition, Access to pure drinking water and nutritional status

were selected as explanatory variables in the studies by Rayhan et al. (2019) and Kulkarni et al. (2016). Therefore, this study has taken explanatory variables such as literacy rate, per capita GDP, per capita health expenditure, sanitary users' rate, poverty headcount ratio, employment rate, malnutrition, access to pure drinking water, doctor per person, and food production index. Thus, the empirical aggregate health production function is given by:

$$LE_i=\varepsilon_0+\varepsilon_1 LR_i+\varepsilon_2 PCGDP_i+\varepsilon_3 PCHE_i+\varepsilon_4 SUR_i+\varepsilon_5 PHR_i+\varepsilon_6 ER_i+\varepsilon_7 MN_i+\varepsilon_8 ADW_i+\varepsilon_9 DPP_i+\varepsilon_{10} FPI_i+\vartheta_i \quad (2)$$

Where:

LE = Life expectancy at birth of Bangladesh (in years)
LR = Literacy rate of the adult population of Bangladesh (% of total population)
PCGDP = Per capita gross domestic product (million $)
PCHE = Per capita health expenditure (million $)
SUR = Sanitation user's rate (% of total population)
PHR = Poverty headcount ratio
ER = Employment rate (% of total population)
MN = Malnutrition rate (% of total population)
ADW = Access to drinking water (% of total population)
DPP = Doctor per person
FPI = Food production index of Bangladesh and
ϑ_i = Residual term.

Equation (2) represents the aggregate health production function used to estimate the effects of socioeconomic, environmental, and healthcare inputs on life expectancy at the national level in Bangladesh. For analytical clarity and consistency with the study's conceptual framework, the independent variables are grouped into three broad categories. Socioeconomic factors include literacy rate, employment rate, poverty headcount ratio, per capita GDP, and the food production index, which capture human capital formation, income conditions, and economic security. Healthcare factors comprise per capita health expenditure and doctors per person, reflecting healthcare financing and service availability. Environmental and public health factors include access to safe drinking water, sanitation users' rate, and malnutrition, which represent living conditions and preventive health determinants. This classification aligns with the theoretical health production function and facilitates a structured interpretation of the empirical results.

For preprocessing time series data, some diagnostic tests are employed, such as tests for multicollinearity, stationarity, and autocorrelation. In cases of multicollinearity, the variance inflation factor (VIF) and Tolerance quantify the degree of collinearity in a regression analysis guided by ordinary least squares (OLS). VIF holds the following form:

$$VIF=\frac{1}{1-r^2} \quad (3)$$

Where r is the correlation between two explanatory variables, and the squared form of r is called the coefficient of determination. If the VIF for one of the explanatory variables is around or above 10, there is collinearity with that variable. A stochastic process is said to be stationary if its mean and variance are constant over time, and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed. A widely popular stationarity test is the unit root test. This study uses the Dickey-Fuller test to check the stationarity of time series data, which is available in many statistical software packages. Autocorrelation is a mathematical representation of the degree of similarity between a given time series and a lagged version of itself over successive time intervals. The Breusch-Godfrey test is used to assess the validity of certain modelling assumptions when applying regression-like models to observed data series. To identify the determinants of health status at the macro level and to employ different diagnostic tests, this study used STATA software, which automatically allows a significance level of up to 10%.

RESULTS

Since its independence, Bangladesh has made remarkable progress in healthcare development despite limited resources. Initially, the health system was urban-centred, elite-biased, and largely curative, with minimal facilities and services. Over time, policy priorities shifted toward rural coverage and preventive care, significantly strengthening primary healthcare delivery. Bangladesh is often cited as a global example of achieving substantial health gains with constrained resources (Perry, 2002). Currently, Bangladesh operates approximately 18,000 community clinics, each serving about 6,000 people, delivering primary healthcare through an innovative government-led model. In addition, there are 472 government primary healthcare facilities (Upazila Health Complexes) with 18,880 beds. Secondary and tertiary public healthcare is provided through 126 facilities with 27,053 beds. The private sector comprises 2,983 registered hospitals offering 45,485 beds. Overall, Bangladesh has only 0.8 hospital beds per 1,000 population (WHO, 2024). Although the healthcare system spans community, regional, and national levels, health workers remain heavily concentrated in urban areas. As a result, a significant proportion of patients rely on informal providers: 43% seek care from traditional healers, 22% from traditional birth attendants, 16% from unqualified allopathic providers, and only 7% from community health workers. Amid ongoing demographic and epidemiological transitions, Bangladesh now faces a dual burden of communicable and non-communicable diseases (Rayhan et al., 2019).

Table 1. Present status of health indicators in Bangladesh.

Health indicators	Status in 2024
Physician per person	0.70
Access to basic drinking water (% of total population)	96.26
Sanitary latrine users rate (% of total population)	37.09
Life expectancy at birth (years)	72.87
Mortality rate (per 1000 adults)	132.96
Maternal mortality rate (per 1000 live births)	1.91
Infant mortality rate (per 1000 live births)	27.3

Source: World Bank, UNICEF, Bangladesh Economic Review, WHO, 2025

Health-related facilities in Bangladesh, such as the number of physicians per person, the availability of health services, access to drinking water, and the rate of sanitary users, are rising but remain insufficient for Bangladesh's huge population. However, access to pure drinking water and the sanitary latrine user rate are satisfactory. However, the number of physicians is in a miserable condition because it is really insufficient for the huge population. Moreover, the number of healthcare centers is insufficient given the large population. In addition, health indicators in Bangladesh, such as life expectancy, mortality rates, infant mortality rate, maternal mortality rate, and malnutrition prevalence, are decreasing. Hence, the overall health status of people in Bangladesh is improving rapidly. As a result, Bangladesh is undergoing a demographic and health transition.

Table 2. Descriptive statistics.

Variables	Mean	SD	Min	Max
Life expectancy at birth (years)	61.34	8.39	46.50	72.86
Per capita GDP (million $)	580.70	272.23	322.33	1288
Literacy rate (% of population)	44.21	15.52	21.5	74.68
Sanitary users' rate (% of population)	28.87	10.15	18.31	51.2
Employment rate (% of population)	54.09	3.06	45	56.56
Poverty headcount ratio	31.04	11.12	13.1	51.2
Malnutrition rate	54.04	17.53	21	74.8
Access to drinking water (% of population)	95.04	1.48	92.57	98.43
Physician per person	.25	.149	.09	.62
Per capita health expenditure ($)	13.53	11.06	5.25	43.5
Food production index	84.92	35.88	41.14	149.5

Source: World Bank, UNICEF, Bangladesh Economic Review, WHO, 2025

The descriptive statistics reflect Bangladesh's socio-economic, health, and nutrition conditions during the study period and highlight structural constraints alongside notable achievements. Average life expectancy at birth is 61.34 years, with wide variation, indicating gradual improvement in population health but persistent disparities over time. Per capita GDP remains low on average (USD 580.7), underscoring Bangladesh's developing economy, though the large range suggests periods of accelerated economic growth. Human capital indicators show mixed performance. The mean literacy rate of 44.21% reveals substantial educational deficits, which are closely linked to health awareness and employment opportunities. Sanitation coverage is particularly weak, with only 28.87% of the population using sanitary facilities on average, reflecting long-standing public health and infrastructure challenges.

In contrast, access to drinking water is remarkably high (95.04%), highlighting Bangladesh's success in expanding safe water access despite resource constraints. Labor market conditions appear relatively stable, with an average employment rate of 54.09%. In comparison, the poverty headcount ratio (31.04%) indicates that nearly one-third of the population lives below the poverty line, reinforcing the strong linkage between income poverty and health outcomes. Nutritional status remains a critical concern, as evidenced by a high mean malnutrition rate of 54.04%, pointing to chronic food insecurity and inadequate dietary diversity. Healthcare capacity indicators reveal limited investment and availability. Physician density is very low (0.25 per person, proxy for per 1,000 population), and per capita health expenditure averages only USD 13.53, confirming under-resourcing of the health sector. Finally, the food production index shows considerable variability, suggesting fluctuations in agricultural performance that may influence nutrition and poverty dynamics. Overall, the table illustrates Bangladesh's dual reality: notable progress in basic services such as drinking water and life expectancy, alongside persistent challenges in income, sanitation, nutrition, and healthcare capacity, which are central to the country's ongoing demographic and health transition.

The dependent variable in the health production function is the population's health status, measured by life expectancy at birth. The analysis uses state-level data for the year 2024. Since these are time-series data, we need to test for stationarity, as non-stationary data may produce spurious regression results. Of the eight variables, five are stationary, and three are non-stationary but become stationary after first differencing; these are presented in Table 3. These time series data are free of multicollinearity, as indicated by VIFs below 10 (Table 4), and there is no autocorrelation among the variables (Table 5). The results for each model, using life expectancy as the dependent variable, are presented in Table 6.

Table 3. Dickey-fuller unit root test for stationarist.

Variables	z(t)	*p*-value
Life expectancy	-3.72	0.004
Per capita GDP	-4.20	0.0007
Literacy rate	-5.67	0.000
Sanitary user's rate	-12.13	0.000
Employment rate	-4.35	0.000
Poverty headcount ratio	-4.65	0.0001
Malnutrition	-8.46	0.000
Access to drinking water	-6.56	0.000
Doctor per person	-5.34	0.000
Adult mortality rate	-8.33	0.000
Infant mortality rate	-14.34	0.000
Per capita health expenditure	-2.96	**0.04**
Food production index	-7.20	0.000

Source: Author's calculation based on secondary data, 2025

Table 4. Variance inflation factor.

Variables	VIF	1/VIF
Per capita GDP (PC GDP)	3.63	0.28
Literacy rate (LR)	4.94	0.20
Sanitation users' rate (SUR)	5.82	0.17
Employment rate (ER)	9.25	0.11
Poverty headcount ratio (PHR)	5.38	0.19
Malnutrition (MN)	8.13	0.12
Access to drinking water (ADW)	6.28	0.16
Doctor per person (DPP)	2.76	0.36
Per capita health expenditure (PCHE)	7.47	0.13
Food production index (FPI)	7.98	0.13
Mean VIF= 6.164		

Source: Author's calculation based on secondary data, 2025

Table 5. Breusch-godfrey LM test for autocorrelation.

Lags(p)	Chi2	df	Prob>Chi2
32 H0: no serial correlation	45.00	32	0.063

Source: Author's calculation based on secondary data, 2025

Table 6 presents the estimated coefficients for various determinants that are significantly related to life expectancy at birth in Bangladesh. The fixed-effect model reveals that six variables—literacy rate, employment rate, poverty headcount ratio, access to drinking water, doctor per person, and per capita health expenditure—have a statistically significant relation with life expectancy. The adjusted R^2 value (64.10%) suggests that the model effectively explains variations in life expectancy, while 35.60% remains unexplained. This implies that measurable macro-level inputs, rather than chance or unobserved factors, are significantly associated with life expectancy in Bangladesh, supporting the applicability of a production-function-based approach in health economics.

Table 6. Estimation results for health production function at national level.

Variables	Coefficient	Std. Error	*t*-value	Sig.
Per capita GDP (PC GDP)	.000	.003	-.12	.91
Literacy rate (LR) .128**	.05	2.37	.02	
Sanitation users' rate (SUR)	.07	.07	-1.02	.31
Employment rate (ER)	.12**	.05	2.22	**.03**
Poverty headcount ratio (PHR)	-.02*	.01	-1.84	.07
Malnutrition (MN)	-.01	.02	-.43	.67
Access to drinking water (ADW)	.58***	.19	2.98	**.005**
Doctor per person (DPP)	0.56***	0.23	2.42	**.004**
Per capita health expenditure (PCHE)	.12**	.053	2.32	**.03**
Food production index (FPI)	.003	.01	-.24	.82
Constant	31.42	19.07	1.65	.12

Sample Size, N= 50 year's data; R-Squared: 0.694; Adjusted R-Squared: 0.641
Note: ***, ** and * indicate significance at 1%, 5% and 10% respectively
Source: Author's calculation based on secondary data, 2025

Literacy rate plays a crucial role in increasing life expectancy. The estimated coefficient (0.13) suggests that a one-unit increase in the literacy rate is associated with a 0.13-year increase in life expectancy at birth. The employment rate also shows a positive, statistically significant relationship with life expectancy. The coefficient of 0.12 implies that a one-unit increase in employment is associated with a 0.12-year increase in life expectancy. Per capita health expenditure is another critical determinant. A one-dollar increase in per capita health spending raises life expectancy by 0.12 years. Access to drinking water has a significant impact, with life expectancy increasing by 0.58 years for each 1% rise in access. Doctor availability is another vital factor, as the coefficient of 0.56 suggests that an increase in the number of doctors per person is associated with a corresponding rise in life expectancy.

On the other hand, the poverty headcount ratio negatively affects life expectancy, with a coefficient of -0.02. This implies that a 1% rise in poverty reduces life expectancy by 0.02 years. Although other factors, such as per capita GDP, sanitation, food production index, and malnutrition, show expected relationships with life expectancy, their coefficients are statistically insignificant. Overall, the estimation results support the theoretical underpinnings of the health production function and confirm that human capital, healthcare investment, and vital public health services, rather than income growth alone, are the main drivers of health outcomes in Bangladesh.

DISCUSSION

The results of this study provide a significant relationship between the determinants of health status and life expectancy in Bangladesh. The findings indicate that a combination of human capital, such as literacy and employment, healthcare investment, including health spending and doctors per person, and access to essential public health infrastructure, such as safe drinking water, influences national health outcomes.

Among the statistically significant determinants, literacy rate emerges as a key factor positively associated with life expectancy. Higher literacy levels are associated with better health awareness, improved health-seeking behavior, and more effective adoption of preventive practices. This result is consistent with earlier empirical studies (Fayissa et al., 2005; Hemsley et al., 2020; Rayhan et al., 2019) and highlights the importance of human capital development in improving population health.

The employment rate also shows a positive, significant relationship with life expectancy, indicating that labor market participation contributes meaningfully to health outcomes. This finding is consistent with the work of Thornton (2010) and Fayissa et al. (2005), who emphasize the role of economic participation in enhancing well-being. Higher employment enhances income stability and access to healthcare services, while also improving overall living conditions. In a country like Bangladesh, where informal employment and underemployment remain widespread, employment generation can therefore function as an important indirect mechanism for improving health. Healthcare-related inputs play a crucial role in explaining life expectancy. Per capita health expenditure shows a statistically significant, positive relationship with life expectancy, underscoring the importance of sustained investment in the health sector. However, the result also reflects the underlying findings of Fayissa et al. (2013) and Rayhan et al. (2019). This result underscores the importance of healthcare investment in improving population health. But the importance of health spending also prompts questions about the effectiveness and fairness of healthcare finance. In Bangladesh, a major portion of health expenditure is paid for out of pocket, limiting access for low-income people.

Similarly, access to safe drinking water significantly improves life expectancy, reflecting the role of preventive and environmental health measures in reducing waterborne diseases, as supported by studies by Rayhan et al. (2019) and Kulkarni et al. (2016). Access to clean water reduces the prevalence of waterborne infections, which remain a serious public health issue in Bangladesh, particularly in rural and flood-prone areas. Moreover, the number of doctors per person shows a strong positive association with life expectancy, underscoring the importance of human resources in healthcare delivery. This aligns with the research of Mehraban and Raghfar (2016) and Hemsley et al. (2020), who emphasize the importance of healthcare accessibility. Shortages of qualified medical practitioners, particularly in rural and underserved areas, continue to impede access to healthcare in Bangladesh. The findings indicate that raising the doctor-to-population ratio can significantly enhance health outcomes by assuring prompt diagnosis, treatment, and preventative care. In contrast, poverty shows a negative, statistically significant association with life expectancy, reinforcing the link between economic deprivation and poor health outcomes, a finding consistent with Fayissa et al. (2013) and Rayhan et al. (2019). This result reinforces the argument that economic deprivation is associated with poorer health outcomes. Poverty reduces access to proper nutrition, healthcare, sanitation, and safe living circumstances, increasing susceptibility to sickness and untimely mortality.

Several variables, such as per capita GDP, sanitation user rate, malnutrition, and the food production index, do not show a statistically significant relationship with life expectancy. This may reflect threshold effects at the national level, measurement limitations, or the masking of regional disparities in aggregated time-series data. The insignificance of per capita GDP suggests that economic growth alone does not automatically translate into improved health outcomes without equitable distribution and effective social investment, and these results align with those of Rayhan et al. (2019) and Hemsley et al. (2020). Similarly, aggregate indicators of food production and nutrition may fail to capture dietary quality, micronutrient deficiencies, and intra-household allocation, thereby limiting their explanatory power, consistent with the results of Kulkarni et al. (2016).

Interpreting the findings through the lens of socioeconomic, healthcare, and environmental determinants reveals clear patterns in the drivers of life expectancy in Bangladesh. Among socioeconomic factors, literacy, employment, and poverty exhibit statistically significant effects, underscoring the role of human capital and economic security in shaping health outcomes. Healthcare-related inputs, particularly per capita health expenditure and physician availability, emerge as strong positive contributors, highlighting the importance of healthcare capacity and investment. In contrast, environmental and public health factors, notably access to safe drinking water, demonstrate substantial preventive effects. At the same time, sanitation and malnutrition show expected but statistically insignificant relationships at the aggregate level.

CONCLUSION

Health is an essential component of human capital development, playing a pivotal role in economic growth and overall societal well-being. Over the past decades, Bangladesh has made remarkable progress in the healthcare sector, as reflected in declining mortality and morbidity rates, increased life expectancy, and rising healthcare expenditures. However, despite these achievements, significant challenges remain in ensuring equitable access to healthcare services and addressing disparities in health outcomes, particularly between urban and rural areas. The findings of this study state the importance of key determinants in shaping the health status of Bangladesh's population. The results of the regression analysis reveal that variables such as literacy rate, employment rate, access to safe drinking water, doctors per person, and per capita health expenditure have a significant positive relationship with life expectancy at birth. One of the major challenges facing Bangladesh's healthcare sector is the shortage of medical infrastructure and healthcare professionals. A significant proportion of the population, particularly in rural areas, lacks access to quality medical services due to the limited number of hospitals, clinics, and trained healthcare providers. This shortage not only restricts the availability of essential healthcare services but also results in overcrowding in existing healthcare facilities, leading to inefficiencies in service delivery.

The findings highlight the importance of strengthening the health system's structural foundations. Investments in education and employment not only enhance economic productivity but also indirectly improve health by increasing health awareness, income security, and access to medical services. Similarly, sustained public investment in healthcare infrastructure and preventive services such as safe drinking water emerges as critical for achieving further gains in life expectancy. These results suggest that health outcomes respond most effectively to coordinated policy interventions that integrate social, economic, and health-sector strategies rather than isolated or growth-centered approaches. From a policy perspective, the study underscores the need for a more equitable and inclusive health financing framework in Bangladesh. Reducing reliance on out-of-pocket expenditures, expanding public healthcare facilities in underserved regions, and addressing shortages of trained medical professionals are essential for improving both efficiency and equity in healthcare delivery. In parallel, broader poverty reduction and employment-generation policies can serve as powerful complementary instruments for improving population health.

Future research could extend this analysis by incorporating regional or district-level data to capture spatial disparities in health outcomes and by exploring dynamic interactions between health, education, and labor markets. Such evidence would further support evidence-based policymaking aimed at sustaining Bangladesh's health gains. Overall, the study reinforces the view that long-term improvements in population health require sustained, inclusive, and multi-sectoral policy commitment, positioning health not merely as a social outcome but as a central pillar of national development.

Overall, the results indicate that improvements in life expectancy in Bangladesh are primarily driven by a combination of socioeconomic advancements, such as raising literacy, increasing employment, and improving access to safe drinking water, and by strengthening the healthcare system, including increasing the number of doctors per person and per capita health expenditure. Investments in education and employment enhance health indirectly through greater awareness and income stability, while healthcare expenditure and physician availability directly improve access to medical services. Environmental factors, particularly access to safe drinking water, continue to play a crucial role in prevention. This integrated interpretation reinforces the study's core objective of identifying how distinct categories of health inputs jointly shape population health outcomes at the national level.

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AUTHOR CONTRIBUTIONS

M. S. A.: Conceptualization, methodology, data visualization, data curation, writing- original draft preparation; M.E.H: Visualization, investigation, supervision; M.A.K: Software, validation, writing-reviewing and editing.

DECLARATION

Informed consent statement

This review study did not involve any human participation or data collection. No ethical approval or informed consent was required for this research.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper. No financial, professional, or personal relationships have influenced the content and findings of this research.

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