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Uncovering The Link Among Institutional Qualities, Expenditure On Health And Mortalities In West Africa

by

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Abstract

The study aims to analyse the effect of institutional quality and health expenditure on mortalities in West African countries. In addition, analysis was done using both public health expenditure and Out-of-Pocket (OOP) health expenditure. This study relies on demand for health theory that focuses on the role of health investments in improving health outcomes. Therefore, the study analysed the effect of government expenditures and out-of-pocket expenditures on mortality indicators such as infant, maternal, and crude death rates. The analysis was carried out using secondary data from the World Bank Indicators (WDI). Fixed-effects and random-effects panel regression models were used to carry out the analyses and Hausman test was performed to pick between the fixed-effects and random-effects models. The results shows that in West African countries, government expenditure reduced mortality rate with the moderation of institutional quality, while increased OOP health expenditure increased infant mortality, maternal mortality, and crude death rate. This revealed that due to financial constraints, high OOP cost reduces individuals' access to quality care, highlighting the significance of reducing personal health burdens through public funding. Therefore, policies developed should be aimed at improving institutional quality as well as expanding public health funding are vital strategies towards reducing mortality rates and improving health equity across West African countries.

Keywords: Institutional quality, mortality rates, health outcomes, health expenditure, fixed effect, Out-of-pocket expenditure, government expenditure

1. Introduction

Individuals across various age groups have a stock of health. In order to improve or maintain individual quality of health, health expenditures are imperative. Health is a fundamental component of human capital and economic development. In the absence of necessary investment for good health such as spending on health, exercise, preventive care and so on; health level will deteriorate to the lowest level and lead to death (Grossman, 1972). The world recognises the importance of health and this necessitated the featuring of good health and well-being as one of the primary targets in the Sustainable Development Goals (SDGs) and it is well spelt out under the third goal of SDGs. SDG Goal 3 aims to ensure healthy lives and promote well-being for all at all ages, which is underpinned by the adequate financing of healthcare systems, reducing the barrier of inadequate access to healthcare caused by Out-of-Pocket (OOP) health spending; direct household payment on health services without any form of reimbursement from a third party including insurance and government aid.

Expenditure on health is an imperative tool to ensure effective and efficient healthcare system performance (Olatunde et al., 2019). This undiluted role of health expenditure led to the agreement of the head of states at Abuja conference in 2001 that members should allocate 15% of their yearly budget to the health sector so as to increase government expenditure and reduce the burden of healthcare on households. Unfortunately, many African countries are not even close to 10%. Nevertheless, countries like Rwanda, Botswana, and Zambia have made significant progress towards meeting or exceeding this target (World Health Organisation, WHO, 2021, Daily Trust, 2023). In 2021, South Africa and Cabo Verde were also notable for achieving the Abuja target (One Campaign, 2023). Kouadio and Mom (2024) showed that increased government health spending according to the Abuja declaration has led to better health outcome. However, inadequate implementation has delayed the progress of curbing mortality rates in West Africa (Oluwaseyi et al., 2022).

It is worth noting that health expenditure encompasses public and private spending on healthcare. The private health expenditure combines spending by households, corporations and non-profit organizations funds. However, the low contribution of the government in Africa to the health financing pool has transferred the burden of healthcare expenditure to households who are now

compelled to pay for healthcare through Out-of-Pocket (OOP). This has a critical implication on mortality health outcomes in West African countries. OOP between 2012 and 2020 accounted for average of 35.8% in the region, highlighting the overwhelming burden of healthcare costs on households, especially in the lack of adequate funds from the government. However, government health expenditure as percentage of current health expenditure as at 2020 ranged between 2.1% and 12%. This low investment in health could be as a result of weak institutional frameworks that affects budget implementation. Report from WHO (2023) stated that OOP continue to be a major funding source for health expenditure in Africa, posing a high risk of financial hardship, particularly for vulnerable populations.

Inadequate funding for healthcare is capable of generating high mortalities outcomes. Oladosu et al. (2022) ascertained that decrease in health expenditure is associated with high mortalities. The Abuja Declaration agreement might have helped African countries to have recorded reduction in mortalities rate compared to the past two decades but has been inadequate to achieve the third goal of SDGs in 2030. In the fact sheet released by WHO in 2023, African region recorded 7.7million death in 2019 compared to 8.7 million death in 2000. More than 1 in 3 deaths in this region were under five children and maternal death recorded more than 46,000 deaths. The major leading causes of death in this region are communicable diseases, maternal, perinatal and nutritional conditions. High mortality rates in Africa are often attributed to factors such as poverty, limited access to healthcare, and prevalent diseases. Aside these, West Africa is also considered to be highly susceptible to wide spread of infections and persistent disease outbreaks like meningitis, monkeypox, Lassa fever, Ebola as well as COVID 19 due to adverse climatic and environmental factors (Angell et al., 2022).

While well-funded healthcare is necessary, the utility of health spending can be impacted by the characteristics of the institutions through which it is spent. Health expenditure efficiency and effectiveness can be largely explained by institutional quality as measured through government effectiveness, regulatory quality, and control of corruption. For example, outpourings of resources, like corruption and inefficiency, can pull in resources, making them less effective at mortality reduction. Ibukun (2021) stated that high-quality institutions can ensure that health funds are allocated and used effectively, leading to reduce mortality rates and promote better health outcomes. In contrast, nations with weaker institutional setups face

problems in translating health expenditure into improved mortality outcomes. Research shows that institutional mismanagement and corruption in many West African countries adversely affect health spending outcomes, leading to continual high maternal and child mortality rates (Akinwale, 2021).

In the literature, increased health expenditure is essential for improving health outcomes; its impact is significantly mediated by the quality of institutions. While the existing literature provides valuable insights into the relationship between institutional qualities, health expenditure, and mortality outcomes, many studies focused on aggregated data for sub-Saharan Africa, with limited exploration of West Africa. With several studies on this research in sub-Saharan Africa, focus on only mortality rates as health outcomes is not common. Many studies combined mortality rates with life expectancy. The most obvious among the gaps in the literature is that OOP from households which constituted larger percentage of private health expenditure has not been treated single handedly. By examining the empirical nature and exploring the detailed connections between institutional quality, health expenditure, and mortality outcomes, this study contributes to an in-depth understanding of the contributing factors to health outcomes in West Africa and informs policy makers on necessary steps to tackle identified challenges.

The structure of this paper is divided into five parts. Following the introductory part of the study is the literature review to show the contribution of existing studies, the third section discusses the methodology, while results and discussion is the focus of the fourth section. The final session presents the conclusion and recommendation.

2. Literature

The inter-link among institutional qualities, expenditure on health and mortalities outcomes is traceable to two major theories. One is the demand for health theory (Grossman, 1972) which captures health expenditure from both private and public sides and two is the Wagner's theory propounded by Adolf Wagner in 1883 which capture only public health expenditure. According to Grossman, individuals view health as an investment in their human capital through spending. Spending on health (health expenditure) is seen as a key factor in maintaining and improving an individual's stock of health. The result of investments in health capital is health outcomes. Accordingly, health outcomes improve when individuals allocate more resources towards

healthcare, make healthier lifestyle choices, and benefit from better medical care. With the help of health expenditure, health outcomes can improve, but its effectiveness depends on the broader institutional environment. Strong institutions ensure that resources are used efficiently, enhancing the return on health investments and vice versa for poor institution. Wagner's theory on the other hand from public sector side states that the government tends to allocate more resources to public services, including healthcare, as the nation's economy grows. This increased health expenditure is expected to lead to better health outcomes, such as higher life expectancy and lower infant mortality rates (Musgrave and Musgrave, 1989). However, the relationship between health spending and health outcomes is deeply influenced by the efficiency and effectiveness of the expenditure. The efficiency and effectiveness of the expenditure is shaped by the institutional quality of a nation. Strong institutions can ensure that the rise in health expenditure improves health outcomes, while the reversed case can prevent these benefits from being fully identified, regardless of the amount invested in health.

Empirical frontier of knowledge on this topic has diverse opinion due to measurement for health expenditure and proxy for health outcomes. Studies have combined mortalities and life expectancy with private and/ public health expenditure without single handedly using OOP that contributes larger percentage to private health expenditure in regional analysis or sub-region analysis. Recent study in West Africa by Osei et al. (2023) considered only child health with government health expenditure without considering OOP and other mortality rates. The study used pooled mean group and found that government expenditure has negative long run effect on under-five mortality rate and prevalence rate of stunting. Also, Boundioa and Thiombiano (2024) used the two-stage least squares (2SLS), a techniques used in addressing endogeneity in regression analysis and panel-corrected standard error (PSCE) across countries in West Africa. They proxy health outcome with just maternal mortality rate and found that public health expenditure reduced health comes, while private health expenditure had significant and positive result on it. Even though private health expenditure was considered in their case, OOP lumped up with corporations and non-profit organizations expenditure to sum up private health expenditure and only one health outcome was used. Another study conducted among ECOWAS countries by Zhou et al. (2023) considered private health expenditure, government health expenditure and external health expenditure combined with life expectancy and infant mortality rate only. In their submission, government expenditure is capable of increasing infant mortality

rate going by the revealed positive and significant results exhibited by both variables after performing Fully Modified Ordinary Least Squares (FMOLS), a techniques used for estimating long-run relationships in panel data. Also, infant mortality rate responded significantly negative to private and external expenditures, life expectancy increased with private health expenditure and the opposite is the response for public health expenditure.

The use of fixed panel Ordinary Least Squares (OLS) by Anyanwu and Erhijakpor (2009) with the focus on African countries generated results for only public health expenditure. They found that public health expenditure significantly affected infant and under-five mortality rates and the effect was negatively related. Oladosu et al., (2022) sampled two countries in West Africa (Ghana and Nigeria) and used infant mortality, maternal mortality, malaria mortality, and HIV/AIDS morbidities as proxy for health outcomes to check the effect of public health expenditure on them. The outcome from their study showed that public health expenditure had negative impact on health outcomes in Ghana while the relationship was recorded positive for Nigeria. They further suggested that there is need to jack up public health expenditure in the two countries investigated.

Health outcomes were measured by using infant mortality and life expectancy in Organisation for Economic Co-operation and Development (OECD) countries by Anwar et al. (2023). The use of system Generalized Method of Moments (GMM) generated outcome that public health expenditure significantly affects infant mortality rate and life expectancy. It had negative effect on the former and had positive effect on the latter. They suggested improvement on health investment as well as appropriateness in the use of available health expenditure. In the case of Olalude et al. (2021) infant under-five mortality rates were considered across Sub-Saharan African countries. They observed mixed results where 24 sub-Saharan African countries recorded negative effect of public health expenditure on selected health outcomes and 13 countries of the region recorded opposite results to their counterparts using Fourier unit root test. With infant and neonatal mortality, public, private and external health care spending, Kiross et al. (2020) also investigated sub-Saharan Africa using random effects model. Private health expenditure had no significant effect on health outcomes, while public and external had negative and significant effect on health outcomes used. Similar random model was used by Nketiah-

Amponsah (2019) in similar region, health expenditure was found to reduce infant mortality, maternal, mortality and improve life expectancy.

The interaction between institutional qualities and health expenditure is complex. Effective institutions can amplify the positive effects of health spending on mortality outcomes. Institutional quality, encompassing governance, transparency, and accountability, significantly influences the efficiency of health expenditure. Strong institutions ensure that health funds are allocated and utilized effectively as well as crucial determinant of health outcomes. For instance, Ibukun (2021) highlighted that in West Africa, the relationship between health expenditure and health outcomes is significantly influenced by the institutional quality. Also, Adegoke et al. (2022) suggested that good governance may be associated with more effective health expenditure, leading to improved health outcomes in sub-Saharan Africa. Asante et al. (2021) used literature scan to explore how institutional quality moderates the effect of health expenditure on health outcomes in West African countries. Their findings indicate that in countries with robust institutions, higher health spending led to significant improvements in health outcomes. A recent study by Efayena and Olele (2024) demonstrated that in sub-Saharan Africa, strong institutional policies have potential to enhance the impact of government expenditure, including health expenditure, on SDGs.

3. Methodology

Stemming from the literature, the 'a-priori expectation' of investing in healthcare and health is to influence health outcomes in a positive way. The micro theory of health production function by Grossman (1972) is followed to model macro level analysis with the view that health expenditure from both government and households (OOP) has the capability to influence mortalities across West African countries with its effectiveness depending on institutional quality control. The institutions are expected to ensure that resources are put into proper use and translate the benefits to improve health outcomes. The study considers 16 West African countries, namely Benin, Burkina Faso, Cape Verde, Gambia, Guinea, Ghana, Guinea-Bissau, Côte d'Ivoire, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo between 2000 and 2022. These periods cover the implementation of Abuja Declaration agreement by African heads of states. Having 16 countries necessitates the use of panel data estimation which is expected to capture

inter-country differences and take care of unbalanced data where necessary. Following the health production function of Grossman, the equation is specified below:

$$H = f(HE, Z) \quad (1)$$

Where H in the above functional model is health outcomes in mortality rates form, HE is the health expenditure and Z is other contributing factors that can influence mortality rates. When the above is specified in panel form, it results in Equation (2) as specified below:

$$H_{it} = \beta_0 + \beta_1 HE_{it} + \beta' Z + \varepsilon_{it} \quad (2)$$

Infant mortality rate, maternal mortality rate and crude death rate are used to proxy for H, expenditure on health are in form of OOP and public health expenditure, i ant t are the country specification and time period, respectively. Other variables which Z stands for are used from findings from existing studies. These variables include education (school enrolment rate), per capita GDP, population growth rate, unemployment rate and number of doctors. The inclusion of education as an independent variable is the argument from Grossman's theory that education is part of human capital and education should have positive effect on health. Also per capita GDP was noted by Osei et al. (2023) that the appropriateness of this variable is because it is expected that higher per capita GDP will translate into higher standard of living for the citizens. Anwar et al. (2023) also corroborated that apart from citizen being able to spend on their health, it is also the case that it will help them to purchase other consumption that are health related. Population growth rate is included to take account of demographic structure in the countries under consideration as noted by Kiross et al. (2020). Unemployment rate is justified from the point of Elijah et al. (2024) that higher unemployment rate can be detrimental to the citizen's population health because it may affect spending. In a similar case for number of doctors, Anwar et al. (2023) suggested that doctors are the controllers of medical system and have control on the use of medical equipment, without them consumption of healthcare is impossible.

As noted earlier that expenditure on health alone cannot only influence mortality rates but institutions have imperative roles to play. Efayena and Olele (2024) suggested that strong institutional framework enhances the impact of fiscal policies, including health expenditure, on

sustainable development goals. Based on this, Equation (2) is modified to include institutional variable:

$$H_{it} = \beta_0 + \beta_1 HE_{it} + \beta_2 INST_{it} + \beta_3 (INST * HE)_{it} + \beta' Z + \varepsilon_{it} \quad (3)$$

From the above, institutional quality is represented by INST. There are two views regarding the relationship between health expenditure and mortality rates. The first argument is that expenditure on health is capable of reducing mortality rate (see Boundioa and Anwar et al., 2023; Osei et al., 2023; Oladosu et al., 2022; Kiross et al., 2020; Nketiah-Amponsah, 2019 and Anyanwu and Erhijakpor, 2009), while the second argument is that expenditure on health is likely to increase mortality rate (see Boundioa and Thiombiano, 2024; Zhou et al., 2023; Oladosu et al., 2022). The strong relationship between these two variables may be missing element of institutional variable to reach consensus. Literature review without empirical exploration by Asante et al. (2021) suggested that stronger instructional framework is capable of ensuring that health expenditure is efficiently used to reduce mortalities. The relationship between previous values of mortality rates may be positive or negative. It may be positive if measures to reduce the mortality rates are not effectively implemented to prevent further increase and vice versa for the negative relationship. A robust institutional quality is expected to reduce mortality rates in West African countries and a poor institutional quality will increase mortality rate. As such, empirical outcome of the relationship between institutional quality and mortality rates may be positive or negative.

This study uses panel fixed and random models to estimate results and draw conclusions. The nature of the data encourages the use of this method so as to control for individual-specific effects and account for individual heterogeneity effects. With this method, isolation of time-varying factors is possible while controlling individual characteristics that remain constant over time. Hausman test is used to determine the best model between fixed and random. The random effect is preferred when the Hausman test is not statistically significant.

Data on all variables for this study is extracted from World Development Indicators (WDI) between 2000 and 2022 except for institutional variables composing of voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law and control of corruption which are retrieved from World Governance Indicators

(WGI). Variables are transformed through logarithmic approach except population growth rate and institutional quality index. Institutional quality index is generated through the use of Principal Component Analysis (PCA) and normalization ranging between 0 and 1 is also done by applying winsorization method following Opeloyeru et al. (2023). This method of normalization is to remove negative values from the variable (institutional quality index). The highest value of 1 is to denote good institutional quality and the lowest value (0) means poor institutional quality.

4. Results and discussion

Table I shows the descriptive statistics of the dependent and independent variables' mean, standard deviation and range (minimum and maximum number). The mean GDP per capita (gdppc) of $1064.97 indicates that the overall economic performance per person across the 16 selected West African countries is quite low. The standard deviation of 796.37 is relatively high, suggesting huge disparities in income levels across countries. On average, the government used 25.32% of the total expenditure to invest in public health, highlighting modest state involvement in healthcare financing with a minimum of 4.83% and a maximum of 73.35% of the total expenditure. The mean Out-of-Pocket health expenditure (OOP) stands at 49.86%, which signifies a heavy reliance on personal payments, which can impact health equity. Infant mortality has a mean value of 64.53 deaths per 1,000 live births with a standard deviation of 24 deaths, a minimum value of 10.6 deaths and a maximum of 138.3 deaths per thousand live births. The mean value of the maternal mortality rate is 592 deaths per 100,000 live births with a standard deviation, minimum and maximum value of 227.3, 40, and 1682 respectively.

Table I: Descriptive Statistics for Full Sample

	Mean	Std. Dev.	min	max	N
GDPPC	1064.974	796.373	138.714	3903.05	368
GHE	25.317	15.599	4.83	73.351	352
OOP	49.856	16.604	9.848	85.053	352
INFR	64.528	24.009	10.6	138.3	368
MMR	592.134	277.311	40	1682	336
CDR	10.388	2.927	4.868	19.794	368
SER	40.049	20.116	6.114	101.391	229
UER	4.67	3.253	0.317	14.66	368
POPR	2.647	0.659	0.8	5.785	368

NOD	0.136	0.146	0.014	0.791	160
INST	0.378	0.197	0	1	351

Note: Gdppc, Ghe , OOP, Infr, Mmr, Cdr, Ser, Uer, Popr, Nod, and inst are GDP per capita, government health expenditure, out-of-pocket health expenditure, infant mortality rate, maternal mortality rate, crude death rate, secondary school enrolment, unemployment rate, population growth rate, number of doctors and institutional quality, respectively..

Table II shows the correlation coefficient shows the connection between the economic, institutional, and health data. The association between variables is stronger the closer the coefficient is to 1 or -1. The pairwise correlation does not show causality between variables, it only indicates the strength and direction of association between variables. The result reveals that GDP per capita has a strong positive association with government health expenditure; the result showed a direct relationship between the two variables, as suggested by the literature, which shows that increased wealth results in increased public health spending. On the other hand, out-of-pocket costs are inversely proportional to the GDP (-0.339), implying that countries with low economic productivity depend more on personal payments. Mortality rates in both infant and Under-five children have a high positive relationship of 0.842, demonstrating similar systemic barriers to health care. Higher institutional quality (inst) is significantly correlated with a higher GDP of 0.545, and it is negatively related to a mortality rate, which means better governance leads towards better health conditions. These correlations state the relation between economic development, institutional dimension and health outcomes. Generally, the estimated coefficient for all the variables is significant at 1% level of significance.

Table II: Pairwise Correlation

Variables	LGDPPC	LGHE	LOOP	LINFR	LMMR	LCDR	LSER	UER	POPR	NOD	INST1
LGDPPC	1.000										
LGHE	0.536***	1.000									
LOOP	-0.339***	-0.464***	1.000								
LINFR	-0.727***	-0.630	0.560***	1.000							
LMMR	-0.683***	-0.664***	0.509***	0.842***	1.000						
LCDR	-0.711***	-0.542***	0.493***	0.913***	0.780***	1.000					
LSER	0.316***	0.209***	-0.417***	-0.593***	-0.560***	-0.621***	1.000				
UER	0.340***	0.309***	-0.444***	-0.628***	-0.511***	-0.474***	0.388***	1.000			
POPR	-	-0.133**	0.165***	0.498***	0.485***	0.402***	-	-	1.000		

	0.295***						0.611***	0.507***			
NOD	0.258***	0.300***	-0.131**	-0.483***	-0.543***	-0.246***	0.571***	0.448***	-0.617***	1.000	
INST	0.548***	0.703***	-0.572***	-0.715***	-0.844***	-0.642***	0.417***	0.447***	-0.352***	0.413***	1.000

The scatter plot shows the correlation or relationship between different variables. The first graphs show that government expenditure on health has a negative relationship with infant mortality rate, implying that higher GHE is associated with lower INFR. The second graph indicates that GHE has a strong negative relationship with maternal mortality rate, indicating that higher government health expenditure is associated with lower MMR. The third graph reveals that the relationship between government health expenditure and crude death rate is also negative but weak, suggesting that higher GHE may result in a decline in the overall death rate.

The second row shows the relationship between out-of-pocket health expenditure and mortality rate. The fourth graph shows that the relationship between out-of-pocket health expenditure and infant mortality appears to be positive but weak; indicating that reliance on OOP is slightly associated with higher infant mortality. The fifth graph shows a positive correlation between OOP and MMR, implying that greater reliance on out-of-pocket spending is associated with higher MMR. This could be due to financial constraints limiting access to quality maternal healthcare. No strong pattern is observed in the last graph, implying little or no correlation between OOP and CDR. This suggests that out-of-pocket health expenditure does not significantly influence the crude death rate. Therefore, the scatter plot suggests that government investment in healthcare is more effective in reducing mortality rates compared to private spending on healthcare.

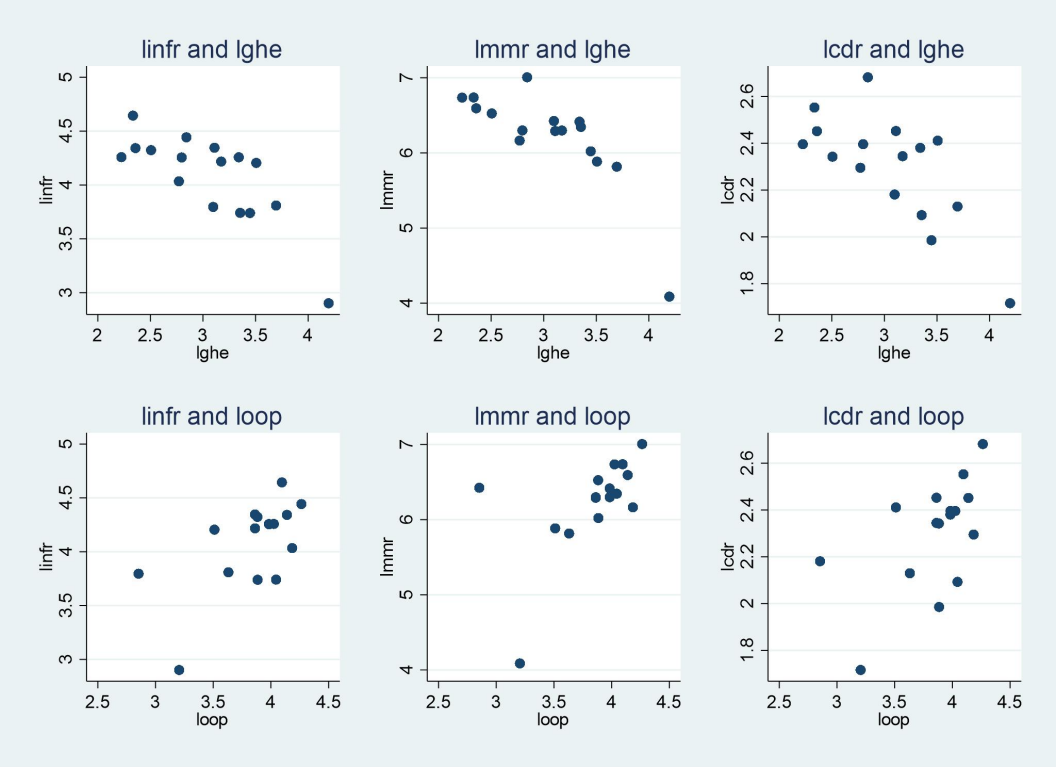

Figure I: Scatter plots for Health expenditure and mortalities in West Africa

The scatter plot in Figure 2 shows the relationship between institutional quality and diverse health and economic indicators. The first scatter plot suggests a weak negative relationship between institutional quality and infant mortality. As institutional quality improves, infant mortality decreases, implying that better institution contributes to positive child health outcomes. The second plot reveals a strong negative relationship between institutional quality and maternal mortality rate, implying that higher institutional quality helps reduce maternal deaths. The third plot is a little clear but suggests a weak negative relationship between institutional quality and the crude death rate. Better institutions may contribute to lower crude death rates, but other factors likely play a role. In the fourth scatter plot, a positive relationship is observed between institutional quality and government health expenditure, implying that countries with better institutions allocate more resources to healthcare. The fifth scatter plot reveals a strong negative relationship between institutional quality and out-of-pocket health expenditure, indicating that reliance on out-of-pocket health expenditure decreases as institutional quality increases. Therefore, the scatter plots reveal the importance of better institutions in achieving better health outcomes and reducing financial barriers to healthcare.

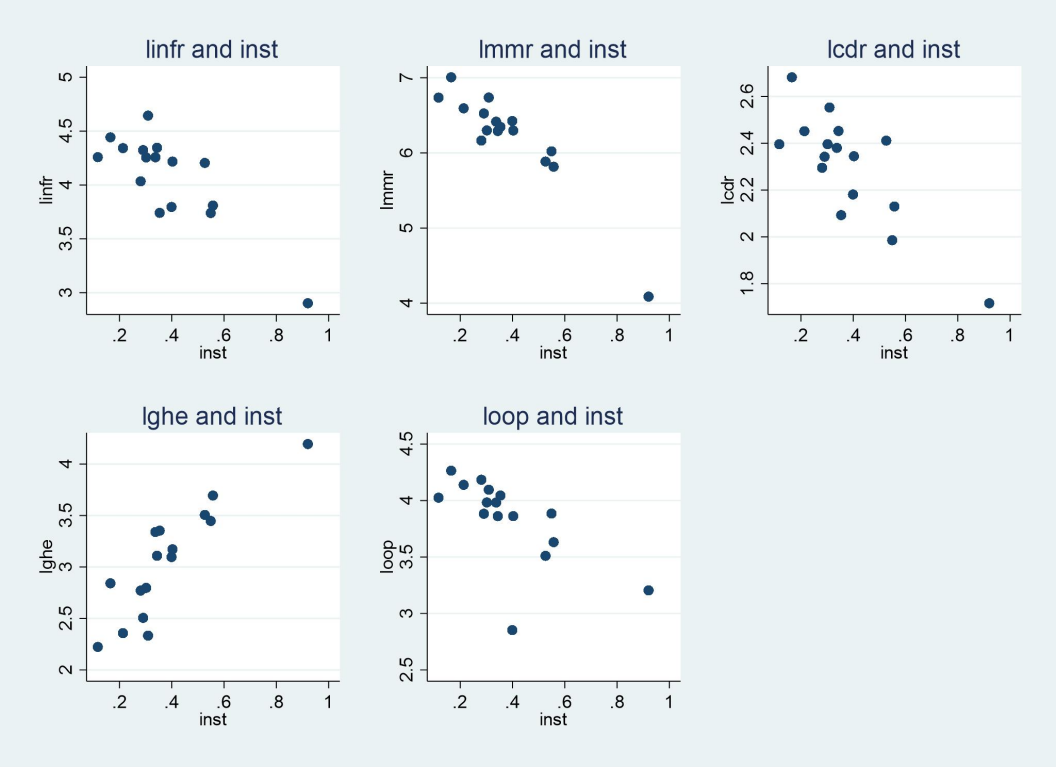

Figure II: Scatter plots for institutional qualities Health expenditure and mortalities in West Africa

Three different results are presented each for government health expenditure and Out-of-pocket health expenditure for all the tables below. The first result is without the inclusion of institutional variable, the second one included institutional variable and the third one interacted the institutional variable with health expenditures to uncover the relationship among them. The table shows the result from either fixed effect (FE) or random effect (RE) of the effect of government health expenditure (GHE) and out of pocket health expenditure (OOP) on infant mortality (LINFR). The Hausman test was used to determine the best model out of the two estimated. The result in Table III indicated that model with and without interaction with institutional quality has similar negative sign but different magnitude of effect of government health expenditure on INFR. Government health expenditure has a significant negative effect on infant mortality rate across both the fixed effect and random effect models. An increase in government health expenditure (LGHE) has potential to reduce infant mortality, a 1% increase in LGHE resulted in a 5.8% reduction in infant mortality. In addition, when institutional quality is included as an interaction of institutional quality, the magnitude of the decrease in infant mortality, increased from a 5.8% reduction without the interaction of institutional quality to 23% reduction in INFR

with institutional quality interaction. Also, GDP per capital has a significant negative relationship with INFR, 1% increase in GDP per capita lowers INFR by 0.16%. Institutional qualities is another factor that significantly influence infant mortality, the result showed that it has a significant and negative impact on INFR as 1% increase in institutional quality reduces infant mortality by 1.487%. Whereas, institutional quality interaction (GHEINST) with the significant positive value of 0.4777 implies that the benefits of government spending on infant mortality is amplified by the institutional qualities. This findings indicates that stronger institutional quality such as control of corruption, transparency, and rule of law contributes to more efficient resource allocation, ensuring that public health funds are directed toward crucial areas and used efficiently. The last three (3) columns show the impact of out of pocket health expenditure on infant mortality. The coefficient of GDP per capita in the three models is consistently negative ranging from -0.134 to -0.162, implying that infant mortality reduces with increase in GDP per capita. In addition, the result showed that out of pocket health expenditure has a significant and positive effect on infant mortality. This revealed that irrespective of the inclusion of institutional quality in the model, high out of pocket expenditure health expenditure lead to increase in infant mortality in the three models. This implies that infant health outcomes can worsen relying on household spending due to financial constraint reducing access to timely and quality care. This also implies that the cost of paying for healthcare is high and as such individual will avoid the use of healthcare services at all cost leading to increase death due to unattended medical need. The coefficient for the interaction between out of pocket health expenditure and institutional quality is negative but insignificant, implying that institutional quality does not significantly. From the table, the role of education is significant in reducing infant mortality rate. An educated individual is expected to respond to medical need as at when needed and can also read in between the lines when a child has symptoms of well-known or common diseases. Further observation from the table also shows that the size of the population is detrimental to infant mortality. Even when institution quality is involved, increase population will increase infant mortality. A similar result is noted for number of doctors in relation to infant mortality. Availability of doctors in West African countries can help to reduce infant mortality.

Table III: Results of Panel linear regression on infant mortality rate and health expenditure (government and OOP without and with interaction)

	(1, FE)	(2, FE)	(3, RE)	(4, FE)	(5, FE)	(6, RE)
	Government Health expenditure			Out of Pocket Health expenditure		
VARIABLES	linfr	linfr	Linfr	Linfr	linfr	linfr
Lghe	-0.058*	-0.051	-0.232***			
	(0.032)	(0.033)	(0.086)			
Lgdppc	-0.160***	-0.160***	-0.175***	-0.136***	-0.134***	-0.162***
	(0.032)	(0.032)	(0.032)	(0.031)	(0.032)	(0.032)
Lser	-0.247***	-0.253***	-0.242***	-0.228***	-0.236***	-0.216***
	(0.037)	(0.038)	(0.038)	(0.035)	(0.037)	(0.036)
Luer	0.001	0.001	-0.002	0.006	-0.000	-0.020
	(0.030)	(0.031)	(0.030)	(0.028)	(0.030)	(0.028)
Popr	0.088**	0.095**	0.118***	0.088**	0.089**	0.083**
	(0.044)	(0.045)	(0.045)	(0.041)	(0.042)	(0.042)
Nod	-0.904***	-0.916***	-0.885***	-1.051***	-1.042***	-0.937***
	(0.163)	(0.166)	(0.163)	(0.162)	(0.163)	(0.157)
Inst		0.146	-1.487**		0.021	0.805
		(0.154)	(0.735)		(0.154)	(1.226)
Llgheinst			0.477**			
			(0.210)			
Loop				0.216***	0.218***	0.313**
				(0.063)	(0.067)	(0.143)
Loopinst						-0.231
						(0.321)
Constant	6.067***	5.987***	6.578***	4.837***	4.842***	4.707***
	(0.225)	(0.249)	(0.356)	(0.392)	(0.395)	(0.618)
Observations	106	104	104	106	104	104

R-squared	0.819	0.810	0.822	0.834	0.827	
chi2	.	.	.	.	.	406.7
Prob.	.	.	.	.	.	0.000
F	63.91	50.03	46.64	71.36	55.91	.
Prob.	0.000	0.000	0.000	0.000	0.000	.
Hausman	17.04***	20.39***	19.39**	11.18*	12.47**	1.98
Prob.	0.009	0.005	0.013	0.083	0.052	0.981

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

FE and RE mean fixed effect and random effect, respectively

Table IV represents the panel regression result on the effect of government and out-of-pocket health expenditure on maternal mortality. The GDP per capita has an inverse but insignificant relationship with maternal mortality. The effect of government expenditure on maternal mortality is negative and significant at a 5% level of significance. A percent increase in GHE will result in a 0.396% reduction in maternal mortality in the sampled countries with the interaction of institutional quality variable. Institutional quality has a significant and direct relationship with maternal mortality; an increase in institutional quality will reduce maternal mortality by 2.954 deaths per 100,000 live births. In addition, secondary school enrollment rate, population growth rate, and number of doctors have an inverse effect on maternal mortality, with only the population growth rate being insignificant while the unemployment rate has a positive impact; an increase in the unemployment rate increases maternal mortality as a result of resource constraint to access quality care. A 1% increase in secondary school enrollment, number of doctors, and institutional quality reduces MMR by 0.361%, 0.412%, and 2.954%, respectively, under the model interacted with institutional quality. This dictates that better institutional framework reduces the rate of maternal deaths. Unemployment status significantly and positively affects MMR, implying that being out of job increased MMR. Maternal mortality increases with the increase in out-of-pocket health expenditure under the model with and without the inclusion of institutional quality variable. The interaction of the institutional variable shows insignificant outcome on out of pocket but significant on GHE. This implies that the improvement in institutional quality significantly enhances the effect of government expenditure and does not directly impact the effect of out-of-pocket health expenditure. Therefore, GHE and INST have a

significant and negative effect on maternal mortality, while OOP has a positive but insignificant effect on maternal mortality. The interaction effects show that INST strengthens the effect of GHE.

Table IV: Results of Panel linear regression on maternal mortality rate and health expenditure (government and OOP without and with interaction)

	(1, FE)	(2, FE)	(3, FE)	(4, RE)	(5, RE)	(6, FE)
	Government health expenditure			Out of pocket health expenditure		
VARIABLES	lmmr	lmmr	Lmmr	lmmr	lmmr	lmmr
Lghe	-0.104**	-0.128***	-0.396***			
	(0.041)	(0.040)	(0.102)			
Lgdppc	-0.021	-0.017	-0.038	-0.026	-0.019	0.013
	(0.040)	(0.039)	(0.038)	(0.042)	(0.042)	(0.043)
Lser	-0.390***	-0.378***	-0.361***	-0.356***	-0.323***	-0.362***
	(0.046)	(0.046)	(0.044)	(0.048)	(0.049)	(0.047)
Luer	0.110***	0.100***	0.099***	0.107***	0.078**	0.110***
	(0.038)	(0.038)	(0.036)	(0.039)	(0.039)	(0.038)
Popr	-0.013	-0.041	-0.006	0.010	-0.021	-0.064
	(0.055)	(0.054)	(0.053)	(0.056)	(0.056)	(0.055)
Nod	-0.512**	-0.457**	-0.412**	-0.727***	-0.731***	-0.653***
	(0.206)	(0.199)	(0.192)	(0.216)	(0.214)	(0.210)
Inst		-0.513***	-2.954***		-0.935***	-1.870
		(0.185)	(0.879)		(0.195)	(1.672)
Llgheinst			0.712***			
			(0.251)			
Loop				0.207**	0.327***	0.139
				(0.085)	(0.085)	(0.191)
Loopinst						0.327
						(0.436)
Constant	7.862***	8.167***	9.036***	6.748***	6.630***	7.097***

	(0.285)	(0.300)	(0.420)	(0.540)	(0.524)	(0.804)
Observations	104	102	102	104	102	102
R-squared	0.739	0.756	0.778			0.756
chi2	.	.	.	223.5***	241.1***	.
Prob	.	.	.	0.000	0.000	.
F	39.19***	35.32***	34.63***	.	.	30.65***
Prob	0.000	0.000	0.000	.	.	0.000
Hausman	21.67***	17.10***	97.42**		6.62	33.32***
Prob.	0.001	0.0167	0.000		0.470	0.000

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

FE and RE mean fixed effect and random effect, respectively

As observed from Table V, the impact of government health expenditure on the crude death rate is negative but statistically insignificant in the in the first and second model under without and with inclusion of institutional quality. It is statistically significant when it is interacted with institutional quality, indicating a strong influence of GHE on crude death rate. The implication under here is that institutional quality plays an imperative role in ensuring that crude death rate is reduced. Similarly, OOP demonstrated the same significant outcome with interaction of institutional quality but in a positive direction. GDP per capita has a negative impact on crude death rate, an increase in economic growth reduces CDR by 0.028 but the impact is weak and insignificant.

Table V: Results of Panel linear regression on crude death rate and health expenditure (government and out of pocket without and with interaction)

	(1, FE)	(2,FE)	(3, FE)	(4, FE)	(5, FE)	(6, FE)
VARIABLES	Lcdr	lcdr	lcdr	lcdr	lcdr	lcdr
Lghe	0.001	-0.005	-0.301***			
	(0.029)	(0.029)	(0.070)			

Lgdppc	-0.008	-0.004	-0.028	-0.001	0.008	-0.023
	(0.028)	(0.028)	(0.026)	(0.029)	(0.029)	(0.029)
Lser	-0.383***	-0.379***	-0.360***	-0.379***	-0.373***	-0.357***
	(0.033)	(0.034)	(0.031)	(0.033)	(0.034)	(0.032)
Luer	0.046*	0.040	0.035	0.046*	0.038	0.031
	(0.026)	(0.028)	(0.025)	(0.026)	(0.027)	(0.026)
Popr	-0.009	-0.022	0.016	-0.006	-0.022	-0.001
	(0.039)	(0.040)	(0.036)	(0.038)	(0.039)	(0.037)
Nod	-0.206	-0.186	-0.135	-0.233	-0.230	-0.134
	(0.145)	(0.148)	(0.133)	(0.150)	(0.150)	(0.144)
Inst		-0.221	-2.892***		-0.277*	3.614***
		(0.137)	(0.600)		(0.142)	(1.133)
Llgheinst			0.780***			
			(0.172)			
Loop				0.042	0.080	0.480***
				(0.059)	(0.062)	(0.130)
Loopinst						-1.020***
						(0.295)
Constant	3.647***	3.757***	4.723***	3.430***	3.365***	1.891***
	(0.200)	(0.220)	(0.290)	(0.364)	(0.363)	(0.546)
Observations	106	104	104	106	104	104
R-squared	0.797	0.784	0.828	0.798	0.788	0.816
Number of id	15	15	15	15	15	15
chi2	.	.	.	.	.	.
Prob	.	.	.	.	.	.
F	55.57***	42.59***	48.81***	55.98***	43.67***	44.81***
Prob	0.000	0.000	0.000	0.000	0.000	0.000
Hausman	77.40***	59.28***	72.56***			57.77***
Prob.	0.000	0.000	0.000	109.22***	88.12***	0.000
				0.000	0.000	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Also, secondary school enrollment has an inverse and significant impact on CDR under the three models. The only variation under the three models is that the magnitude of the effect varies. However, the variables unemployment rate, population growth rate, and out of pocket health expenditure has a positive but insignificant impact on overall mortality rate. 1% increase in unemployment rate, population growth rate, and out of pocket health expenditure increases crude death rate by 0.035%, 0.016%, and 0.480% respectively. A 1% increase in the number of doctors will reduce crude death rate by 0.135 while a 1% improvement in the institution quality will decrease CDR by 2.892%. The interaction of institution quality and government health expenditure is significant, indicating that good governance significantly enhances the impact of government health expenditure while the interaction with out of pocket health expenditure is negative (-1.020) implying that better institutions might successfully offset the adverse effect of out-of pocket spending.

5. Conclusion and recommendation

The study examined the nexus between institutional qualities, health expenditures, and mortality outcomes in West Africa. The result revealed that the correlation between government health expenditures and mortality (infant, maternal, and crude death) rates is significant and positive. This finding is in accordance with prior studies, which revealed similar results in other West African countries (Adegoke et al., 2022). The study by Boundioa and Thiombiano (2024) found that increased government health spending reduces infant mortality in West African Economic and Monetary Union (WAEMU) countries. In addition, Anwar et al. (2023) affirmed that government expenditure on health was discovered to positively influence health outcomes in OECD countries, reducing infant and maternal mortality. It is observed that countries that can successfully offer basic and quite affordable healthcare services, particularly child and mother healthcare, immunisation, and increasing government investment in such programs reduce maternal and infant mortality.

Similarly, the findings of this study indicate that government health expenditures reduce the crude death rate in West African countries, which aligns with previous research revealing a

positive relationship between government health expenditures and total mortality (Adegoke et al., 2022). The rise in government expenditure reduces the mortality rate by providing timely and effective healthcare services and facilities. Therefore, there is a need for government intervention in the healthcare sector for the effective allocation of resources into infrastructure development and medical research. The study also revealed that the secondary enrollment rate has a significant negative effect on infant mortality, maternal mortality and crude death rate. This aligns with the study by Adegoke et al. (2022), indicating that high education quality reduces maternal and infant mortalities in selected African countries.

The findings also revealed that a rise in the number of doctors and GDP per capita reduces maternal mortality, infant mortality, and crude death rates in West African countries. A study by Anwar et al. (2023) also showed similar findings. Hence, the vital component of any healthcare sector is the availability of adequate and quality doctors. In West African countries, the average number of doctors is 0.136 per 1000 population. An improved in number of doctors and better institutional framework will help to reduce both infant and maternal mortalities in West African countries

However, the study found that an increase in out-of-pocket health expenditure increases infant mortality, maternal mortality, and crude death rate. This revealed that due to financial constraints, high OOP cost reduces individuals' access to quality care, highlighting the significance of reducing personal health burdens through public funding. The institutional quality showed mixed results; its interaction with government health expenditure suggests that stronger institutional frameworks strengthen the negative effect of GHE on infant mortality, maternal mortality, and crude death rate, but its interaction with out-of-pocket health expenditure suggests that institutional quality does not offset the effect of OOP expenditure.

In conclusion, the mortality rate in West African countries can be reduced by improving institutional quality and government health expenditures. Due to the negative effects of increased out-of-pocket spending on health outcomes, personal funding for healthcare services should be reduced. Governments should work on the universal health coverage (UHC) schemes and subsidizing care for poverty-stricken dwellings and expanding public health insurance servicing in order to alleviate the economic burden and increasing accessing to quality healthcare services.

This will ensure that essential health services including maternal care and emergency treatment become accessible and affordable to everyone regardless of income level. Also, policymakers should focus on strengthening public healthcare systems and institutional frameworks to improve overall health indicators. Addressing this may help to achieve part of SDGs in 2030 and protect many citizens in various countries. Additionally, education is part of human capital, investment in education and health jointly with support system from the institution may be a last long solution to moderate mortality rate in West African countries.

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