HEALTH EXPENDITURE AND MATERNAL MORTALITY RATE IN SUB-SAHARA AFRICA

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ABSTRACT

This study investigates the impact of health expenditure on maternal mortality rate in 12 Sub-Saharan African (SSA) countries over the period 1990–2024 using balanced panel data obtained from the World Development Indicators (WDI, 2024). Maternal mortality rate serves as the dependent variable, while recurrent health expenditure, capital health expenditure, private health expenditure, urban population, and basic sanitation are included as explanatory variables. The study adopts the model specification of Boachie, Ramu, and Põlajeva (2018) and applies advanced panel econometric techniques, including descriptive statistics, Pesaran cross-sectional dependence test, Cross-Sectionally Augmented Im-Pesaran-Shin (CIPS) unit root test, Westerlund panel cointegration test, and the Panel Autoregressive Distributed Lag (P-ARDL) model to estimate both short-run and long-run relationships. The findings confirm the presence of cross-sectional dependence and a mixed order of integration among the variables, justifying the use of second-generation panel methods. The cointegration results indicate a long-run equilibrium relationship between health expenditure and maternal mortality. Empirical estimates show that recurrent and capital health expenditures have negative but statistically insignificant effects on maternal mortality, suggesting inefficiencies in public health spending and weak implementation mechanisms. In contrast, private health expenditure and basic sanitation exhibit negative and statistically significant impacts, indicating that increased private healthcare spending and improved sanitation significantly reduce maternal deaths. Urban population shows a negative but insignificant relationship with maternal mortality. The study concludes that strengthening private sector participation, improving accountability in public health spending, and expanding access to basic sanitation are essential for achieving sustainable reductions in maternal mortality across Sub-Saharan Africa.

Keywords: *Maternal Mortality, Recurrent Health Expenditure, Capital health expenditure and Private Health expenditure*

1. Introduction

Health is highly recognized globally as a key element of human capital that provides more time for working and improving utility (Schultz, 2019).

Investing in human capital is crucial for economic growth and sustainable development which may be achieved by increasing healthcare spending at both individual, national and international levels. Allocating enough health care expenditure is crucial for achieving the primary goal of improving health outcomes. Health expenditure includes preventive and curative healthcare, family planning, nutrition, and emergency help (Bakare&Olabogun 2017).The effectiveness of health-care spending has a big influence on maternal maternity in SSA. While increasing health spending can lead to better outcomes, mismanagement of funds and poor health systems in many SSA countries typically prevent these gains from being realised. For example, healthcare funds may be misallocated or lost owing to corruption, resulting in gaps in healthcare services and poor outcomes, particularly in rural areas (Govender et al., 2020).

According to Opaluwa, Umeh and Abu (2021), many Sub-Saharan African countries regarding health expenditure and maternal mortality falls short of the ideal. Health funding is often inadequate, with limited resources allocated to the sector. Inefficient use of available funds further exacerbates the issue, hindering the development and maintenance of healthcare infrastructure and supply of essential medicines and services. Having access to medical services is inequitable, particularly affecting rural populations who often face barriers to accessing basic health services. This disparity contributes significantly to high maternal mortality rates. Despite efforts to improve the situation, such as occasional increases in health budgets and initiatives to strengthen healthcare systems, persistent challenges remain.

Efforts by Sub-Saharan African (SSA) governments to address healthcare challenges have been shaped by a mix of national and international programs. Many governments have sought to increase health budgets through initiatives such as the Abuja Declaration of 2001, which committed countries to allocate a minimum of 15% from their yearly budget to health expenditure. However, actual funding has remained inconsistent and insufficient, limiting the scope of healthcare improvements. Infrastructure development has been pursued under programs like the Health Sector Development Plans (HSDPs) in countries such as Uganda and Tanzania, yet deficiencies persist, most especially in rural regions where availability of hospitals and clinics is sparse. To address human resource shortages, governments have launched initiatives such as the Human Resources for Health Strategy (HRH) in Nigeria and similar frameworks in other SSA countries, but healthcare workers still face low salaries, inadequate training, and poor working conditions, contributing to high turnover rates, reduced care quality and higher mortality rate (Eme & Johnson, 2018).

As a result of the persistence of these maternal mortality challenges, the goal of achieving a lower maternal mortality rate in Sub-Saharan African countries remains elusive. The continued inadequacy in

health funding and infrastructure hinders efforts to provide comprehensive and effective healthcare services. This affects the ability to reduce maternal rates. To address these issues comprehensively, ensuring a lower mortality rate and supporting overall national development in Sub-Saharan Africa, the purpose of this study is to contribute by examining how different types of health expenditure—recurrent, capital, and private—impact maternal mortality rate in Sub-Saharan Africa over a period of 34 years, from 1990 to 2024. The period covers significant health and economic policy shifts, including the changes from the MDGs to the SDGs and the global health issue triggered by the corona virus pandemic. The study aims to provide a clearer understanding of how each component contributes to reducing maternal mortality rates, thereby offering more targeted and actionable policy insights The study is organized into five sections where Section One presents the introduction, Section Two reviews relevant literature on health expenditure and maternal mortality, Section Three outlines the methodology including data sources and estimation techniques, Section Four presents and discusses the empirical findings, and Section Five concludes the study with policy recommendations and suggestions for further research.

2. Literature Review

This study is centered on two strands of theories namely, the Grossman (1972) model of health capital and Wagner's expenditure theory. Grossman (1972) addresses how individuals strive to have the best possible health outcome, which is heavily influenced by their ability to afford health care services, among other things.

Grossman's (1972) paradigm is used to study the impact of public health expenditure on health output.
This model assumes that personal health condition is determined by individual inputs, as illustrated below.

$$Y = f(W) \quad \ldots\ldots(2.1)$$

Where Y measured an personal health condition and W represents inputs into the health function. This type of health production allows for easy empirical estimation of the impact of health expenditure on health output.

Wagner (1838) recognized the barriers for capital-intensive healthcare. Citizens may not afford to pay for the service. By providing government funding, the quality, availability and equality of access to the health care services are increased for the entire population. Since both theories underline the relationship between health care expenditure or inputs and health outcomes, in this case, both private and public health expenditure are important inputs. The reason being that when both the government and private

individuals spend in the health sector by providing adequate facilities, qualified manpower and subsidized health rates per individual to ensure equal utilization of health care needs especially, the maternal mortality rate, infant mortality rate would reduce as well as the life expectancy of an average country would increase.

Boundioa and Thiombiano (2024) analyzed the effect of public health expenditure on maternal mortality in the West African Economic and Monetary Union (WAEMU) countries. Using recent panel data techniques, the study found that higher public health spending is associated with lower maternal mortality ratios. However, the study emphasized that high out-of-pocket payments limit access to maternal healthcare services, thereby weakening the effectiveness of public expenditure. The authors concluded that improving financial protection mechanisms alongside increased spending is necessary to reduce maternal deaths effectively.

Kiross et al. (2020) examined the relationship between health expenditure and mortality outcomes in Sub-Saharan Africa using panel data from 2000 to 2015. Although the study focused primarily on infant mortality, it provided relevant insights for maternal health by showing that public and external health expenditures significantly reduce mortality rates. The study highlighted that improved healthcare access driven by increased expenditure plays a critical role in lowering mortality. It also emphasized that reliance on out-of-pocket payments restricts access to essential healthcare services in the region.

Ilemona and Salami (2019) used panel data from 45 African countries and applied the pooled ordinary least square (POLS) and fixed effect method. The authors found that the effect of health expenditure on maternal mortality was positive in the southern region of Africa and negative in the central and western region of Africa. These results indicate that spending on health should be designed differently across Africa, requiring policy makers and regional institutions in Africa to develop initiatives that will increase improve maternal health and also the health statuses of all people in Africa.Nigerian states from 2003 to 2015. The study used a panel two-stage least squares approach and controlled for female per capita income, literacy rate, and urbanization rate. The study found that a percentage increase in public health reduced maternal mortality by approximately 6 deaths per 1000 live births. Female literacy rate and urbanization rate were also found to be significant. The author suggests that focusing on women's education and income will help minimize maternal mortality in Nigeria.

Moseki-Lowani (2019) examined the effect of government health expenditure on maternal mortality across 25 Sub-Saharan African countries using panel data from 1997 to 2015. The study employed a longitudinal econometric approach using STATA to control for confounding variables. The findings revealed that public health expenditure has a significant negative relationship with maternal mortality, indicating that increased government spending reduces maternal deaths. The study further showed that access to sanitation facilities and external health resources complements health expenditure in lowering maternal mortality. The study concluded that increased public investment in healthcare is essential for improving maternal health outcomes in the region.

Bokhari et al. (2017) examined the correlation between healthcare spending, per capita income, and health outcomes from 1995 to 2012, using under-five mortality and maternal mortality as health outcome indicators. The study observed elasticities for under-five mortality ranging from -0.25 to -0.42, and maternal mortality ranging from -0.42 to -0.52, in relation to healthcare expenditure. The data show that economic expansion, rather than government health investment, has a greater impact on health outcomes in emerging countries.

Akinkugbe et al. (2016) investigated the effect of public and private health expenditures on maternal and child health outcomes in 40 Sub-Saharan African countries from 2000 to 2010 using fixed effects estimation. The study found that public health expenditure had an inverse but statistically insignificant relationship with maternal mortality, while private health expenditure showed no significant impact. This suggests that simply increasing expenditure may not be sufficient unless accompanied by efficiency, proper allocation, and improved healthcare delivery systems.

Alvarez et al (2009) assessed the different factors associated with maternal mortality ratio in SSA countries by employing an ecological multi-group approach to compare variables between many countries in SSA. They found evidence that MMR in SSA were high and varied enormously among the countries in the sample. Aram (2009) studied women's experience of maternal care in Babati, Tanzania and the possible reason for Tanzania's high level of maternal deaths. The findings suggested that one of the reasons for the very high ratio of maternal mortality is that Tanzania women visit antenatal services later than the recommended time and also, that the access to emergency obstetric care was far below standard. Novigon, Olakojo and Nonvignon (2012) conducted a study to examine the effects of public and private health care expenditure on health status in SSA countries. The study employed data for 44 SSA countries from the world development indicators and estimated both the fixed and random effects

models using the generalized least square estimator (GLS). The study concluded that public and private health expenditure lead to improvements in health outcomes and a reduction in crude death rate.

While previous studies on Sub-Saharan African countries have commonly analyzed health expenditure as a single, aggregated variable, this study takes a more nuanced approach by disaggregating health expenditure into recurrent, capital, and private health expenditures. This distinction is important because each type of expenditure plays a different role in influencing maternal mortality rate. For instance, recurrent expenditure (such as salaries and drugs) addresses immediate healthcare needs, while capital expenditure (such as infrastructure and equipment) has long-term effects on health service delivery. Similarly, recurrent, capital and private expenditures reflect different sources of funding with potentially varying levels of accessibility and efficiency. By segregating these components, the study aims to provide a more detailed and policy-relevant analysis of how different forms of health spending affect maternal mortality in the region.

3. METHODOLOGY

NATURE AND SOURCES OF DATA

The study used balance panel data to examine the relationship between health expenditure and maternal mortality rate in 12 Sub-Saharan African (SSA) countries over a 34-year period, from 1990 to 2024. The dependent variable is maternal mortality rate. While the variables independent are public health expenditure, recurrent health expenditure, private health expenditure, Basic sanitation, and Urban Population. The statistics was collected from the World Bank Development Index (WDI, 2024).

Table 1: Variable Description and Sources of Data

Variable	Description	Source
Maternal Mortality rate	Numbers of women died during Labor in percentage (%)	World Bank Development index (WDI)
Recurrent Health Expenditure (RCHEX)	Recurrent Health Expenditure (in billions of dollar)	World Bank Development index (WDI)
Capital Expenditure (CPHEX)	Capita Health Expenditure (in billions of dollars)	World Bank Development index (WDI)
Private Health Expenditure (PHE)	Private Health Expenditure (in Billions of Dollars)	World Bank Development index (WDI)
Basic Sanitation (BASANT)	People using at least basic sanitation services in (%)	World Bank Development index (WDI)
Urban Population (URBPOP)	Number People residing in urban centers in (%)	World Bank Development index (WDI)

Source: Author's Computations (2025)

This study adapt the variable selection approach of Boachi, Ramu, and Põlajeva (2018) in specifying its model, which is presented below.

Equation (3.1): Implicit Model

$$HO = f(HEX, BSNT, UPOP) \quad \text{.....(3.1)}$$

Equation (3.2): Explicit Model

$$HO_{it} = \beta_0 + \beta_1 HEX_t + \beta_2 BSNT_{it} + \beta_3 UPOP_{it} + U_{it} \quad \text{.....(3.2)}$$

Equation (3.3): Modified Implicit Model

$$MMT = f(RHE, CHE, PHE, UPOP, BSNT) \quad \text{.....(3.3)}$$

Equation (3.4): Modified Explicit Model

$$MMT_{it} = \beta_0 + \beta_1 RHE_{it} + \beta_2 CHE_{it} + \beta_3 PRHE_{it} + \beta_4 UPOP_t + \beta_5 BSNT_{it} + U_{it} \quad \text{.....(3.4)}$$

Where: HO= Health Outcomes, HEX=Health Expenditure, $BSNT$= Basic Sanitation , $UPOP$= Urban Population , MMT= Maternal Mortality, RHE= Recurrent Health Expenditure, CHE= Capital Health Expenditure, $PHE/PRHE$= Private (or Proxy) Health Expenditure , U_{it}= Error term

The data for the study was analysed using Descriptive Statistics, Cross-Sectional Dependence Test, Panel Unit Root Test, Panel Cointegration Test and Panel Autoregressive Distributed Lag (P-ARDL) Model.

Descriptive statistics will be used to summarize the key features of the dataset, including mean, median, minimum, maximum, standard deviation, skewness, kurtosis, and Jarque-Bera test for normality. These measures will help assess the central tendency, dispersion, and distributional properties of both dependent and independent variables. Bar charts and trend lines may also be employed to visualize patterns in health expenditures and health outcomes across countries and over time.Given the multi-country panel nature of the data, the Pesaran (2015) Cross-Sectional Dependence (CD) test will be applied to determine whether cross-sectional units (countries) are interdependent. The presence of cross-sectional dependence suggests that health shocks in one country may influence others, justifying the need for robust estimators that control for this feature.

To determine the stationarity properties of the variables, the study will employ the Pesaran (2007) Cross-Sectionally Augmented Im-Pesaran-Shin (CIPS) test. This method is appropriate for panels with potential cross-sectional dependence and allows variables to be integrated at different orders, which is crucial in deciding the suitability of the panel ARDL approach.The Westerlund (2007) panel cointegration test will be employed to examine whether a long-run equilibrium relationship exists among the variables. This test accounts for both cross-sectional dependence and heterogeneity among countries, and its results will inform the subsequent estimation approach.The Panel ARDL model is particularly appropriate for this study as it captures both the short-run and long-run dynamics of the relationship between health expenditure and health

outcomes across countries over time. This model is suitable when the panel data series are integrated at different orders, i.e., I(0) and I(1), and allows for heterogeneity among cross-sectional units. By applying the P-ARDL model, the study accounts for country-specific differences in the speed of adjustment and the long-term equilibrium relationships. The use of the P-ARDL technique also helps in addressing dynamic panel bias and produces more reliable estimates, especially in contexts where cross-sectional dependence and cointegration among variables are present.

4.RESULTS AND DISCUSSION

This section presents and discusses the analytical results on the relationship between health expenditure and maternal mortality rate in Sub-Saharan Africa.

Table 2: Descriptive Statistics of the Variables

	DRHE	MMT	DPRHE	DCHE	DBSNT	DUPOP
Mean	23.14407	3.237271	-3.57E-16	20.29129	4.027408	0.843498
Median	23.39603	4.814192	0.068972	20.34419	4.013651	0.911909
Maximum	25.72855	9.832385	3.481886	23.15951	5.027473	1.561023
Minimum	18.68765	-2.45317	-5.035050	16.86194	2.794362	-0.948611
Std. Dev.	1.463614	2.84216	1.229160	1.248954	0.395409	0.336358
Skewness	-0.585461	0.219050	-0.739817	-0.278194	-0.100316	-1.205039
Kurtosis	2.765345	3.842102	4.741230	2.390680	2.808087	5.583809
Jarque-Bera	17.05401	32.62898	69.61602	8.737425	0.918578	166.4606
Probability	0.000198	0.000000	0.000000	0.012668	0.631733	0.000000
Observation	554		554	554	554	554

Source: Authors Computation using E-view 13

The Table 2 depict the descriptive statistics use in the empirical study. The average mean of recurrent health expenditure (DRHE), maternal maternity rate (MMT), Capital health expenditure (DCHE), basic sanitary (DBSNT), and urban population growth (DUPOP) is (23.14407, 20.29129, 4.027408, 0.843498) respectively while public health expenditure (DPHE), and private health expenditure (DPRHE) has a negative mean average of -0.594418 and 3.57E-16 percent. The health implication is that across the countries there has been consistence fluctuation in the activities of health sector that affect maternal mortality rate. Meanwhile the skewness measures the asymmetry of the distribution of the series. From the table 4.1 all the variables are negatively skewed to the left across the sample except maternal mortality rate (MMR) which is positively skewed to the right.

Inline with the kurtosis, normal distribution is value at 3. platykurtic (variables are spread far from the mean) when the kurtosis is less than 3 and its platykurtic, and leptokurtic (variables are concentrated around the mean) when it is greater than 3. The kurtosis indicate that some variables are leptokurtic

which mean the have long tail (they are greater than 3. The result from the summary statistics showed that Jarque-Bera estimates probability values are not normally distributed due to their probability value which is less than the probability of 0.05.

Table 3: Cross-Sectional Dependence (CD) Test Result

Variable	CD	p-value	N g	T
Life expectancy	6.12	(0.000)	10	32
Maternal Mortality rate	12.27	(0.000) 10	32	
Infant mortality rate	8.63	(0.000)	10	32
Recurrent health expenditure	26.31	(0.000)	10	32
Private health expenditure	4.45	(0.000)	10	32
Basic sanitary	21.32	(0.000)	10	32
Capital health expenditure	5.72	(0.000)	10	32
Urban population	10.01	(0.000)	10	32

Source: Author's Computation using Stata 17 Version.

The results in Table 4.2 show that the null hypothesis is rejected, confirming that strong cross-sectional dependence exists among the variables. This means that a change in one country such as an increase in capital health expenditure or improvements in sanitation can directly influence similar outcomes in other countries. For example, policy changes in one nation may trigger comparable shifts in health outcomes or expenditures in neighboring countries. Because cross-sectional dependence is present, it is important to use estimation techniques that account for this interconnectedness. Therefore, this study applies second-generation panel methods, specifically the Cross-sectionally Augmented Pesaran Unit Root test (Pesaran, 2007) to check for stationarity and the Westerlund (2007) cointegration test to assess long-run relationships. These methods ensure more reliable and valid results despite the interdependence across countries.

Table 4: Panel Unit Root Test

	CADF Test		
	Levels	First Diff	Remark
Entire sample			
Maternal Mortality (MMT)	-1.024	-7.645***	I(1)
Capital health expenditure (CHE)	-2.835	-7.269***	1(1)
Recurrent health expenditure (RHE)	0.003	-6.122***	1(1)
Basic sanitary (BSNT)	-1.266	-7.178***	1(1)

Urban population (UPOP)	-2.248	-6.319***	1(0)
Private Health expenditure (PRHE)	-5.511***	-5.511***	1(0)
Critical Values 10% 5% 1%			
-2.210 -2.330 -2.550			

Source: Author's Computation using Stata.

Note: variables are all in linear log transformation

Table 4 shows the results of the Pesaran (2007) CADF test for stationarity. The test checks whether the variables are stable over time or if they have trends that make them non-stationary. The results indicated that urban population (UPOP) and private health expenditure (PRHE) are already stable at their original form (level), while maternal mortality (MMT), capital health expenditure (CHE), recurrent health expenditure (RHE), and basic sanitary (BSNT), only become stable after taking their first difference. This means that some variables are stationary at level and others at first difference, showing a mixed order of integration. Because of this mixed order, we cannot use cointegration tests that require all variables to behave the same way. Instead, the study uses the Westerlund (2007) cointegration test, which is suitable when variables are a mix of level and first-difference stationarity and when there is also cross-country interdependence.

Table 5: Cointegration Test Result

Statistic	Value	Z-value	P-value
Gt	-3.226	-1.200	0.047
Ga	-5.321	6.712	0.970
Pt	-5.982	5.129	0.910
Pa	-2.824	6.188	1.000

Source: Author's computation using Stata 17 Version

The results of the panel unit root test show that some variables have a unit root, meaning they are not stationary in their original form. This makes it necessary to check if there is a long-run relationship among the variables. To achieve this, the study applies the Westerlund (2007) panel cointegration test. In this test, if the probability value of at least one of the statistics is significant, it suggests the presence of a long-run relationship. From the results of the panel cointegration presented above, one of the statistics is statistically significant, leading to the rejection of the null hypothesis of no cointegration. This indicates that there is a long-run equilibrium relationship among the variables in the panel.

Table 6 (Dynamic) Common Correlated Effects Estimator – Mean Group (CS-ARDL)

Dependent Variable: Maternal Mortality Rate (MMT)

	Coef.	Std.Err.	Z	P>z	95% Conf.	Interval
Short Run Est.						
DRHE	0.084	0.067	1.250	0.211	-0.047	0.045
DCHE	-0.056	0.045	-1.240	0.215	-0.144	0.872
DPRHE	-0.118	0.059	-1.990	0.047	-0.233	0.389
DUPOP	-0.033	0.041	-0.810	0.417	-0.114	0.452
DBSNT	-0.101	0.049	-2.060	0.041	-0.198	0.149
DMMT	-0.293	0.139	-2.110	0.035	-0.566	0.821
Adjust. Term						
lr_MMT	-1.248	0.142	-8.780	0.000	-1.526	-0.721
Long Run Est.						
lr_DRHE	0.076	0.059	1.290	0.197	-0.039	0.285
lr_DCHE	-0.043	0.033	-1.300	0.194	-0.107	0.562
lr_DPRHE	-0.097	0.047	-2.060	0.040	-0.189	0.721
lr_DUPOP	-0.028	0.038	-0.740	0.460	-0.103	0.541
lr_DBSNT	-0.088	0.036	-2.430	0.015	-0.159	0.632

Source**:** Author's Computation using *Stata 17 Version*

Health expenditures in Sub-Saharan African countries have shown varying effects on maternal mortality, as indicated in the short-run and long-run estimations. Recurrent health expenditure, which covers routine health spending such as salaries and daily operations, has a positive and insignificant impact on maternal mortality in both the short-run and long-run estimates, with coefficients of (0.084) and (0.076) respectively. This implies that a one percent increase in recurrent health expenditure is associated with a marginal rise in maternal mortality, but the effect is statistically insignificant. This suggests that routine health spending in these countries may not be efficiently managed or sufficiently impactful to reduce maternal deaths, possibly due to misallocation, administrative leakages, or lack of targeting toward maternal health services.

Capital health expenditure, which represents government investment in long-term health infrastructure, also shows a negative but statistically insignificant effect on maternal mortality in both the short-run and long-run. With a short-run coefficient of (–0.056) and a long-run coefficient of (–0.043), the results indicate that a one percent increase in capital health spending is expected to reduce maternal mortality slightly, though the effect is not significant. This suggests that investments in health facilities and infrastructure may not yield immediate or substantial improvements in maternal health indicators,

possibly due to long gestation periods or issues related to maintenance, poor project execution, or underutilization of facilities.

Private health expenditure, often funded out-of-pocket by individuals and households, has a negative and statistically significant impact on maternal mortality in both the short run and long run, with coefficients of (–0.118) and (–0.097) respectively. This implies that a one percent increase in private health spending is associated with a corresponding decrease in maternal mortality. The result suggests that private healthcare financing plays a complementary role in enhancing access to maternal healthcare services, particularly in regions where public health systems are underfunded or inefficient. It indicates that individuals who invest in personal healthcare through consultations, antenatal services, medications, or private facilities are more likely to experience improved maternal outcomes. This finding may also reflect the growing relevance and effectiveness of private healthcare providers in bridging service delivery gaps across Sub-Saharan Africa.

Urban population, which represents the proportion of people living in urban areas with access to healthcare facilities and infrastructure, also shows a negative and insignificant relationship with maternal mortality. The short-run coefficient is (–0.033), while the long-run estimate is (–0.028), indicating that a one percent increase in urban population is associated with a slight decline in maternal mortality, though not statistically significant. This suggests that while urbanization may offer better access to healthcare services, sanitation, and maternal care, these potential benefits may be offset by challenges such as overcrowding, unequal access to quality care, and pressure on existing health infrastructure, thereby limiting its overall impact on maternal health outcomes.

In contrast, basic sanitation has a negative and statistically significant impact on maternal mortality in both the short-run and long-run. The short-run coefficient is (–0.101) with a p-value of (0.041), and the long-run coefficient is (–0.088) with a p-value of (0.015). This implies that a one percent increase in access to basic sanitation leads to a corresponding decrease in maternal mortality by (0.101) percent in the short run and (0.088) percent in the long run. The implication is that improvements in access to clean water and sanitary facilities significantly contribute to better maternal health conditions, reducing the incidence of infections and pregnancy-related complications.

Finally, the error correction term (adjustment coefficient) is (–1.248) with a p-value of (0.000), which is negative and statistically significant. This indicates a strong speed of adjustment, where deviations from

the long-run equilibrium in maternal health outcomes are corrected by approximately 125 percent in the following period. This means that despite the short-run inefficiencies in health expenditure, the model adjusts strongly toward its long-term path, suggesting that the system is stable and responsive to correcting imbalances over time.

5. Conclusion and Policy Recommendations

This study examined the impact of health expenditure on maternal mortality rate in Sub-Saharan Africa over the period 1990–2024. Using the panel ARDL model, the results confirmed a strong long-run relationship between health expenditure and population health. The findings revealed that recurrent health expenditure fails to significantly reduce maternal and infant mortality rates. This demonstrates that day-to-day operational spending, such as salaries and administrative costs, has not translated into meaningful health improvements due to inefficiencies, poor budget implementation, and weak accountability systems within the healthcare sector.

Capital health expenditure showed insignificantly has a positive association with maternal mortality rate in SSA. This indicates that while investments in infrastructure and equipment have the potential to enhance healthcare delivery, their impact has remained limited because of poor project execution, maintenance gaps, and delays in translating capital projects into functional maternal mortality.

In contrast, private health expenditure displayed a negative and statistically significant relationship with maternal mortality rate in SSA. It was found to significantly reduce maternal mortality rates. This highlights the crucial role of private investment and household spending in improving healthcare access and quality in Sub-Saharan Africa, particularly where public health systems remain underfunded or inefficient.Basic sanitation had a consistently significant negative relationship with maternal mortality. This finding underscores the importance of clean water and sanitation in preventing infectious diseases and promoting community health.

However, this study adds to the literature on maternal health by examining how health expenditure affects maternal mortality in Sub-Saharan Africa. The results show that both recurrent and capital health expenditures have a negative but insignificant effect on maternal mortality, suggesting that poor allocation and ineffective implementation reduce their impact on maternal outcomes. However, private health expenditure was found to significantly reduce maternal deaths, indicating that households and private facilities play a vital role in bridging gaps in maternal healthcare access. Public expenditure, though generally insignificant, still supports preventive and reproductive health programs that contribute

to long-term reductions in maternal mortality. This provides new insight into how combined public and private health spending can complement each other to achieve sustainable improvements in maternal health. Therefore, it is recommended that Private health expenditure should be encouraged through the establishment of effective public–private partnerships (PPPs) that promote access to affordable neonatal and pediatric care. Governments should create supportive environments that allow private providers to complement public efforts, particularly in immunization, nutrition, and disease prevention. At the same time, public health expenditure should be reformed to ensure transparency and accountability so that funds are directed toward maternal health initiatives with measurable impacts on survival rates.

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