Impact of Health Outcomes on Economic Performance in Sub-Saharan Africa

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ABSTRACT

Using panel data from 46 Sub-Saharan Countries, this study employed Descriptives statistics, Correlation, Bound test for cointegration, Panel ARDL analysis to analysed the data by examining how health outcomes affect economic performance in Sub-Saharan. The study was motivated by the growing recognition that health is an important component of human capital development and a critical determinant of productivity, labor efficiency, and sustainable economic growth. Despite various healthcare reforms and increased investments in the health sector across the region, many countries in Sub-Saharan Africa continue to experience poor health outcomes, including low life expectancy and high under-five mortality rates, which may hinder economic performance. Against this background, the study investigated the extent to which selected health outcome indicators influence economic growth in the region. The findings indicates that life expectancy, under-five mortality, health expenditure and Population have significant impact on economic growth. The study recommends among others that Authorities in Sub-Saharan Africa should place more emphasis on measurable improvements in life expectancy and reductions in under-five mortality by adopting targeted, high-impact health interventions.

Keywords: Health Outcomes, Economic Performance, Life Expectancy, Under-Five Mortality, Health Expenditure, Panel ARDL.

JEL Code: I15, O15, O47, O55

INTRODUCTION

Health is increasingly recognized as a key driver of economic development because the wellbeing of a population directly affects productivity, innovation, and overall national growth. A healthy population is more capable of working efficiently, learning new skills, and contributing meaningfully to economic activities. In developing regions such as Sub-Saharan Africa, where poverty, disease burden, and weak healthcare systems remain widespread, health outcomes have become an important factor in determining the pace and sustainability of economic performance. People who enjoy good health are more likely to participate actively in the labor force, work for longer periods, and contribute positively to economic growth. In contrast, poor health outcomes such as high maternal and infant mortality rates, low life expectancy, malnutrition, and the increasing spread of communicable and non-communicable diseases reduce labor productivity, increase healthcare spending, discourage investment, and slow economic progress (Asongu & Odhiambo, 2023; Musah et al., 2025).

Over the years, the connection between health outcomes and economic performance has attracted increasing attention from scholars, governments, and international development organizations. This growing interest is largely influenced by the human capital theory, which explains that investment in people's wellbeing, especially health and education, enhances productivity and supports long-term economic growth. Countries with stronger healthcare systems and better health conditions often experience higher economic performance because healthy individuals are more productive and capable of contributing effectively to development activities. In many developed countries, improvements in healthcare services, nutrition, sanitation, and disease prevention have

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contributed significantly to economic transformation and higher standards of living. However, despite several policy reforms and international health interventions, many countries in Sub-Saharan Africa still experience poor health indicators alongside weak economic performance (Gebrihet et al., 2024).

The healthcare sector in Sub-Saharan Africa continues to face numerous structural and institutional problems. Many countries in the region struggle with inadequate healthcare infrastructure, poor funding of health services, shortage of qualified medical personnel, limited access to quality healthcare facilities, poor sanitation, and recurring outbreaks of diseases such as malaria, tuberculosis, and HIV/AIDS. More recently, emerging epidemics and public health emergencies have exposed the weaknesses and fragility of healthcare systems across the region. These persistent challenges have contributed to low life expectancy, high maternal and child mortality rates, and declining labor productivity, all of which negatively affect economic performance. As a result, many countries in the region continue to experience slow economic growth, high unemployment, widespread poverty, and low per capita income despite being richly endowed with human and natural resources (World Bank, 2024).

In response to these challenges, governments and development partners have introduced several reforms and healthcare policies aimed at improving health outcomes and promoting economic growth. These measures include increased government expenditure on healthcare, expansion of health insurance schemes, vaccination campaigns, maternal and child healthcare programs, and greater investment in primary healthcare services. International donor agencies and development organizations have also provided financial and technical support to strengthen healthcare delivery across the region. Although these interventions have contributed to some improvements in healthcare access and disease control, their overall impact on economic performance has remained uneven across many Sub-Saharan African countries. This has raised concerns about the effectiveness, sustainability, and inclusiveness of existing healthcare policies and interventions in achieving long-term economic development. Recent studies also suggest that increased investment in healthcare contributes significantly to productivity growth and human capital development across African economies (Journal of Economic Structures, 2025).

Despite the growing recognition of the importance of health in economic development, there are still major gaps in the literature regarding how health outcomes influence economic performance in Sub-Saharan Africa. Existing empirical studies such as Olabisi and Adegbenro (2025), Tonny (2026), and Olowu and Ojo (2021) have mainly focused on the relationship between health expenditure and health outcomes or between specific health indicators and economic growth. For example, Olabisi and Adegbenro (2025) examined the interaction between fiscal policy, government health expenditure, and child health outcomes in Sub-Saharan Africa between 2010 and 2022 using the Generalized Method of Moments (GMM) approach. Similarly, Musah et al. (2025) investigated the relationship between financial development, public health financing, and health outcomes in 45 Sub-Saharan African countries and found that improved healthcare financing positively affects life expectancy and reduces mortality rates. While these studies provide valuable insights, most of them focus mainly on selected dimensions of health outcomes without adequately addressing the broader issue of health inequality across different socioeconomic groups within the region.

Furthermore, many previous studies rely mainly on conventional health indicators and pay limited attention to inequalities in healthcare access and health outcomes among different populations. Consequently, there is still limited empirical evidence on how disparities in health outcomes affect economic performance in Sub-Saharan Africa. Recent findings also indicate that poor healthcare systems, the circulation of substandard medicines, malnutrition, and increasing youth mortality continue to weaken labor productivity and sustainable development across the region (The Guardian, 2024; The Guardian, 2025). This study therefore seeks to fill this gap by providing a more comprehensive and evidence-based analysis of the impact of health outcomes on economic performance in Sub-Saharan Africa. Specifically, the study employs a robust methodological approach through the use of a concentration index to measure socioeconomic inequalities in health outcomes, thereby providing a clearer understanding of disparities across populations and over time. By linking measures of health outcomes with indicators of economic performance, the study contributes to the growing literature on health economics and development by examining the impact of health outcomes on economic performance in Sub-Saharan Africa. While also providing policy-relevant recommendations for improving both health outcomes and economic growth in Sub-Saharan Africa.

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LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Conceptual Review

Concept of Health

Understanding what "health" means is an essential starting point for exploring how health inequality affects economic growth. Across disciplines, health is recognized as a multidimensional concept that goes beyond simply avoiding illness. The classic WHO definition describes health as complete physical, mental, and social well-being (WHO, 1948), but this idealized view has been widely debated for being too absolute. As a result, scholars and global health institutions have developed broader and more practical interpretations.

The WHO's Ottawa Charter (1986) reframes health as a *resource for everyday life*, highlighting that good health enables people to function, participate in society, and pursue meaningful goals. This perspective aligns with the idea that health supports productivity and economic contribution.

More traditional biomedical views define health as the absence of disease or biological problems (Boorse, 1977), but this approach is limited because it overlooks social, psychological, and environmental influences. The biopsychosocial model introduced by Engel (1977) addresses this gap by showing that health is shaped by the interaction of biological conditions, mental states, and social environments.

Public health scholars extend this thinking by viewing health as the ability of individuals and communities to reach their full potential and live productive lives (Fawcett et al., 2000). Economists further emphasize health as a form of *human capital* that increases productivity, raises earnings, and supports long-term economic growth (Grossman, 1972).

From a development perspective, Amartya Sen's capability approach defines health as the real freedom to achieve well-being and live a life one values (Sen, 1999), drawing attention to social and institutional factors that create or limit health opportunities.

More recent thinking sees health as the ability to adapt and manage life's challenges (Huber et al., 2011), while environmental health scholars stress the importance of conditions such as air quality, water safety, housing, and climate (McMichael, 1999).

Together, these perspectives show that health is a complex and dynamic concept influenced by biological, economic, social, and environmental forces. This comprehensive understanding provides a strong foundation for examining how health inequalities arise and how they ultimately affect economic growth in Sub-Saharan Africa.

Health Outcomes and Economic Performance

Health outcomes such as life expectancy, child mortality, and disease burden are central indicators of population well-being and play a significant role in shaping the economic trajectory of nations. In the context of Sub-Saharan Africa, where health challenges remain pervasive, these outcomes offer important insight into how variations in population health influence economic performance and long-term development. Theoretical and empirical literature consistently highlights that improvements in population health enhance productivity, strengthen human capital, and support sustained economic growth (Bloom & Canning, 2000; Weil, 2007).

Life expectancy serves as a widely used proxy for overall population health and longevity. Higher life expectancy reflects improved healthcare systems, better nutrition, disease control, and increased living standards. Economic theories of human capital suggest that when individuals live longer and healthier lives, they tend to invest more in education and skills, resulting in a more productive labor force (Becker, 2007). Furthermore, longer life expectancy increases the number of working years, allowing economies to benefit from a larger and more experienced workforce. Conversely, low life expectancy reduces productive years and undermines the accumulation of skills and knowledge, ultimately limiting economic growth potential (Barro, 2013).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Child mortality is another critical health outcome that provides insight into the broader socioeconomic and health environment. High child mortality rates reflect deficiencies in healthcare access, maternal health, sanitation, and socioeconomic conditions (UNICEF, 2023). Economically, high child mortality weakens future labor supply and productivity, as fewer children survive to adulthood and those who do often suffer long-term health consequences associated with early-life deprivations (Currie & Vogl, 2013). The loss of children also imposes emotional and financial burdens on households, reducing savings, increasing healthcare spending, and lowering overall economic welfare. Countries with persistently high child mortality rates often face long-term growth constraints due to a weakened demographic and human capital base.

Disease burden, encompassing both communicable and non-communicable diseases, exerts a direct and indirect influence on economic performance. Illness reduces labor availability, lowers productivity, and increases absenteeism, while simultaneously imposing high healthcare costs on households and governments (Sachs & Malaney, 2002). Sub-Saharan Africa bears a disproportionate burden of diseases such as malaria, HIV/AIDS, tuberculosis, and rising non-communicable diseases, all of which significantly erode human capital and limit economic participation (WHO, 2021). High disease burden also diverts public expenditures from productive investments such as education, infrastructure, and technology toward healthcare and disease management, thereby constraining long-term development prospects (Bloom, Canning & Sevilla, 2004). Collectively, variations in life expectancy, child mortality, and disease burden directly shape economic performance by influencing labor supply, productivity, public expenditure patterns, and human capital formation. Improvements in health outcomes enhance economic growth, whereas poor health conditions reinforce cycles of poverty and underdevelopment.

Theoretical Review

Human Capital Theory

Michael Grossman's propounded the model of investment in health capital in 1972. This has provided a breakthrough of the manner economic researchers model healthcare related behavior (Grossman, 1972). The model by Grossman is strongly in the tradition of Becker "Human Capital theory" the Grossman model presumes that "the individual is a forward looking, optimizing individual who, in making decisions today, takes account of their possible future consequences" In the Grossman's model, the components provided that "an individual's fundamental state of health is treated as a capital good, to be built up by investment and run down by lack of investment" Thus it is not a goods that can be obtain immediately. A person who desires to raise his wealth of health capital to a particular target can only do so over period time. Health Capital in this case is conceived to be different from how healthy a person happens to be. The state of sickness or even severe sickness, may not essentially lessen one's wealth of health capital, regardless of how much it might lessen one's immediate state of satisfaction. Health capital is the best idea of relating to a person's capability to withstand disease, and to execute what the health care researchers termed as activities of daily life. For instance, a severe arthritis, which can make a person to have difficult going upstairs or downstairs, does reflect a reduction in the person's stock of health capital (Grossman, 1972).

Demographic Transition Theory

Demographic transition is the factual movement in demographics from soaring infant mortality and birth rates in a given community that has little economic growth and education, to demographics of decreased death and birth rates in a community with high level of technology, education and economic growth, to the phase between these two scenarios. Although the shift has taken place in many industrialized countries. This theory and methodology are often inaccurate when applied to different nations because of specific socio-economic and political factors influencing specifically populations (Notestein, 1953).

The theory of demographic transition is drawn from an exposition to demographic account which began in 1929 by a demographer in America named Warren Thompson from 1887 to1973. Similar observation was also made by Adolphe Landry from France on the issue of demographic marking and development of population potentials within 1934s. Frank W. Notestein in the 1940s-1960s also review a more comprehensive demographic transition

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theory. By 2009, the extant of a pessimistic coexistence between productiveness and industrial growth had become one of the keys generally acceptable findings the field of social science (Dyson, 2009).

Epidemiologic Transition Theory

In 1971, Omran Abdel (1971) who was an Egyptian American epidemiologist published "The Epidemiologic Transition: The theory was regarded as the Theory of the Epidemiology of Population Change" This is based on the mortality and morbidity patterns which was observed to have been changing world over with variations in timing and pace over the past century.

Epidemiology has to do with the distribution of death and disease alongside with their determinants as well as their implications in population. So long as patterns of disease and health are important parts of population dynamics, epidemiology's ideas on these markings and their components in population set, serves not only as an important predictor of population dynamics but also as a birth place of supposition that can be to a great extent verified to correct, refine and build population theory. Moreover, a lot of epidemiologic approach that have been restricted to the evaluation of disease and health patterns can be applied and benefit well when explore by other fields of studies has to do with fertility control (McMichael, 2001; Caldwell, 2001)

Empirical review

The empirical literature on health outcomes and economic performance in Sub-Saharan Africa largely supports the view that improvements in health outcomes contribute positively to economic growth and development. Several studies have consistently shown that increased investment in healthcare, improved life expectancy, and reductions in infant and child mortality enhance labor productivity, strengthen human capital formation, and promote higher GDP per capita growth across the region. For instance, Olabisi and Adegbenro (2025) found that efficient government health spending significantly reduced under-five mortality rates in Sub-Saharan Africa, emphasizing that fiscal commitment to healthcare promotes a healthier and more productive population. Similarly, Ahmed and Idowu (2024) revealed that public, private, and external health expenditures contributed to reducing infant mortality while simultaneously improving life expectancy in 45 Sub-Saharan African countries.

In the same vein, Sirag et al. (2022) and Arthur and Oaikhenan (2020) established that higher life expectancy and lower child mortality rates positively influence GDP per capita growth, suggesting that better health conditions improve workforce productivity and economic performance. Kiross et al. (2020) further demonstrated that increased health expenditure significantly reduces infant and neonatal mortality, thereby supporting long-term economic growth through improvements in the quality of the future labor force. Adebowale and Onisanwa (2024) corroborated these findings by showing that targeted public and private health investments contribute significantly to better health outcomes and macroeconomic performance across Sub-Saharan Africa.

Furthermore, Ajak and Moracha (2020) identified a bidirectional relationship between economic growth and health outcomes, arguing that economic growth improves health conditions while better health simultaneously stimulates productivity and economic expansion. Chewe et al. (2020) also highlighted the importance of healthcare access and quality, noting that countries with more equitable healthcare systems recorded higher life expectancy and lower child mortality, which translated into stronger economic performance. Beyond healthcare expenditure alone, Sisay (2023) demonstrated that food insecurity negatively affects health outcomes and economic productivity by increasing infant mortality and reducing life expectancy. In addition, Helena (2025) emphasized that the economic benefits of improved maternal and child health outcomes depend greatly on institutional quality, governance, and the efficiency of health expenditure, with countries possessing stronger institutions achieving better economic returns from health investments.

Theoretical framework

Endogenous growth happened due to forces engendered within the economic system and not otherwise. It can also be referred to as growth emanating from the actions of the economic agents within a particular economic system. Even technological change is the outcome of the actions of profit maximizing economic agents.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

According to Romer, investments in human capital, including health, are key drivers of economic growth. Health outcomes play a vital role in enhancing productivity, increased health expenditure improves population health, reducing absenteeism and increasing labor productivity. A healthier workforce is better equipped to engage in research, learning, and innovation, which are critical to sustaining growth in Romer's framework. In Sub-Saharan Africa, where health challenges are significant, higher health expenditure represents a direct investment in human capital that aligns with Romer's emphasis on endogenous growth (Romer, 1990).

Human capital is central to Romer's model, and health outcomes came undermines its development by reducing educational attainment. With poor health outcomes limit school attendance and cognitive development, thereby reducing the quality of human capital formation. In addition, it limiting skill acquisition.

METHODOLOGY

Research design

This study will adopt a longitudinal research design, leveraging on panel data to investigate the relationship between health outcomes and economic performance across Sub-Saharan Africa from 1990 to 2022. The data for this paper was obtained from secondary sources.

Model specification

To achieve this objective, which seeks to determine the influence of health outcome on economic performance, the study adopted and modify the model of Helena (2025)

The functional form of the equation is given as:

$$RGDP_{it} = f(LEX_{it}, UNM_{it}, \text{HEX}, EDU_{it}, POP_{it}) \quad (3.0)$$

Hence, the estimated Model is specified in equation (3.1)

Bounds Test for Cointegration Equation

$$\Delta RGDP_{it} = \alpha_0 + \sum_{j=1}^{p} \alpha_1 \Delta RGDP_{i,t-j} + \sum_{j=0}^{q} \alpha_2 \Delta LEX_{i,t-j} + \sum_{j=0}^{q} \alpha_3 \Delta UN + \sum_{j=0}^{q} \alpha_4 \Delta HEX_{i,t-j} + \sum_{j=0}^{q} \alpha_5 \Delta EDU_{i,t-j} + \sum_{j=0}^{q} \alpha_6 \Delta POP_{i,t-j} + \lambda_1 RGDP_{i,t-1} + \lambda_2 LEX_{i,t-1} + \lambda_3 UNM_{i,t-1} + \lambda_4 HEX_{i,t-1} + \lambda_5 EDU_{i,t-1} + \lambda_6 POP_{i,t-1} + \gamma_i + \varepsilon_{it} \quad (3.2)$$

Long-Run Equation

Since it was confirmed that cointegration exist in the model, the long-run relationship is:

$$RGDP_{it} = \beta_0 + \beta_1 LEX_{it} + \beta_2 UNM_{it} + \beta_3 HEX_{it} + \beta_4 EDU_{it} + \beta_5 POP_{it} + \gamma_i + \varepsilon_{it} \quad (3.3)$$

Short-Run Equation (ECM)

$$\Delta RGDP_{it} = \alpha_0 + \sum_{j=1}^{p} \alpha_1 \Delta RGDP_{i,t-j} + \sum_{j=0}^{q} \alpha_2 \Delta LEX_{i,t-j} + \sum_{j=0}^{q} \alpha_3 \Delta UN + \sum_{j=0}^{q} \alpha_4 \Delta HEX_{i,t-j} + \sum_{j=0}^{q} \alpha_5 \Delta EDU_{i,t-j} + \sum_{j=0}^{q} \alpha_6 \Delta POP_{i,t-j} + \phi ECM_{i,t-1} + \gamma_i + \varepsilon_{it} \quad (3.4)$$

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Error Correction Term (ECT)

$$ECM_{i,t-1} = RGDP_{i,t-1} - \beta_1 LEX_{i,t-1} - \beta_2 UNM_{i,t-1} - \beta_3 HEX_{i,t-1} - \beta_4 EDU - \beta_5 POP_{i,t-1} \quad (3.5)$$

where:

$RGPD_{it}$ = Real GDP growth rate

LEX_{it} = Life expectancy

UNM_{it} = Under five mortalities

HEX_{it} = Health expenditure

EDU_{it} = Educational expenditure

POP_{it} = Population

ε_{it} = Error term

i = country specific

Technique of analysis

This study employs panel econometric techniques to examine the long-run and short-run relationships among health inequality, macroeconomic variables, and development outcomes in Sub-Saharan Africa. Given the dynamic nature of the relationships and the mixed order of integration of the variables, the Panel Autoregressive Distributed Lag (Panel ARDL) model using the Pooled Mean Group (PMG) estimator is adopted as the main estimation technique.

Variables and Measurement

Variable	Notation	Measurement	Source
Real GDP	RGDP	Annual growth rate of real GDP (inflation-adjusted)	WDI, 2023
GDP per capita	GDP	GDP per capita growth rate (% annual)	WDI, 2023
Life expectancy	LEX	The average number of years a newborn is expected to live (*life expectancy at birth total*)	WDI, 2023
Health expenditure,	HEX	Total health expenditure as % of GDP	WDI, 2023
Health inequality.	HIQ	Concentration index	WDI, 2023
Labour productivity	LPR	Labor force participation rate (% of working-age population)	WDI, 2023
Under five mortalities	UNM	Number of deaths of children under 5 years of age per 1,000	WDI, 2023
Education expenditure	EDU	Government education expenditure as % of GDP	WDI, 2023
Air pollution	POLL	Carbon dioxide emission	WDI, 2023
Population	POP	Annual population growth rate (%)	WDI, 2023

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Institutional quality	INQ	Control of Corruption	WDI, 2023
Investment	INV	Gross fixed capital formation (% of GDP)	WDI, 2023

The selection of variables for the study is theoretically grounded in the Human Capital Theory, Endogenous Growth Theory, and the Grossman Health Demand Model, which emphasize health as a critical component of human capital and economic productivity. Economic performance, measured by GDP per capita or economic growth, reflects the productive capacity of an economy. Health outcome variables such as life expectancy, infant mortality, and maternal mortality are included because they capture the quality of population health and labor efficiency. Improved health outcomes increase productivity, labor participation, and human capital development, thereby promoting economic growth. Health expenditure is incorporated because investment in healthcare enhances healthcare access, disease prevention, and workforce productivity. Education is included as a complementary human capital variable that improves health awareness and labor quality. Labor force participation explains how healthy populations contribute to economic activities, while inflation captures macroeconomic stability that may influence healthcare access and growth. Foreign direct investment is included because healthier economies are more attractive to investors and can stimulate development through technology transfer and employment generation. Overall, the variables are theoretically justified based on their direct and indirect influence on economic performance in Sub-Saharan Africa.

In addressing potential missing data issues arising from inconsistencies in cross-country and time-series observations, the study adopts an unbalanced panel estimation approach. This is considered appropriate given that some countries within the sample may not have complete data for all variables and time periods due to differences in data availability, reporting standards, and statistical capacity.

RESULTS AND DISCUSSIONS

Table 4.1 Descriptive Analysis of the variables (1990-2022)

	RGDP	LEX	UNM	HEX	EDU	POP
Mean	4.509146	56.69764	7.711258	59.21100	6.303130	16060972
Median	4.114379	57.05200	4.940000	21.13278	3.029710	6226773.
Maximum	149.9730	75.90700	36.47200	1232.375	128.3863	2.23E+08
Minimum	-51.03086	14.66500	0.316000	-3832.625	0.002960	375428.0
Std. Dev.	9.400897	7.297897	6.806979	238.0888	15.86193	30035138
Skewness	5.641530	-0.172000	1.234154	-8.811367	5.772758	4.038285
Kurtosis	77.37665	4.237066	3.509917	131.7884	36.38587	21.40617
Jarque-Bera	256785.9	74.80839	288.2472	766701.5	56624.17	18332.32
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	4910.460	61743.73	8397.560	64480.78	6864.109	1.75E+10
Sum Sq. Dev.	96154.03	57946.11	50412.43	61674666	273741.7	9.81E+17
Observations	1089	1089	1089	1089	1089	1089

Source: Authors computation using Eviews 10, 2026.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Table 4.1 shows that economic growth (RGDP) has the average value of 4.51 annual growth rate, with a median of 4.11 annual growth rate. This is an indication that the mean of annual growth rate of economic growth in Sub-Saharan Africa is about 4.5 within the period of the study 1990 to 2022. It recorded a maximum of 149.94 annual growth rate recorded in Equatorial Guinea in 1997 which can be linked to rapid expansion in the oil sector due the oil boom. While the minimum of about -51.03 annual growth rate which was recorded by Liberia in 1990 attribute to the devastating impact of First Civil War which started in 1989. The standard deviation of 9.40 indicates a significant fluctuation in the annual growth rate across countries in Sub-Saharan Africa. 5.64 of the Skewness indicates that the distribution that the distributions are positively skewed suggesting higher growth values pulling the distribution to the right side. The Kurtosis has the value of 77.38.

Life expectancy (LEX) has the average of 56.70 years with the median of 57.05 years which indicates that the distribution symmetric relatively. The maximum of 75.90 years was observed in Cabo Verde in 2022. This may be attributed to strong social and health system performance. The minimum of 14.67years in Central African Republic in 2022 which may be attributed to severe structural and humanitarian challenges. The standard deviation of 7.30 shows that life expectancy across the region deviate moderately.

The mean of under-five mortality rate is (UNM) 7.71 deaths, with a median 4.94 deaths respectively indicates that under-five mortality rate is lower than the average in most of the observations owing to high mortality scenarios across Sub-Saharan countries. Under-five mortality also has the maximum of 36.47deaths recorded by Guinea in 1990 which marks the period of economic instability, structural imbalance and weak industrial development. The minimum of 0.32 deaths was recorded by Cabo Verde in 2022 characterized by relatively stable political environment. The standard deviation of under-five mortality of 6.81 shows a significant dispersion in the rate within the period of study. The distribution is positively skewed with 1.23 indicating that only few countries in the distribution are within the extreme under-five mortality circle. The kurtosis for unemployment is 3.52.

Health expenditure (HEX) across the region deviate considerably with a mean of 59.21 total health expenditure and a median of 21.13 total health expenditure indicating that only few countries with a very high health expenditure greatly influenced the average. The maximum of 1232.375 total health expenditure is recorded in Cabo verde in 2021 which can be attributed to strong policy focus on health and minimum of -3832.625 total health expenditure is recorded in Burkina Faso in 1999. A substantial disparity in health spending in the region was indicated by the large standard deviation of 238.09.

Education expenditure (EDU) has the mean of 6.30 government education expenditure and the median of 3.03 government education expenditure which suggests that most of the observations in the education expenditure across the region lies below the mean level of education expenditure. The maximum 128.3863 government education expenditure was recorded in Republic of the Congo in 2011 which can be attributed to combine increase in government investment in education. The minimum of 0.002960 government education expenditure was recorded in Gambia in 1994 which can be linked to weak spending in education. The standard deviation of 15.86 and the maximum values which are large suggested a significant disparity in education expenditure among the countries in the sub region.

The mean value of population growth rate (POP) is 16,060,972 annually while the median population growth rate is 6,226,773 annually indicating many countries population are below the average because of few large countries in the sub region. The maximum population is 223 annually from Nigeria in 2022 attribute to high fertility rate, large landmass and sustain population growth over the years. The minimum is 375,428 annually recorded by Seychelles in 1990 reflecting the country's small geographical size. The standard deviation is 30,035. The distribution of population in the region is passively skewed. The kurtosis is 21.41.

Table: 4.2 Correction Analysis test Result

	RGDP	LEX	UNM	HEX	EDU	POP
RGDP	1.000000					

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

LEX	0.072604	1.000000				
UNM	-0.054413	0.144231	1.000000			
HEX	-0.027280	0.056417	0.294467	1.000000		
EDU	-0.012713	0.103687	0.365314	0.008019	1.000000	
POP	0.005696	-0.114517	-0.244235	-0.062292	-0.093232	1.000000

Source: Authors computation using Eviews 10, 2026.

The correction analysis in Table 4.2 indicates that economic growth (RGDP) 0.072 has a positive correlation with life expectancy (LEX) in Sub-Saharan. On the contrary, economic growth (RGDP)-0.054 has a weak negative correlation with under-five mortality rate (UNM) in Sub-Saharan Africa. Similarly, economic growth (RGDP) -0.027 has a very weak correlation with health expenditure (HEX). Economic growth (RGDP) -0.012 has a weak negative correlation with education expenditure (EDU).

There is a positive correlation between life expectancy (LEX) 0.144 and under-five mortality (UNM). Furthermore, life expectancy (LEX) 0.056 has a positive correlation with health expenditure (HEX). Similarly, life expectancy (LEX) 0.103 has a positive correlation with education expenditure (EDU). There a negative correlation between life expectancy (LEX) and population (POP). The correlation between under-five mortality rate (UNM) 0.294 and health expenditure (HEX) is positive. Similarly, under-five mortality (UNM) 0.365 has a positive correlation with education expenditure (EDU). While under-five mortality UNM) -0.244 has a negative correlation with population (POP).

There is a positive correlation between health expenditure (HEX) 0.008 and education expenditure (EDU). While the correlation between health expenditure (HEX) -0.062 and population (POP) is negative. There is a weak negative correlation between education expenditure (EDU) -0.09 and population. Population (POP) has a weak correlation with almost all the variables. It has a positive association with economic growth (RGDP) 0.005, weak negative correlation with life expectancy (LEX), under-five mortality (UNM), health expenditure (HEX) and education expenditure (EDU) with -0.114, -0.244, -0.062 and -0.09 respectively.

Table 4.3: Results of Levin Lin and Chu and Im Pesaran-Shin panel Unit Root Test

Levin Lin and Chu panel Unit Root Test					
Variables	**Statistics**	**Prob.****	**Statistics**	**Prob.****	**Stationarity**
LEX	1.58961	0.0560	-	-	I(0)
HEX	6.13527	1.0000	13.0952	0.0000	I(1)
EDU	3.57512	0.0002	-	-	I(0)
POP	1.87270	0.9694	-3.14329	0.0008	I(1)
UNM	3.29647	0.9995	-18.8839	0.0000	I(1)
RGDP	-5.43716	0.0000			I(0)
Im Pesaran-Shin panel Unit Root Test					
Variables	**Statistics**	**Prob.**	**Statistics**	**Prob.**	**Stationarity**

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

LEX	0.89637	0.8150	9.95823	0.0000	I(1)
HEX	5.42154	1.0000	15.5488	0.0000	I(1)
EDU	4.81494	0.0000	-	-	I(0)
POP	11.7297	1.0000	-9.89197	0.0000	I(1)
UNM	0.28844	0.6135	-14.5173	0.0000	I(1)
RGDP	-12.5285	0.0000	-	-	I(0)

Source: Authors computation using Eviews 10, 2026

Based on the results of the Levin-Lin and Chu and Im Pesaran and Shin panel unit root test presented in Table 4.3 the results present varying results based on the stationarity of the panel data. However, the variables have are a mix of I(0) and I(1) as can be observed from the results. For instance, life expectancy (LEX), education expenditure (EDU) and economic growth were found to be stationary at level I(0) based on the Levin-Lin and Chu pane unit root results while health expenditure (HEX), population (POP) and under-five mortality (UNM) were stationary after first differencing I(1). However, education expenditure (EDU), institutional quality and economic growth (RGDP) were found to be stationary at level I(0) under the Im Pesaran and Shin panel unit root test, while life expectancy (LEX), health expenditure (HEX), population (POP) and under-five mortaltiy (UNM) were stationary after first difference I(1). But the result present mixed evidence regarding the stationarity of the variable life expectancy (LEX) and under the Levin-Lin and Chu is I(0), in Im Pesaran and Shin it is I(1). While the former assumes a common autoregressive parameter across cross-section, the latter allows for heterogeneity among panel units. Since heterogeneity is typical in macroeconomic panel data sets, emphasis is placed on IPS results. Therefore, the results of the panel unit root have met the requirement for estimating a panel ARDL.

Table 4.4 Bound test for the model

ARDL bound test of co-integration						
Lag =2 F-statistics = 6.514874*						
Critical Value Bound of the F-statistics						
K	5%		2.5%		1%	
	I(0)	I(1)	I0)	I(1)	I(0)	I(1)
4	2.79	3.7	3.15	4.08	3.65	4.66
Note: * implies that computed f-statistics is above upper bound values						

Source: Authors computation using Eviews 10, 2026

Table 4.4 presents result of ARDL bound testing co-integration approach for electricity consumption equation. The first step in this technique is to compare result of calculated f-statistic with it critical values given in the study of Pesaran, Shin & Smith, (2001). Consequently, f-statistic of 6.514874 which is calculated at k=4 (number of independent variable) exceeds the upper critical value at 5 per cent, 2.5 per cent and 1 per cent. Therefore, null hypothesis of no co-integration was rejected without considering whether they are integrated of the same order or not. Thus, it was concluded that long run relationship exists among the variables at 5% level of significance.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Table 4.5: ARDL regression Results Long run form

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LEX	0.989891	0.057080	17.34216	0.0000
UNM	-0.132834	0.010671	-12.44845	0.0000
HEX	-0.028314	0.001767	-16.02671	0.0000
EDU	0.146694	0.026564	5.522342	0.0000
POP	-9.34E-08	1.17E-08	-7.982510	0.0000

Source: Authors computation using Eviews 10, 2026.

The ARDL results in Table 4.5 indicates that the coefficient of life expectancy (LEX) 0.989 is positive and statistically significant at 5% level. This suggests that an increase in life expectancy will increase the economic performance (RGDP) across the Sub-Sharan region. Specifically, one unit increase in life expectancy leads to 0.989 increase in economic growth (RGDP). This implies that improvement in population health which could be reflected through better life expectancy that will enhance labour productivity, human capital accumulation and overall economic performance. These findings also align theoretical proposition that population health contributes more effectively on economic performance (Theodore Schultz and Gary Becker, 1960-70) and the study of Sirag et al (2022) which reported that higher life expectancy increase economic growth in 43 Sud-Saharan countries.

In contrast, the coefficient of under-five mortality (UNM) -0.133 is negative and statistically significant at 5% level. The coefficient of -0.133 implies that one unit increase in under-five mortality rate reduces economic performance by approximately -0.133 indicating that poor child health outcomes in Sub-Saharan Africa significantly reduce the economic growth in the region. High under-five mortality rate reflects poor child nutrition, weak human capital development and inadequate or weak healthcare system.

Similarly, the coefficient of health expenditure (HEX) -0.028 exhibits a negative and statistically significant effect of economic growth in Sub-Saharan Africa. The coefficient of -0.028 suggest that one unit increase in health expenditure will reduce economic performance by -0.02 in the long run. This suggests a misappropriation of healthcare spending or misallocation of resources in respect to health expenditure.

Furthermore, Education expenditure (EDU) with the coefficient of 0.147 is positive and statistically significant at 5% level. This suggests that one unit increase in education expenditure will lead to an increase in economic growth by 0.147. This result reflects the significance of human capital development which drive economic performance. Education enhances human capital accumulation through skill acquisition, innovations and labour productivity which in turn contribute significantly to economic growth.

Lastly, the coefficient of population (POP) -9.34 exerts a negative and statistically significant long run effects on economic growth in Sub-Sharan Africa. The coefficient of population (POP) -9.34 suggests that one unit increase in population will reduce economic growth by -9.43. The negative sign of population suggests that rapid population growth may place too much pressure on the limited resources available such as: social and health services and infrastructure which can hinder economic progress. Studies such as (Butali, 2026; Akinyemi & Adeniran, 2021; Adu & Afriyie, 2021; Olumide & Anwar, 2021) strongly support the findings of this study by establishing that health expenditure has a positive effect on economic growth. This aligned with the positive effect of life expectancy in this study. Furthermore, studies like (Chakraborty et al., 2021; Klasen & Misselhorn, 2022; Omran et al., 2021) revealed that poor health outcomes and unequal access to healthcare services have a negative effect on economic growth. These findings are in support of the results of this study specifically the negative impact of under-five mortality and population growth in the region.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Table 4.6: Results of the Error Correction Mechanism (ECM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
COINTEQ01	-0.700838	0.263399	-6.457259	0.0000
D(RGDP(-1))	0.465778	0.205555	2.265956	0.0243
D(LEX)	1.287587	2.350055	0.547897	0.5842
D(LEX(-1))	-0.047769	1.843763	-0.025908	0.9794
D(UNM)	-1.116262	2.213145	-0.504378	0.6144
D(UNM(-1))	-3.756793	2.048036	-1.834339	0.0678
D(HEX)	0.187084	0.096992	1.928869	0.0548
D(HEX(-1))	-0.000363	0.154481	-0.002350	0.9981
D(EDU)	7.705071	8.101552	0.951061	0.3425
D(EDU(-1))	1.910108	1.957881	0.975599	0.3302
D(POP)	0.000427	0.000588	0.726152	0.4684
D(POP(-1))	-0.000707	0.001107	-0.638394	0.5238
C	-118.5721	20.88444	-5.677535	0.0000
Mean dependent var	0.191124	S.D. dependent var		9.190820
S.E. of regression	3.517292	Akaike info criterion		4.047593
Sum squared resid	3204.177	Schwarz criterion		7.853105
Log likelihood	-1373.915	Hannan-Quinn criter.		5.487955

Source: Authors computation using Eviews 10, 2026.

Table 4.6 indicates that the error correction term (-0.7008) is negative and significant, suggesting a stable long-run relationship. This implies that about 70.1% of deviations from equilibrium are corrected each period. It also shows that the short-run coefficient of one period lagged of economic growth (RGDP) 0.465778 is positive and statistically significant at 5% level. The coefficient of life expectancy (LEX) and one period lagged are not statistically significant at 5% level. Similarly, the short-run coefficient of under-five mortality (UNM) and one period lagged are negative but not statistically significant at 5% level.

The short-run coefficient of health expenditure (HEX) is positive and statistically significant at 5% level. While the coefficient of one period lagged of health expenditure is negative but not statistically significant at 5% level. The coefficient of education (EDU) and the one period lagged of education are not statistically significant at 5% level. Similarly, the short-run coefficient of population (POP) and one period lagged of population are not statistically significant at 5% level. The constant term -118.5721 is negative and highly significant, indicating a substantial baseline decrease in the dependent variable due to unobserved factors.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

Diagnostic Tests of the Estimated Model

F-statistic	1.074673	Prob. F(2,2)	0.4820
Obs*R-squared	15.02189	Prob. Chi-Square(2)	0.7005

Source: Authors computation using Eviews 10,2026.

The Breusch-Godfrey Serial Correlation test indicates that there is no serial correlation in the model residuals. The F-statistic of 1.074673 and probability value of 0.4820 and an Obc*R-squared of 15.02189 and probability of 0.7005 which greater than 5% level of significant. Therefore, since the probability is greater than 5%, the null hypothesis of no serial correlation cannot be rejected.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	4.913906	Prob. F(24,4)	0.0660
Obs*R-squared	28.04866	Prob. Chi-Square(24)	0.2580
Scaled explained SS	0.419750	Prob. Chi-Square(24)	1.0000

Source: Authors computation using Eviews 10,2026.

The Breusch-Pagan-Godfrey heteroskedasticity test was conducted to show whether the variance of the residuals is constant. The results indicates that the model does not suffer from homoscedasticity since the probability values is greater than 5% level of significance. With the F-statistic of 4.913906 and probability of 0.0660 and Obs*R-squared of 28.04866 with Chi-square probability of 0.2580, the null hypothesis of heteroskedasticity cannot be rejected.

Robustness check

Panel Two-Stage Least Squares (Panel TSLS) estimation

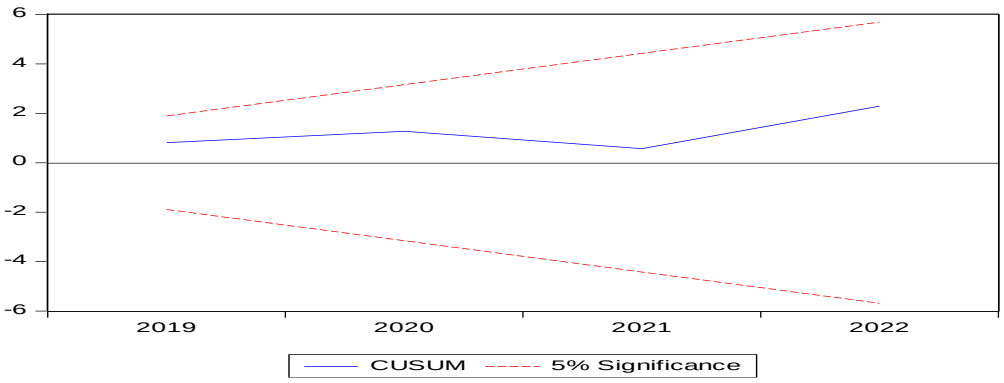
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.509146	0.270978	16.64029	0.0000
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.821804	Mean dependent var		4.509146
Adjusted R-squared	0.095192	S.D. dependent var		9.400897
S.E. of regression	8.942264	Sum squared resid		84442.07
F-statistic	4.577041	Durbin-Watson stat		2.097065
Prob(F-statistic)	0.000000	Second-Stage SSR		84442.07
Instrument rank	36	Prob(J-statistic)		0.150372

Source: Authors computation using Eviews 10,2026.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

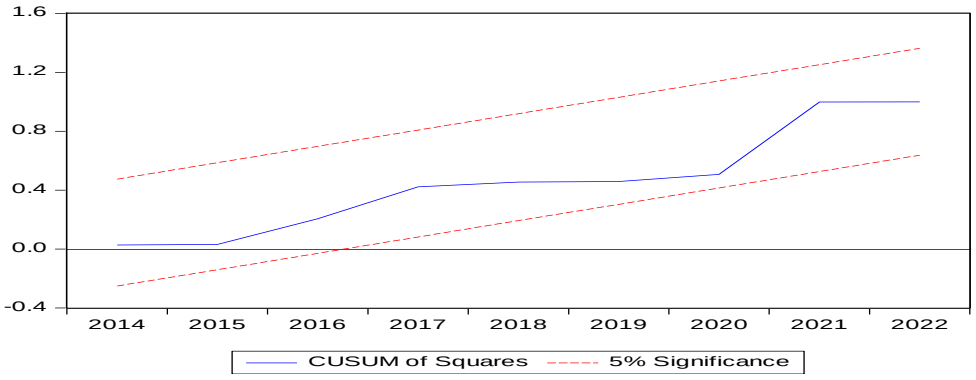
The Panel TSLS results examine how health variables affect RGDP across 33 Sub-Saharan African countries from 1990-2022 using 1,089 observations. To deal with endogeneity, life expectancy, health expenditure, and education were used as instruments. Fixed effects were also included to capture country differences in institutions and governance. The constant term is positive and highly significant, showing a stable baseline level of RGDP. The R-squared (0.8218) suggests strong explanatory power, although the adjusted R-squared drops sharply after accounting for fixed effects. The model is jointly significant based on the F-statistic (p = 0.0000). The Durbin-Watson statistic (2.097) shows no serious autocorrelation problem. The instrument rank confirms proper model identification, and the J-statistic (p = 0.150) indicates valid instruments. The model is statistically sound and suggests that health-related factors are important in explaining economic performance in Sub-Saharan Africa.

Figure 4.3 Cusum test



This was conducted to determine whether the parameters of the model are stable over the study period. The graphical results in Figure 4.3 suggests that Cusum line lies within the critical bound at 5% throughout the period of the study. This indicate that estimated coefficient of the model is stable with no evidence of structural instability.

Figure 4.4 Cusum of Sqaures



The graph shows that the Cusum of squares line lies within the critical bound of 5% indicating that the estimated coefficients of the model are stable with the period of study.

CONCLUSION AND RECOMMENDATIONS

This study examines how health outcomes affect economic performance in Sub-Saharan Africa using panel data from 47 Sub-Saharan countries. The results concludes that life expectancy (LEX) has a positive impact on economic performance in Sub-Saharan Africa. Whereas under-five mortality (UNM), health expenditure (HEX) and Population (POP) also exert a negative impact on economic performance in Sub-Saharan Africa. Thus, the study recommends that Authorities in Sub-Saharan Africa should place more emphasis on measurable improvements in life expectancy and reductions in under-five mortality by adopting targeted, high-impact health interventions. Specifically, this includes expanding the immunization coverage, scaling up access to child healthcare and maternal services (such as antenatal, skilled birth attendance, and postnatal care), and overhauling

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue V May 2026

the primary healthcare systems, particularly in rural and medically underserved areas. Governments can also invest in nutrition programs, safe drinking water, sanitation infrastructure, and malaria prevention initiatives (such as malaria vaccines and treated Mosquito nets) to address the major drivers of child mortality.

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