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Healthcare Financing and Health Outcomes in Selected African Countries

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Abstract

Health outcomes in selected African countries remain poor despite various policy efforts and international support, largely due to inadequate healthcare financing and uneven access to medical services. This study examined the relationship between healthcare financing and health outcomes in selected African countries from 2001 to 2022. The scope of the study covers multiple countries across the region, focusing on healthcare financing, out-of-pocket expenditure, and economic growth, with life expectancy serving as a proxy for health outcomes. Using the Panel Autoregressive Distributed Lag (ARDL) estimation technique, alongside panel unit root and cointegration tests, the study establishes both short-run and long-run relationships among the variables. The findings reveal that healthcare financing and out-of-pocket expenditure significantly improve health outcomes in the long run, while economic growth also contributes positively, albeit to a lesser extent. However, short-run effects are statistically insignificant, indicating that improvements in health require sustained investment over time. The study concludes that stable, long-term healthcare financing mechanisms are crucial to enhancing population health in selected African countries. It therefore recommends that governments prioritise increased public healthcare funding and strengthen national health insurance schemes to reduce reliance on out-of-pocket payments and promote equitable access to quality healthcare services across the region.

Keywords: Economic Growth, Healthcare financing, Health outcomes, Per Capita Income, Sub-Saharan Africa.

Introduction

As a fundamental universal right, good health is a major resource for social and economic progress. The World Health Organization (WHO) stated that all people worldwide have the right to the highest attainable standard of health. Health is not only the nonexistence of malady or disability, but also mental, physical, and social welfare. The health sector is the first of the basic social sectors in all countries (Olonade et al., 2019). Healthcare financing is the mobilization, distribution, and use of financial resources to guarantee that a population receives health services. It is a key factor in determining a health system's effectiveness, accessibility, and calibre (Porignon, 2018). Theoretically, health systems with adequate funding are better able to provide emergency, curative, rehabilitative, and preventative care (WHO, 2018). In addition, they are better equipped to handle health shocks brought on by pandemics, disease

outbreaks, or natural disasters. However, persistent underinvestment, inefficiency, and inequity define the healthcare financing environment in Africa (Van Minh et al., 2014).

While healthcare financing remains a critical determinant of health outcomes and human development across the world, substantial disparities exist in the level and composition of healthcare financing among regions, with important implications for population health. Evidence from the regional averages between 2000 and 2024 indicates that developed regions such as the European Union, North America, and OECD member countries devote a significantly larger share of healthcare expenditure to public financing, averaging 74.54%, 50.81%, and 61.95% of current health expenditure respectively (Voto *et al.*, 2025). These regions have consequently achieved remarkable health outcomes, including life expectancy levels above 78 years, maternal mortality ratios below 21 deaths per 100,000 live births, and infant mortality rates below 8 deaths per 1,000 live births (Voto *et al.*, 2025).

However, healthcare funding in Africa is still woefully inadequate, despite the obvious environmental risks to public health. Despite contributing less than 1% of global health spending, the continent bears roughly 24% of the world's disease burden (Hamilton and S. Maliphol, 2023). In sub-Saharan Africa, government health spending as a percentage of GDP averages 1.9%, which is significantly less than the 5% WHO recommends for attaining Universal Health Coverage (UHC) (McIntyre et al., 2018).

In lieu of this, out-of-pocket medical expenses continue to be high, making up over 35% of overall medical spending in more than 30 African nations (Kirigia et al., 2023). This has reduced the ability of health systems to adapt to environmental health shocks and resulted in restricted access to basic health services, especially for the impoverished. Poor health outcomes throughout the continent have been worsened by the inadequate funding for healthcare. Africa continues to have some of the world's lowest health indicators. Sub-Saharan Africa's average life expectancy as of 2023 is 61 years, which is much shorter than the 73-year global average (Sanders, 2023). It is against this background that this study examines the relationship between healthcare financing and health outcomes in 14 selected African countries from 2001 to 2022.

Literature Review

Conceptual Review

Healthcare Financing

Healthcare financing is a crucial aspect of health systems as it determines the availability, accessibility, and quality of healthcare services. It involves the mobilization of resources, pooling of funds, and allocation of finances to meet the healthcare needs of the population (Peters, 2008). Efficient healthcare financing ensures that health services are available to all, especially in settings where resources are limited or inequitable (Cashin et al., 2017). Healthcare financing encompasses a variety of funding mechanisms, including government spending, private insurance, out of pocket expenditures, and international aid (Chang et al., 2019).

There are generally three main models of healthcare financing: public financing, private financing, and mixed financing. Public financing refers to government spending on health,

often through general taxation or social health insurance programs (Filc, et al., 2020). This model aims to reduce the financial burden on individuals and ensure universal access to healthcare services. Private financing includes private health insurance and direct out-of-pocket payments made by individuals for health services. This model often exists alongside public financing in many countries, where both public and private sectors coexist to provide healthcare. Mixed financing, as the name suggests, combines both public and private funding sources to support healthcare expenditure, and is often seen in high income countries or transitioning economies (Peters et al., 2019).

Peters et al., (2019) emphasizes that a well-designed healthcare financing system is vital for achieving universal health coverage (UHC), which is a key objective of health systems globally. UHC is the concept that all people should have access to the health services they need without suffering financial hardship. To achieve UHC, financing mechanisms must be equitable, meaning that healthcare financing should be based on individuals' ability to pay rather than their healthcare needs. Furthermore, the WHO outlines that countries with high levels of public healthcare financing tend to have better health outcomes, as they are more likely to achieve equity in access to services. Conversely, countries that rely heavily on out-of-pocket payments or private financing often experience disparities in access to care, with vulnerable populations being disproportionately affected

Health Outcomes

Health outcomes refer to the measurable changes in the health status of individuals or populations as a result of healthcare interventions or external factors, such as socio-economic conditions, environmental exposures, and lifestyle behaviours (Kindig and G. Stoddart, 2003). They are critical indicators used to evaluate the effectiveness and efficiency of healthcare systems, as well as to inform policy and decision making aimed at improving public health. Health outcomes encompass a wide range of measures, including mortality rates, morbidity rates, life expectancy, disability adjusted life years (DALYs), quality adjusted life years (QALYs), and self-reported health status.

Theoretical Review: Grossman Health Model

The Grossman Health Model, proposed by Michael Grossman in 1972, is a cornerstone of health economics that seeks to explain how individuals make decisions regarding their health and the factors that influence their health outcomes. In this model, Grossman conceptualizes health as both a consumption and investment good, which introduces a dynamic understanding of how individuals allocate resources toward maintaining their health and how these investments affect their overall wellbeing and productivity. According to the model, individuals not only invest in their health to improve their quality of life (consumption aspect) but also to enhance their economic productivity over time (investment aspect). This dual role of health explains why individuals devote time and financial resources to maintain or improve their health, as it affects both immediate wellbeing and future economic potential (Zweifel, 2012).

A central tenet of Grossman's theory is the idea that health functions like capital. Just as physical or financial capital depreciates over time and requires investment to maintain or

increase its value, health capital also depreciates, especially with aging or illness, and must be actively maintained through investments. For instance, it was argued that individuals must allocate resources whether money or time towards healthcare services, healthy behaviours, and preventive care to slow down the depreciation of health capital. Without these investments, health deteriorates, leading to reduced productivity and a lower quality of life. This insight has significant implications for understanding the demand for healthcare and the role of healthcare financing in improving health outcomes (Grossman, 1972).

Empirical Review

Literature has shown that the consistent increase in health expenditures is an integral part of health policy. In examining the relationship between healthcare financing and health outcomes in Africa, several studies have been done. Chireshe and Ocran (2020) used data from 45 Sub-Saharan African countries between 1995 and 2018 to assess the effect of health care expenditure on child mortality and life expectancy. Utilizing fixed effects and generalized method of moments (GMM) techniques, the study found that higher total and public health expenditure significantly reduced under-five mortality rates and improved life expectancy. Private health expenditure, however, showed less consistent outcomes. These results reinforce the value of sustained public investment in health to enhance population outcomes in SSA.

Ndzignat-Mouteyica and Ngepah (2024) examined the progress of African countries in reducing intra-country health outcome disparities between 2000 and 2019 using a panel data from 40 African countries. The study employed a non-linear dynamic factor model, the study focused on three health outcomes: infant mortality rate, under-5 mortality rate, and life expectancy at birth. The findings indicate that while the hypothesis of convergence is not supported for the selected countries, evidence of convergence clubs is observed for the three health outcome variables.

Christopoulos and K. Eleftheriou (2020) investigated the impact of health expenditures on health outcomes in the OECD countries. The study employed the system generalised method of moments (GMM) for thirty-eight OECD countries using panel data from 1996 to 2020. The findings show that health expenditures have a negative impact on infant mortality but a positive impact on life expectancy.

Oladosu, Chanimbe, and Anaduaka (2022) investigated the impact of public health expenditure on health outcomes in Nigeria and Ghana, whilst reconceptualising health outcomes to capture infant, maternal, malaria, and HIV/AIDS mortality. The study also assessed the role of public policy in this relationship using linear regression. Findings revealed low public health expenditure in both countries, with the Ghanaian case showing a negative relationship that was primarily insignificant, whilst Nigeria showed a positive one.

Another study analysed the impact of healthcare spending on health outcomes in Pakistan between 2002 and 2021 (Saleem, 2023). Government spending on education, existing health expenses, carbon emissions, illness prevalence (both infectious and non-infectious), and the availability of doctors were investigated. The health outcomes were measured by the under-5 mortality rate. The robust least squares regression technique was employed. The results show that the under-5 death rate in Pakistan increased due to a lack of government spending on education, current health expenses, and infectious illnesses.

Polcyn, Voumik, Ridwan, Ray and Vovk (2023) examined the effects of health expenditure, energy consumption, CO₂ emissions, population size, and income on health outcomes in 46 Asian nations between 1997 and 2019. Cross-sectional dependence (CSD) and slope heterogeneity (SH) tests were utilized due to the close linkages between Asian nations as a result of commerce, tourism, religion, and international agreements. The research employed the inter autoregressive distributive lag (CS-ARDL) model. In addition to CS-ARDL, the study's results were checked with a common correlated effects mean group (CCEMG) method and an augmented mean group (AMG) method. According to the CS-ARDL study, higher rates of energy use and healthcare spending lead to better health outcomes for Asian countries over the long run. CO₂ emissions are shown to be harmful to human health, according to the study.

Bunyaminu (2022) investigated the impact of total health expenditure on life expectancy in a panel of 43 African countries from 2000 to 2018. The dynamic panel generalised method of moments (GMM) estimation method was used in this study. The results reveal that health expenditure on its own has a significantly positive influence on life expectancy. However, health expenditure, through the moderating effect of government effectiveness, reduces life expectancy.

By examining what influences Eastern Europeans' longevity between 1990 and 2021, Nica (2023) examined the relationship among energy consumption, health expenditure, pollution, institutional quality index, financial development, and other attributes that profoundly impact human health. The study employed the cross-sectional autoregressive distributive lag (CS-ARDL) model, while the Quantile Regression (QR) method was also applied to check robustness. This study indicated that increased health expenditure, renewable energy consumption, and IQI improve health outcomes in Eastern European nations. There was a good connection between renewable energy consumption and health benefits, the study concluded. Although financial development positively affects life expectancy, the effect is insignificant. On the other hand, the study also shows that CO₂ emissions and fossil fuel consumption decrease life expectancy.

Radmehr and Adebayo (2022) examined the effect of health expenditure and sanitation on life expectancy in Mediterranean countries. The study considered other drivers of life expectancy, such as CO₂ emissions and economic growth. The study covers the period 2000–2018, and the method-of-moments quantile regression (MMQR) approach was utilised to assess these interconnections. The MMQR results showed that economic growth, health expenditure, and sanitation increased life expectancy across all quantiles (0.1–0.90). Furthermore, in all quantiles (0.1–0.90), the effect of CO₂ emissions on life expectancy was negative. Moreover, as a robustness check, the FMOLS, DOLS, and FE-OLS long-run estimators were applied, and the outcomes validated the MMQR outcomes.

Mouteyica and Ngepah (2024) examined the convergence hypothesis in health outcomes using a panel data set from 40 African countries between 2000 and 2019. Employing a non-linear dynamic factor model, the study focused on three health outcomes: infant mortality rate, under-5 mortality rate, and life expectancy at birth. The findings indicate that while the hypothesis of convergence is not supported for the selected countries, evidence of convergence clubs is observed for the three health outcome variables. The study also examined the factors contributing to club formation by using the marginal effects of the ordered logit regression

model. The findings indicate that the overall impact of the control variables aligns with existing research. Moreover, governance quality and domestic government health expenditure emerge as significant determinants influencing the probability of membership in specific clubs for the child mortality rate models. In the life expectancy model, governance quality significantly drives club formation. The results suggest a need for common health policies across the different convergence clubs, while country-specific policies should be implemented for the divergent countries.

Methodology

Model Specification

The study hinges on the Grossman Health Model, sequel to model specified by Osemwengie and Okeke (2023) in determining the effect of healthcare financing on health outcomes in 14 selected African countries. The countries include Cameroon, Congo DR, Cote D'Ivoire, Egypt, Ghana, Morocco, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda, Kenya and Ethiopia. The countries were selected based on stratified sampling, cutting across the different sub-regions (North, South, East, West and Central Africa). The model is functionally specified below:

$$LEX_{it}=f(HCF_{it}, OPE_{it}, PCI_{it}).....1.0$$

Where:

LEX_{it} = Life Expectancy

HCF= Healthcare financing

OPE_{it} = Out of Pocket Expenditure

PCI_{it} = Per capita Income

To complete the specification of the econometric model, we consider the form of algebraic or linear relationship among the variables. The corresponding econometric model is specified in linear form:

$$LEX_{it}= \alpha_0+\alpha_1HCF_{it}+\alpha_2OPE_{it}+\alpha_3PCI_{it}+\mu_{it}.....2.0$$

Since the variables are in different measurements, regressing this nature of the variables leads to the problem of heteroskedasticity, therefore, in order to avoid the issue of heteroskedasticity, the variables will be rescaled into ratio through logging those them, thus the model was re-specified in a log linear form

$$LEX_{it}=\alpha_0+\alpha_1\ln HCF_{it}+\alpha_2\ln OPE_{it}+\alpha_3\ln PCI_{it}+\mu_{it}.....3.0$$

$\ln$ = Natural logarithm

α_0 = Intercept, which explains the average value of the dependent variable as the independent variables are held constant

$\alpha_{1,2,3}$ = Parameters of the independent variables. This measures the rate at which the dependent variables change, given that the dependent variables change by a unit.

μ = Stochastic or error term

it = Countries at time variant

The variables used in the study are described, along with their respective measurements and sources, in Table 1 below,

Table 1: Measurement and theoretical Expectation of the variables

Variable	Description	Measurement	Source(s)	A’priori Expectation
HCFit	Healthcare financing	Percentage of GDP spent on healthcare	WHO, World Bank	
LEXit	Life expectancy as a measure of health outcomes	Average number of years a person is expected to live	WHO, WDI	Positive
OPEit	Out-of-pocket healthcare expenditure	Percentage of total healthcare expenditure	WHO, IMF	Positive
PCIit	Per capita income	Constant USD per person	World Bank	Positive

Source: Author’s Computation, 2025

Estimation Techniques

This study adopts the Pooled Mean Group (PMG) estimator developed by Pesaran, Shin, and Smith (1999) within the framework of an Autoregressive Distributed Lag (ARDL) model for panel data. The PMG technique is particularly suitable for analysing panel data across countries due to the inherent heterogeneity. The PMG estimator allows short-run coefficients, intercepts, and error variances to differ across countries, while constraining the long-run coefficients to be the same across countries.

Before implementing the PMG estimator, several pre-estimation diagnostics were conducted to ensure the validity of the model. These include panel unit root tests, such as Levin-Lin-Chu (LLC) tests, to determine the order of integration of the variables. The variables are expected to be stationary at level $I(0)$ or first difference $I(1)$, but not at second difference $I(2)$. Additionally, panel co-integration tests, such as the Augmented Dickey-Fuller tests, were employed to verify the existence of a long-run equilibrium relationship among the variables. If cointegration is confirmed, the PMG estimator is appropriate for estimating both the long-run and short-run dynamics.

Result and Discussion

Table 2: Descriptive Statistics

	LEXP	HCF	OPE	LNGDPPCI
Mean	60.74833	4.674171	30.11802	6.999538
Median	60.62150	4.324230	24.94847	7.085564
Maximum	75.16100	9.013292	100.1612	9.064859
Minimum	47.14300	1.789449	2.084706	4.696781
Std. Dev.	6.195228	1.379979	23.87897	0.902659
Skewness	0.036793	1.068573	1.110708	-0.115239
Kurtosis	2.276841	3.722468	3.545125	2.686833
Jarque-Bera	6.560637	63.19283	64.96217	1.877318
Probability	0.037616	0.000000	0.000000	0.391152

Sum	18103.00	1392.903	8975.170	2085.862
Sum Sq. Dev.	11399.11	565.5896	169350.9	241.9938
Observations	298	298	298	298

Source: Author's Computation, 2025

Note: LEXP is Life expectancy, HCF is Healthcare Financing, OPE is Out-of-pocket Expenditure, GDPCI is GDP per Capita

The descriptive statistics in Table 2 provide valuable insights into the distribution and spread of the four key variables life expectancy (LEXP), healthcare financing (HCF), out-of-pocket expenditure (OPE), and GDP per capita (LNGDPPCI). The mean values represent the average levels across the 298 observations. Life expectancy averages 60.75 years, indicating that people in the sampled countries can expect to live roughly 61 years on average. Healthcare financing records a mean of 4.67, reflecting a relatively modest level of funding directed toward health. Out-of-pocket expenditure has a much higher mean of 30.12, showing that individuals bear a significant share of healthcare costs directly. GDP per capita, expressed in natural logarithms, averages 6.99, suggesting a moderate level of economic development. The minimum and maximum values highlight the range of each variable. Life expectancy varies widely, from a low of 47.14 years to a high of 75.16 years, showing large disparities in population health outcomes. Healthcare financing ranges from 1.79 to 9.01, indicating substantial differences in health sector investment across countries. Out-of-pocket expenditure spans an exceptionally broad range, from as little as 2.08 to a high of 100.16, pointing to extreme variations in personal healthcare costs. GDP per capita ranges between 4.70 and 9.06 (log values), underscoring notable economic diversity among the observations.

The standard deviation values measure the degree of variability around the mean, providing an indication of how dispersed the data are. Out-of-pocket expenditure displays the greatest variability (23.88), reflecting wide inequalities in personal health spending across the sample. Life expectancy shows a moderate spread with a standard deviation of 6.20, suggesting noticeable but less extreme differences in health outcomes. Healthcare financing (1.38) and GDP per capita (0.90) are relatively less dispersed, indicating more stability in health funding levels and economic output. The Jarque-Bera (JB) statistics test the normality of each distribution. Life expectancy records a JB statistic of 6.56 with a p-value of 0.0376, indicating a slight but significant deviation from normality. Healthcare financing and out-of-pocket expenditure show very high JB statistics (63.19 and 64.96, respectively) with p-values of 0.0000, confirming strong departures from normality driven by positive skewness and extreme values. In contrast, GDP per capita reports a JB statistic of 1.88 with a p-value of 0.3912, suggesting that it follows an approximately normal distribution. These results highlight that while economic development and life expectancy are relatively stable and close to normal, healthcare financing and out-of-pocket spending exhibit high variability and non-normal distributions, reflecting underlying inequalities in healthcare access and financing across the observed countries.

Table 3: Correlation Matrix

	LEXP	HCF	OPE	LNGDPPCI
LEXP	1			
HCF	0.010365	1		
OPE	0.397078	0.004832	1	
LNGDPPCI	0.342406	0.255679	0.237936	1

Source: Author's Computation, 2025

Note: LEXP is Life expectancy, HCF is Healthcare Financing, OPE is Out-of-pocket Expenditure, GDPCI is GDP per Capita

The correlation matrix in Table 3 reveals the strength and direction of the relationships among life expectancy (LEXP), healthcare financing (HCF), out-of-pocket expenditure (OPE), and GDP per capita (LNGDPPCI). Life expectancy shows a positive but weak correlation with healthcare financing ($r = 0.01$), suggesting that increased healthcare financing has little direct linear association with improvements in life expectancy within the sample. The relationship between life expectancy and out-of-pocket expenditure is moderate and positive ($r = 0.40$), indicating that higher personal health spending is associated with longer life expectancy, though this could reflect either better access to care or a higher cost burden in countries with longer lifespans. Life expectancy also exhibits a moderate positive correlation with GDP per capita ($r = 0.34$), consistent with economic literature showing that wealthier economies generally achieve better health outcomes (Preston, 1975). Healthcare financing is weakly correlated with both out-of-pocket expenditure ($r = 0.00$) and GDP per capita ($r = 0.26$), implying that increases in formal health funding do not necessarily translate into lower individual spending or closely track economic development. Out-of-pocket expenditure has a low positive correlation with GDP per capita ($r = 0.24$), suggesting that higher income levels are only slightly associated with greater personal health spending.

To evaluate potential multicollinearity, the rule of thumb proposed by Gujarati and Porter (2009) considers correlation coefficients above 0.80 as indicative of a serious multicollinearity problem. None of the pairwise correlations in Table 3 exceed this threshold, with the highest being 0.40 between life expectancy and out-of-pocket expenditure. This indicates that the variables do not exhibit problematic interdependence that could distort regression estimates. The absence of high correlations implies that each variable contributes unique information to the model, allowing for reliable estimation of their individual effects on life expectancy and related outcomes. This low level of multicollinearity strengthens the validity of subsequent econometric analyses, as the explanatory variables can be included together without concern for severe overlapping effects (Wooldridge, 2016).

Table 4: Panel Unit Root Test

	Levin, Lin & Chu t		Stationarity
	Level	First Diff.	
LEXP	-4.45366	-	I(0)
HCF	-1.13938	-4.69824	I(1)
OPE	-1.41526	-5.02161	I(1)
LNGDPPCI	-4.75904	-	I(0)

Source: Author's Computation, 2025

Note: LEXP is Life expectancy, HCF is Healthcare Financing, OPE is Out-of-pocket Expenditure, GDPCI is GDP per Capita

The panel unit root results in Table 4 indicate the order of integration for the study variables based on the Levin, Lin & Chu (LLC) test. Life expectancy (LEXP) and GDP per capita (LNGDPPCI) are stationary at level [I(0)], as their test statistics (−4.45366 and −4.75904, respectively) are significant, implying that these variables exhibit stable long-run properties without requiring differencing. In contrast, healthcare financing (HCF) and out-of-pocket expenditure (OPE) are non-stationary at level but become stationary after first differencing [I(1)], as shown by their insignificant level statistics (−1.13938 and −1.41526) but significant first-difference statistics (−4.69824 and −5.02161). This mixture of I(0) and I(1) series suggests that the data are suitable for estimation techniques such as the Autoregressive Distributed Lag (ARDL) or panel cointegration approaches, which can accommodate variables with different integration orders without risking spurious regression results (Pesaran, Shin, & Smith, 2001).

Table 5: Kao Residual Cointegration Test

		t-Statistic	Prob.
ADF		2.652654	0.0040
Residual variance		0.470746	
HAC variance		0.754231	

Source; Author's Computation, 2025

Note: LEXP is Life expectancy, HCF is Healthcare Financing, OPE is Out-of-pocket Expenditure, GDPCI is GDP per Capita

The Kao residual cointegration test in Table 5 shows a t-statistic of 2.652654 with a probability value of 0.0040, which is significant at the 1% level. This result rejects the null hypothesis of no cointegration and confirms the existence of a long-run equilibrium relationship among life expectancy (LEXP), healthcare financing (HCF), out-of-pocket expenditure (OPE), and GDP per capita (LNGDPPCI). In other words, despite short-term fluctuations, these variables move together over time, indicating that changes in healthcare financing and economic growth are closely linked to life expectancy in the long run. The residual variance (0.470746) and HAC variance (0.754231) further validate the robustness of the test by showing that the model's

residuals are stable and not excessively dispersed, supporting the conclusion of a stable long-run association (Kao, 1999).

Table 6: Estimated Result on Environmental Degradation and health outcomes in Selected Africa Countries

Dependent Variable: D(LEXP)				
Method: ARDL				
Sample: 2001 2022				
Included observations: 308				
Selected Model: ARDL(1, 1, 1, 1)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long Run Equation				
HCF	1.524643	0.428287	3.559860	0.0005
OPE	0.054290	0.005683	9.552270	0.0000
LNGDPPCI	1.599090	0.947514	1.687670	0.0930
Short Run Equation				
COINTEQ01	-0.082119	0.035646	-2.303748	0.0222
D(LEXP(-1))	0.273582	0.181675	1.505885	0.1336
D(HCF)	-0.069700	0.072989	-0.954942	0.3407
D(OPE)	0.007643	0.017114	0.446609	0.6556
D(LNGDPPCI)	0.448299	0.427938	1.047581	0.2960
C	3.924849	1.560378	2.515320	0.0126

Source: Author's Computation, 2025

Note: LEXP is Life expectancy, HCF is Healthcare Financing, OPE is Out-of-pocket Expenditure, GDPCI is GDP per Capita

The ARDL estimation results in Table 6 provide both long-run and short-run dynamics between healthcare financing (HCF), out-of-pocket expenditure (OPE), GDP per capita (LNGDPPCI), and life expectancy (LEXP) in selected African countries. In the long-run equation, all the explanatory variables have positive coefficients, indicating that improvements in these factors enhance healthcare financing over time. Specifically, HCF has a coefficient of 1.5246 ($p = 0.0005$), showing that a 1% increase in healthcare financing is strongly and significantly associated with a 1.52% increase in the dependent variable, reinforcing the critical role of sustained funding in promoting health outcomes. Out-of-pocket expenditure exhibits a coefficient of 0.0543 ($p = 0.0000$), signifying that a rise in personal health spending significantly boosts healthcare financing in the long run, though it may also reflect higher cost burdens on households. GDP per capita has a positive coefficient of 1.5991, but its probability value ($p = 0.0930$) indicates a weaker, marginally significant effect at the 10% level. This suggests that economic growth contributes to healthcare financing over time, but its impact is less robust compared to direct health spending and financing mechanisms.

In the short-run equation, the error correction term (COINTEQ01) is negative and significant (-0.0821 ; $p = 0.0222$), confirming the presence of a stable long-run relationship and indicating

that approximately 8.2% of any short-term disequilibrium is corrected within a year. This implies that deviations from the long-run equilibrium are gradually adjusted back to balance over time. However, most of the short-run variables—including changes in life expectancy [D(LEXP(-1))], healthcare financing [D(HCF)], out-of-pocket expenditure [D(OPE)], and GDP per capita [D(LNGDPPCI)] are statistically insignificant, with p-values well above 0.10. This suggests that short-term fluctuations in these variables do not exert an immediate effect on healthcare financing, and policy interventions may take time to translate into measurable changes. The positive and significant constant term ($C = 3.9248$; $p = 0.0126$) further indicates that other unobserved factors may provide a baseline contribution to healthcare financing in the region. Overall, the results highlight that long-run drivers, rather than short-run shocks, are the key determinants of healthcare financing in addressing environmental degradation and health outcomes across the selected African countries.

Discussion of Findings

The findings from the ARDL analysis show that healthcare financing and out-of-pocket expenditure have a significant positive long-run effect on health outcomes, while GDP per capita contributes positively but less strongly. The significant error correction term indicates a stable long-run adjustment process, meaning that improvements in healthcare financing eventually translate into better health outcomes such as life expectancy, even though short-run effects are weak. This implies that health sector investments in Sub-Saharan Africa require sustained commitment over time to yield measurable improvements in population health.

These results are broadly in line with previous empirical evidence. For instance, Chireshe and Ocran (2020) and Novignon et al. (2012) both found that higher total and public health expenditures significantly improve life expectancy and reduce child mortality in SSA, which supports the present finding that healthcare financing is a key driver of health outcomes. Similarly, Tae and Shannon (2013), using OECD countries, reported that greater public health expenditure improves life expectancy and reduces infant mortality, reinforcing the argument for sustained government investment. Farag et al. (2013) also highlighted the beneficial effects of macro-level health spending when accompanied by good governance, aligning with the long-run significance observed here. Likewise, Rad et al. (2013) found that public health expenditure significantly lowers infant mortality, but private spending shows weaker or inconsistent effects, echoing the current study's observation that while out-of-pocket expenditure contributes to health outcomes, it may reflect cost burdens rather than efficient financing.

Conversely, Syeda et al. (2013) reported a negative or insignificant relationship between health expenditures and health outcomes in South Asian countries, viewing health spending as a luxury good—a finding that contradicts the positive long-run association identified in this study for SSA. The current results also resonate with Otieno et al. (2024), who stressed the need to integrate mental health financing into national health budgets to achieve universal health coverage (UHC) goals, reinforcing the importance of broad-based health sector investment for long-term socioeconomic development. The evidence from developed economies such as Nixon and Usman (2006) further supports the notion of diminishing marginal returns to health spending in high-income contexts, which differs from the strong positive effect observed here, reflecting SSA's lower baseline health expenditure and greater potential for gains. Overall, the findings affirm the empirical consensus that public healthcare

financing is a critical determinant of health outcomes in SSA, while also highlighting that the benefits of private spending are mixed and must be carefully managed to avoid excessive household financial burdens.

Conclusion and Recommendations

This study examined the relationship between healthcare financing and health outcomes in selected African countries, using panel data spanning 2001 to 2022 and applying the Autoregressive Distributed Lag (ARDL) estimation technique. The analysis explored how healthcare financing, out-of-pocket expenditure, and economic growth, measured by GDP per capita, influence health outcomes, with life expectancy serving as a key indicator of population health. The panel unit root and cointegration tests confirmed a mix of stationary and non-stationary variables and the existence of a long-run equilibrium relationship among the variables, justifying the ARDL approach. Descriptive statistics highlighted considerable disparities in healthcare spending, personal health costs, and economic development across the region. Correlation analysis revealed weak to moderate positive relationships among the variables, with no evidence of multicollinearity, indicating that each variable independently contributes to explaining health outcomes.

The results show that healthcare financing and out-of-pocket expenditure significantly improve health outcomes in the long run, implying that increased investment in the health sector and individual health spending are crucial drivers of life expectancy in SSA. Economic growth also supports better health outcomes over time, though its impact is less pronounced compared to direct health-related spending. In the short run, however, changes in healthcare financing, personal health costs, and economic growth do not have immediate significant effects, suggesting that health improvements require sustained and long-term investments rather than short-term interventions. The significant error correction mechanism confirms a stable adjustment process, meaning that any short-term deviations from the long-run relationship are gradually corrected. Overall, the study underscores the importance of strengthening healthcare financing mechanisms and promoting economic development to achieve lasting improvements in health outcomes across Sub-Saharan Africa.

The study recommends the following:

1. Governments in Sub-Saharan Africa should prioritize sustained increases in public healthcare financing through budgetary allocations and innovative funding mechanisms. Expanding health budgets will reduce reliance on out-of-pocket spending, improve access to essential services, and support long-term improvements in life expectancy.
2. Policymakers should expand and strengthen national health insurance schemes to provide affordable and equitable healthcare. Broader insurance coverage will protect households from catastrophic health expenditures, reduce inequality in access to care, and ensure that health financing translates into better population health outcomes.
3. Economic development strategies should integrate health sector investments by channeling growth gains into improved healthcare infrastructure, human resources, and service delivery. Sustained economic growth, when linked to healthcare spending, can

create a virtuous cycle that enhances both health outcomes and overall well-being in the region.

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