Government Health Expenditure and Maternal Mortality in Sub-Saharan Africa: Does Governance Matter?

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Abstract

Target 3.1 of the Sustainable Development Goal (SDG-3) seeks to reduce maternal mortality ratio (MMR) to at most 70 per 100,000 live births by 2030. It is believed that fostering good governance is a critical pathway to accelerate the reduction of MMR. The study examines the link between government health expenditure, governance and maternal mortality in Sub-Saharan Africa (SSA), and utilizes panel dataset of forty-two countries for the period 2001 to 2016. It specifies a dynamic panel data model (DPDM) and utilized the system Generalized Method of Moments Instrumental Variable (sys GMM-IV) technique to estimate the model. The result provides two sets of econometric evidence. First, it finds that government health expenditure is statistically significant and has a negative impact on maternal mortaltiy. In the same vein, governance, proxied by government effectiveness and control of corruption was found to have a significant negative impact on MMR. Second, the interaction of government health expenditure with governance provides an explanation for the variation in maternal ratios across SSA countries. The study concludes that achieving the target 3.1 of the SDG in SSA countries requires a committed political leadership that is consistently devoted to good governance.

Key words: Governance, SDG-3, maternal mortality ratio, government health expenditure, GMM

1. Introduction

Maternal mortality remains a major global health challenge, especially in Sub-Saharan Africa (SSA), where the burden is disproportionately high (UNICEF, 2022). According to WHO (2022) SSA alone accounted for around 70% of maternal deaths (202,000). Despite having the gravest burden, the rate of reduction of maternal mortality in SSA remains the lowest in the world compared to other regions (WHO. 2022). Thus, the need to understand this sluggish trend in maternal mortality ratio (MMR) cannot be overemphasized. MMR is an essential aspect of measurement of the health outcome of a country. This indicator measures the quality of a given population because it indirectly reflects many aspects of people's welfare, including their levels of

income, nutrition, environmental quality among others (WHO, 2019; UNICEF, 2016). Maternal mortality is tragic and creates long term negative effects for the health of the new born, lost opportunities for any older children and the socio-economic position of the family and the economy as a whole (UNICEF, 2016). Thus maternal mortality is part of the widely accepted health outcomes which form the foundation for pro-poor sustainable development Sustainable Development Goals (SDGs). Generally, tthese goals frame health as both outcomes and foundation for social inclusion and poverty reduction (UN, 2015; WHO, 2016).

In spite of the strong consideration given to maternal health in the international health attainment goals, not much progress has been made in the fight to reduce maternal mortality among sub-Saharan Africa countries. Rather there appears to be wider dichotomies in the outcome within and across countries and regions (UNICEF, 2016). Moreover, evidence of consistent decline in global maternal mortality has not been noticed in many SSA countries where the pace of reduction is not only sluggish but there is a contemporaneous prevalence of poor health outcomes and governance. For example, as shown in Figure 1, SSA contributes more than 55.2% to global maternal deaths compared to Americas (5.3%), South Asia (16.7%), European region (1.6%), Eastern Mediterranean region 16.9%) and Western pacific (4.2%). This sharp contrast is worrisome and warrants further empirical investigation with a view to identifying factors that may have constrained progress in SSA.

[Figure, here. see appendix]

As a continuous advocacy, many world agencies have often considered government involvement as a critical aspect for achieving health outcomes and goals in the long term. For instance, while skilled birth attendants and emergency obstetric care are widely acknowledged to be essential to combating high maternal mortality, their provision requires functioning health systems that include well trained and highly motivated health workers, equipped facilities, and rapid referral systems for complications. In the same vein, good governance of the health system allows for better administrative regimes that guarantee wide-spread access and effectiveness. While spending patterns are critical for procurement of equipment and staff motivation, the administrative component – at both the policy and execution levels – is essential for overall effectiveness. In both areas, SSA countries appear to be less forthcoming. For example, Pritchett and Summers (1996) found that all of the insignificant or ambivalent impact of public spending on health in many SSA countries could potentially be a reflection of differences in the efficacy of spending. Thus, efficiency of spending may be strongly linked to the governance systems and administrative efficiency.

Consequently, the capacity of SSA government to design, formulate and implement health policies has come under severe scrutiny as a sizable proportion of government health expenditure may have been wasted, embezzled through "state captured" (Obadan, 2017; Oyefusi, 2010). In this direction, there is now a global consensus that health systems strengthening especially health financing and good governance are critical in improving health status of mothers in SSA. While the proposition to increase government health expenditure seems straightforward and irrefutable, yet, health outcomes in SSA are still the issues of grave concern (WHO, 2019). Observably, poor governance which manifests in grand corruption and government ineffectiveness pose formidable challenges to translate public spending into effective service in developing countries (World Bank, 2016; Obadan, 2017; Oyefusi, 2010; Collier and Gunning 2007). Specifically, a fascinating observation

is that while SSA countries all rank low in the UNDP-HDI/WHO report year-in-year-out; they all score very high, and rather perennially too, on the Corruption Perception Index (CPI) of the Transparency International (TI) and the World Wide Governance Indicators.

These shared commonalities of high corruption levels, government ineffectiveness and poor health outcomes constitute the research issue of this study. Previous studies such as (Anyanwu & Erhijakpor, 2007; Hopkins, 2010; Sede & Izilien, 2014; Devarajan et al, 1996; Filmer & Pritchett, 2000; Mittnik & Neumann, 2003) only concentrated on the impact of government spending on health outcomes without considering the possible impact of governance. Obviously, these studies were carried out with the assumption that increased spending would automatically translate to improvement in health outcome. In this study, the effect of government health expenditure on maternal mortality is examined for the sub-Saharan Africa region. In particular, the study seeks to explain how government spending (in relation to private health spending) explains the pattern of maternal mortality in the region. The role of governance quality in enhancing (or inhibiting) the effectiveness of government spending in reducing maternal mortality is also assessed in the study.

2. Literature Review

The literature on spending and health outcomes in developing countries is pervasive and possess varied outcomes. The role of governance and institutions in the relationship is however a recent area of interest for researchers. Gottret and Schieber, (2006) conducted a study of 81 low and middle income countries and found that a 10 percent increase in government health expenditure has a larger impact in reducing maternal mortality than a 10 percent increase in education, roads and sanitation. Bokhari, Gai, and Gottret (2007) provides additional econometric evidence linking a countries per capita income to two health outcomes: maternal mortality ratios.

On the role of the country's wealth in explaining maternal mortality, Alvarez et al (2006) finds that the African region has the highest maternal death compared to the other regions and that a negative relationship exists between GDP and maternal mortality ratios in SSA. Shen and Williamson (1999), used lagged cross-sectional and path analysis with a sample of 79 less developed countries to assess the impact of predictors linked to three theoretical perspectives modernization, economic dependency, and gender stratification. The result showed that women's status measured by indicators such as levels of education relative to men, age at first marriage, and reproductive autonomy, is a strong predictor of maternal mortality. The study also finds that economic dependency, especially multidimensional corporate investment, has a detrimental effect on maternal mortality that is mediated by its harmful impacts on economic growth and the status of women. Similarly, Sede and Izilein (2014) conducted a study on the impact of government spending on health (FEH), per capita income (GDPGR), Unemployment rate (UPR), Secondary School Enrolment rate (SECER) on MMR in Nigeria for the period 1980 to 2011. Using the Grossman death model and the Ordinary Least Square (OLS) technique for estimation, the study found that while all other explanatory variables passed the significant test at 5% level of significance, GEH was insignificant. Thus, government expenditure was shown to have negligible effects on maternal mortality in Nigeria. In consonance with the findings of Sede and Izilien,

Arshia and Gerdtham (2013) examined the relationship between maternal mortality, child mortality and national incomes using the Data Envelopment Analysis (DEA). The study found that in 105 of 108 (58%) countries, there existed a one-way relationship from maternal mortality to

GDP in 50 countries (29%) and one-way causality from GDP to maternal mortality for 19 countries (11%). No relationships were found in 33 countries (19%). The study also showed that the magnitude of the effect of GDP on maternal and child health outcomes in LMICs and LICs were larger relative to HICs and UMICs. In another study, Marathappu, et al (2014) investigated the association between reductions in government healthcare spending (GHS) on maternal mortality in 24 countries in the European Union (EU) for 1981–2010. Five-year lag-time analyses were performed to estimate longer standing effects. The results showed that for every annual 1% decrease in GHS, 89 excess maternal deaths occurred in the EU, a 10.6% annual increase in maternal mortality. The impact on maternal mortality was sustained for up to 1 year. The associations remained significant after accounting for economic, infrastructure and hospital resource controls, in addition to out-of-pocket expenditure, private health spending and total fertility rate. In the same vein, Muldoon et. al (2011), examined the link between mortality rates and 13 explanatory variables, including government and out-of-pocket expenditures on health, using a sample of 136 United Nations (UN) member countries for 2008. Performing mixed effects linear regression analysis, the authors found that out-of-pocket expenditures on health is significantly related to mortality rates.

In an attempt to examine the global burden of maternal mortality, Betrain et al (2005) conducted a systemic review of the incidence and prevalence of maternal mortality and morbidity following a standard methodology for systematic review. Maternal mortality was found to strongly respond to the proportion of deliveries assisted by skilled birth attendant, infant mortality rate and health expenditure per capita. Berger and Messer (2002) also conducted a study to investigate the effects of public financing of health expenditure, insurance coverage and other factor on health outcomes utilizing mortality rate per 100,000 as proxy for 20 OECD countries and the period between 1960 and 1992. The findings suggested that mortality rates depend on a mix of healthcare expenditure and the type of health insurance coverage. Evidence from the results also indicated that increases in the public financed share of health expenditures are associated with increase in mortality rates even though increases in total health expenditures resulted in decreases in mortality rates. Moreover, GDP per capita, female labour force participation, proportion of the population with at least post-secondary education and tobacco consumption per capita have an effect on mortality rates.

For the SSA and MENA countries, Akinkugbe and Afekhena (2006) investigated the effect of public spending as a determinant of health status using a pooled, multi-country annual time series data for the period 1980 to 2003. The findings showed that spending in the health sector has a significant impact on health outcomes in both SSA and MENA countries. Availability of physicians, female literacy rate and immunization were found also to be significant to health outcomes. In another study in SSA, 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.

The literature on the relationship between health expenditure and maternal mortality has not yet come to a consensus as evidenced by the reviewed literature. Undoubtedly, all of the ambivalent results may have been influenced by the policy environment in SSA. Thus, it is imperative to take into account the issue of governance in examining the impact of health expenditure on health outcome. The focus of the current study is to empirically investigate whether there is a definitive relationship between government health expenditure, governance and maternal mortality. Moreover, previous studies only examined the relationship between health expenditure and health outcome without interacting government health expenditures with a variety of governance indicators which warrants further empirical investigation of this nature.

3. Methodology

3.1 The Model

This study draws from the Grossman (1972) model of health investment and the health production function model. The applicability of the Grossman health investment theory as the theoretical basis for this study is underpinned by the intuition that since the stock of health capital diminishes over time, for which time mortality occurs when below a critical minimum through government health expenditure, stock of human capital can be augmented leading to a reduction in mortality. In particular, Grossman (1972) included a function in the equation which could be expanded to include government health expenditure and governance as a determinant of maternal deaths.

From Grossman's model, it is expected that the total rate of return on an investment in health is equal to the user cost of health capital in terms of the price of gross investment at equilibrium. Thus, the reduced form of the model (Grossman, 1972) can be stated as:

$$lnH = \alpha lnM + \rho E + \delta t - ln\varepsilon \qquad (1)$$

Where; H = stock of good health,
M = Health investment
E = Education

Grossman (1972), highlighted the importance of education in the production of good health. It is usually referred to as the stock of human capital which augments the productivity of all other factors of production in the economy. It is imperative to note that health is a social good that creates spillover effect on the economy. Thus, health can be regarded as a normal social good whose marginal social benefit is greater than its marginal social cost. That is, the externalities or spillover effect makes it difficult for the market system to allocate efficiently. This argument provides the impetus for government health expenditure with a view to bridging the supply gap. Thus health can be seen as an invisible social good whose supply can be stimulated by government expenditure in health care system (Haldar, 2008).

Conceptually, maternal health is a function of investment (spending) through the provision of health inputs. Health inputs include hospital equipment, physicians and other skilled healthcare providers, hospital beds etc. Increases in spending (especially financial resources by the government and private sector) are likely to impact positively on MMR. On the other hand,

corruption is not only likely to dampen the impact of expenditures on maternal health but also serves as a tax which adds on to the overall cost of maternal health interventions and programmes by government and private sector (WHO, 2016). Following, Odhimabo (2014), Filmer and Pritchet (1999) and Yaqub, et. al (2012) we select our key variables for the model as:

Dependent variable - Maternal mortality ratio (MMR)

Independent variables - Government expenditures on health as a percentage of total expenditures
per capita GNI
Out-of-pocket expenditures on health (PPP in US$)
Physician's density (per 10,000 populations)
Malaria incidence per 1,000 populations
HIV/AIDS prevalent rate
Female Literacy rate (proxied by female average yrs of schooling)
Household size (proxied by female fertility rate)
Control of Corruption (CC)
Government effectiveness (GEFF)
Adolescent Birth Rate
Female labour force participation rate
Proportion of women attended to by skilled birth attendant (SBA)

The health production function for estimating the relationship between health expenditure, governance and maternal can be specified as:

$$MMR = Af(HEXP, RGDP, GOV) \quad (2)$$

Where; MMR = Maternal Mortality Ratio,
RGDP = Real Gross Domestic Product per capita (real income per Capita);
HEXP = health spending (total, public and private health care spending).
GOV = governance indicator (government effectiveness and Control of corruption)
A = Technical progress, which is assumed to be constant.

From Equation (2) the model assumes that; increase in real per capita GDP leads to a reduction in maternal mortality ratio. The mechanisms through which real income per capita affects maternal health are: allocation of more financial resources to maternal health services. Health expenditure influences maternal health through the following channels: availability of maternal health focused interventions such as ante natal services, nutrition boosters (protein and energy). Health expenditure also facilitates availability of adequate health workers, drugs and medical supplies and infrastructure (clinics and hospitals) for provision of maternal health related services.

Improving quality of governance by reducing corruption and strengthening the bureaucracy is expected to lead to a decline in MMR. Low corruption environment is likely to promote transparency and accountability in provision of health services. Hence, reducing leakages leads to effectiveness of health service delivery and which ultimately leads to improved maternal health. Model (2) is transformed into a Cobb-Douglas health production model; the production function relates health status with health spending and real gross domestic product (GDP) per

capita. It is augmented with a governance variable and this relationship is expressed as equation (3) below:

$$MMR_t = A(RGDP_{it})^{\alpha} * (HEXP_{it})^{\beta} * (GOV_{it})^{\delta} \quad (3)$$

The log-linear form of equation (3) becomes;

$$MMR_{it} = lnA + \alpha lnRGDP_{it} + \beta lnHEXP_{it} + \delta_1 lnCOR_{it} + \delta_2 lnGEFF_{it} \quad (4)$$

The parameters are defined as follows:

α = the coefficient of real GDP per capita; which measures the elasticity of maternal health with respect to change in per capita income.

β = the elasticity of maternal health with respect to changes in health expenditure

δ_1 = the elasticity of maternal health with respect to changes in levels of corruption.

δ_1 = the elasticity of maternal health with respect to changes in government effectiveness.

In equation (4) above, we contrived additional assumption. The study assumes that part of health spending (total, public and private is lost or wasted due to corruption and inefficiency. This wastage has consequences on the effectiveness of health spending in a given country or region. Following Yaqub, et al. (2012), Pritchett and Summers (1996) and Odhiambo (2014), and assuming ϕ(.) is a part of resources allocated to health that is spent on productive purposes, the β coefficient of health spending on say programme k takes the form;

$$\beta = \pi(.) * \beta_k \quad (5)$$

Where β_k represents the productivity of public or private capital that is created from spending on health programme k. Assuming further that π(.) measures the effectiveness of health spending which is a function of level of corruption $COR_{it,}$ and government effectiveness then it follows that

$$\pi = \phi_0 + \phi_1 COR_{it} + \phi_2 GEFF_{it} \quad (6)$$

Substituting equations (4.2.4) and (4.2.5) into (4.2.3) gives the following equations

$$\ln MMR_{it} = \ln A + \alpha \ln RGDPC_{it} + \beta k(\phi_0 + \phi_1 COR_{it} + \phi_2 GEFF_{it}) \ln HEXP_{it} + \lambda \ln COR_{it} \quad (7)$$

In order estimate the impact of health expenditure and corruption on Maternal Mortality Ratio as well as how governance has influenced effectiveness of health expenditure, three models are specified. The baseline model measures the effect of health expenditure on MMR and is specified with control variables. The baseline empirical model is specified as follows;

$$MMR_{it} = \gamma_0 + \gamma_1 \ln HEXP_{it} + X'_{it} \Gamma + \xi_{it} \quad (8)$$

Where X'_{it} is a vector of control variables. In order to estimate the impact of governance on MMR, the baseline model in equation (8) is extended by adding the corruption index and government effectiveness variables to yield the following.

$$\ln MMR_{it} = \eta_0 + \eta_1 \ln HEX_{it} + \eta_2 \ln COR_{it} + \eta_3 \ln GEFF_{it} + X'_{it} + \upsilon_{it} \quad (9)$$

The interaction of corruption index, government effectiveness and health expenditure is added to model (9) to measure how governance influences efficiency of health expenditure on maternal mortality ratio. Thus we have the following equation;

$$MMR_{it} = \pi_0 + \pi_i lnHEXP_{it} + \pi_2 lnCOR_{it} + \pi_3 lnGEFF_{it} + \pi_4 [COR_{it} * lnHEXP] + \pi_5 [GEFF_{it} * lnHEXP] + \pi_5 X_{it} + \epsilon_t \quad (10)$$

Equations (8), (9) and (10) relate the natural logarithm of maternal mortality rates to natural logarithm of health expenditure, natural logarithm of corruption index, government

effectiveness, the interaction of government health expenditure and government effectiveness the interaction of corruption index and natural logarithm of health expenditure. In order to capture the direct and the indirect effects that governance may have on MMR, COR and GEFF enters into the model both as an independent variable and interacted with the share of government health expenditure in total government expenditure. The interaction term is used to capture the indirect effect of governance on maternal mortality. X_{it} is a vector of control variables. The control variables are natural log of real income per capita, natural log of female literacy rate, natural log Malaria incidence, natural log of adolescent fertility rate, natural log of total fertility rate, natural log of number of physicians per 10,000 populations and natural log of access to family planning and reproductive health services. Where ξ_{it}, υ_{it} and μ_{it} are the composite error terms. The composite error terms are assumed to be normally distributed and homoscedastic. γ_1 ,η_1 and $\boldsymbol{\iota_1}$ are the structural coefficients of health expenditure and are expected to be negative. η_2 and $\boldsymbol{\iota_2}$ are the coefficients of corruption and are expected to be negative. π_i is the coefficient of the interaction of corruption index and health expenditure and is expected to be either positive or negative. Γ is the vector of coefficients of the control variables.

3.2 Estimation Procedure of Maternal Mortality Model

Health expenditure could be potentially endogenous in maternal mortality models in the presence of measurement errors, omitted variables and reverse causality. For instance, economic adjustments, changes in population characteristics and political regime changes or upheavals, wars, insurgency and extremism are likely to be omitted variables correlated with health expenditure. Another concern is the problems of unobserved heterogeneity. Estimation under these statistical challenges can produce inconsistent and biased estimates of the structural coefficients of the hypothesized relationships specified in the model. Consequently, the system Generalized Method of Moments estimation technique is adopted in order to obviate the aforementioned potential problems. Specifically, the Generalized Method of Moments instrumental variable linear dynamic panel model is suitable to estimate the model because, the number of cross-sections (N=42) in the study is greater than the time (T=16). Again, one main reason for the popularity in empirical research is that the GMM estimation approach may provide asymptotically efficient inference employing a relatively minimal set of statistical assumptions. Linear Dynamic Panel Data (LDPD) is a hybrid model emanating from works of Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). It combines the properties of the Arellano-Bond GMM and Systems GMM estimators. Diagnostic tests for validity of instruments (Sargan test), overall significance of explanatory variables (Wald test) and autocorrelation (Arellano-Bond tests) is carried out.

Arising from the above, a system generalized moment equations (sys GMM) is specified as follows:

$$MMR_{it} = \pi_0 + \varphi MMR_{it} + \pi_i lnHEXP_{it} + \pi_2 lnCOR_{it} + \pi_3 lnGEFF_{it} + \pi_4[COR_{it} * lnHEXP] + \pi_5[GEFF_{it} * lnHEXP] + \pi_5 X_{it} + \mu_i + \omega_t + \epsilon_t \quad (10)$$

In the following analysis, lagged maternal mortality ratio and other variables such as per capita income, health financing, are treated as endogenous variables. On the other hand, malaria, gender, and governance which are not strictly exogenous, are assumed to be "predetermined variables. It is well known (e.g. Blundell and Bond, 1998) that the GMM estimator of the first-differenced

model can have poor finite sample properties in terms of bias and precision when the series are persistent . One reason for this is that in this case lagged levels are weak predictors of the first differences. Blundell and Bond (1998) advocated the use of extra moment conditions that rely on certain stationarity restrictions on the series properties of the data, as suggested by Arellano and Bover (1995). Following Blundell and Bond, 2000 and Mishra and Newhouse, 2009, we adopt the system GMM because it improves the accuracy of estimates by setting the additional moment conditions in the level equations when the dependent variable. Consequently, the following assumptions are made under the system GMM estimators (Blundell and Bond, 2000).

3.3 Variables in Model and Description of Data

The variables in the model and their description are presented in the Appendix. In order to further provide a wider outlook for the data set, we report the descriptive statistics for the combined data in Table 1. These results also include the second moment characteristics of the data that may provide information on the use of panel data analysis technique in this study. Overall, average maternal mortality ratio is at 572.95 per 100,000 live births. The standard deviation value is much lower than the mean MMR value, suggesting that all the SSA countries in the sample have similar maternal mortality rates over the years. Average government expenditure on health as a proportion of total annual expenditures is low at 10.75%, and the very low standard deviation value of 3.73 shows that the average value is characteristic of most African economies. Also, average private expenditure on health (in ratio of total household expenditure) was 3.05, with a large standard deviation value. Average values for the two governance variables are low, indicating the poor governance structure among SSA countries over the years. Female literacy rate is just below 50% for the region, while average female labour force participation rate is 63.55%, which is an impressive rate. Total fertility rate is also very high at an average of 4.99 children per woman; this is one of the highest rates in the world. The other indicators in the descriptive statistics generally highlight the poor level of social facilities in the SSA region which could combine with weak governance composition to exacerbate poor health outcome for the region. In terms of the third moments of the variable distributions, we consider the Jacque-Bera (J-B) values for each of the series.

Table 1: Descriptive Statistics in SSA

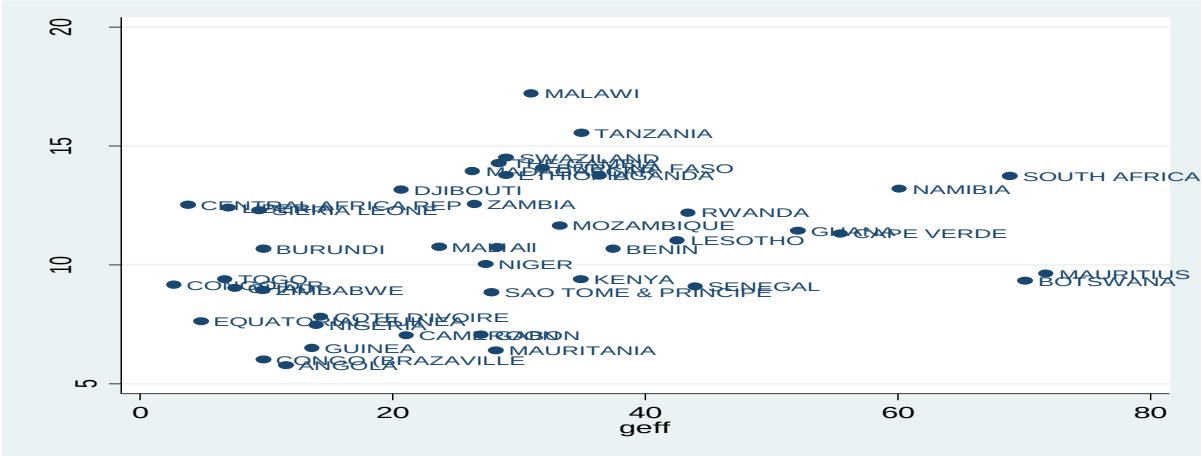
Variable	Mean	Max.	Min.	Std. Dev.	J-B	Prob.	N
MMR	572.95	2530.00	35.00	323.27	1243.50	0.00	667
GHEXP	10.75	28.20	2.44	3.74	32.60	0.00	672
OPKT	3.05	11.05	0.45	1.71	704.15	0.00	671
CC	3.24	8.85	-0.54	2.50	44.55	0.00	672
GEFF	2.83	8.73	-0.64	1.96	58.63	0.00	672
GDPPC	1858.03	15263.43	194.17	2293.37	1216.35	0.00	672
FLTR	49.60	101.14	39.56	8.19	15284.48	0.00	670
FLFPR	63.55	88.80	23.70	14.90	21.30	0.00	672
TFR	4.99	7.73	1.36	1.26	23.99	0.00	672
MIPR	249.70	679.30	0.20	170.22	32.41	0.00	672
PISN	33.20	94.30	6.80	19.96	93.21	0.00	672

Source: Author's Computation; Where, MMR=maternal mortality rate, GHEXP= Government health mortality rate, PHEXP=Private health expenditure, CC= Control of Corruption, GEFF= Government Effectiveness, GDPPC= GDP per capita, FLTR= Female Literacy rate, FLFPR= Female labour force participation rate, TFR= Total fertility rate, MIPR= Malaria prevalence rate, PISN=Population with improve sanitation,

5. Results and Empirical Analysis

It is important to understand how governance and health expenditures interract among the African countries. In Figure 2 and 3, the relationship between government effectiveness and government expenditure on health, on the one hand and private expenditure on health, on the other hand are presented respectively. A clear positive relationship is demonstrated between government effectiveness and government health expenditure, indicating that both factors move in the same direction. This outcome confirms the findings by Odhiambo (2014) and Adegboye and Oziegbe (2018) who found that improving the quality of institutions generates more health outcomes than just increasing spending on health which implies that "the cost of poor institutions on education and health output in the region is higher than the cost of poor funding".

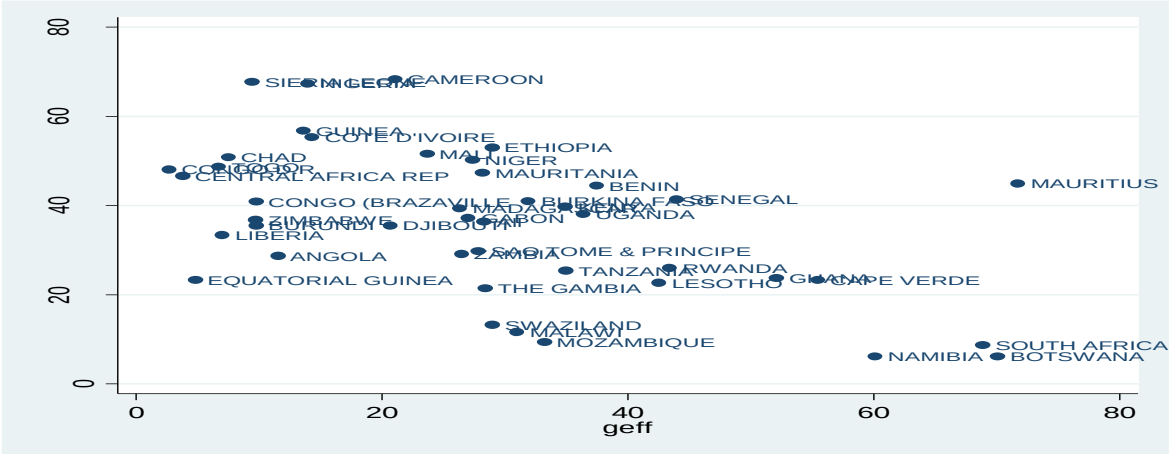
Fig. 1: Relationship between government effectiveness and private health expenditure among SSA countries



Source: authur's computation using data from WDI (2016)

On the other hand, a negative relationship exists between government effectiveness and private expenditure on health. The negative relationship is plausible given that with better governance, the private sector may have to spend less of their resources on health care since government would have taken more of the responsibility.

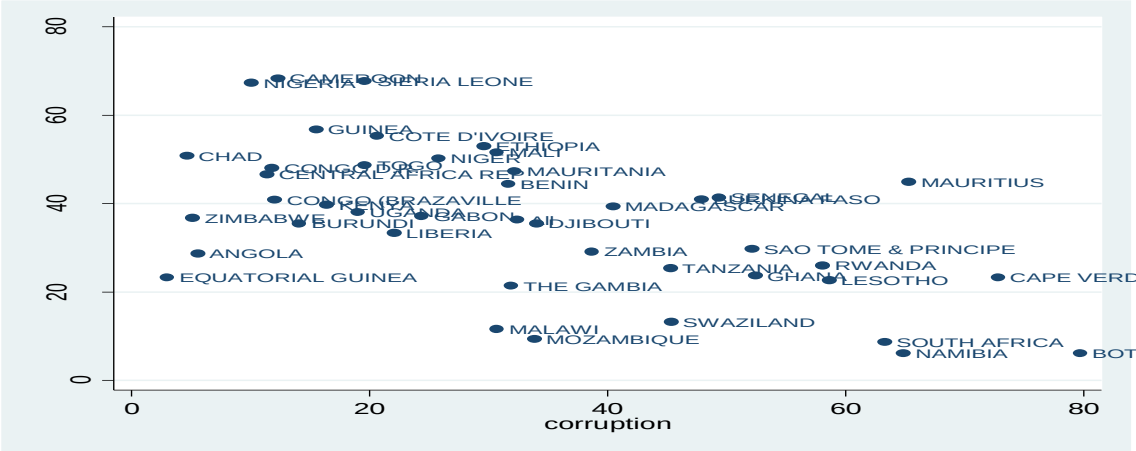
Fig. 2: Relationship between government effetiveness and Out of Pocket expenditure among SSA countries



Source: authur's computation using data from WDI (2016)

It should be noted that the countries at the right edges of the chart are the leading countries in terms of governance indicators, while the countries at the top of Figure 5.4 have the highest government expenditure on health. The relationships between control of corruption and both government and private health expenditures are presented in Figures 5.6 and 5.7 respectively. The correlation charts reveal a generally negative relationship between corruption control and private health expenditures among the SSA countries, suggesting that less corruption is associated with less private health spending.

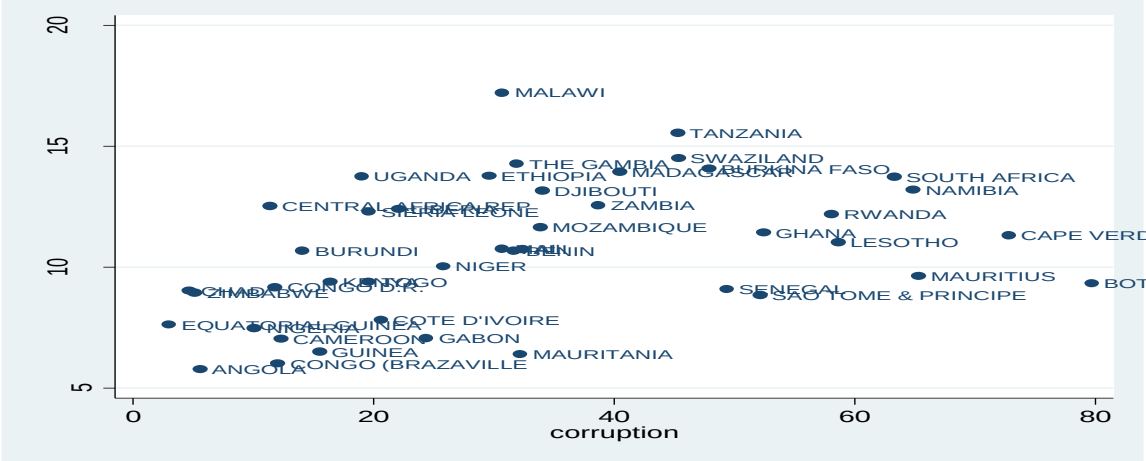
Fig. 3: Relationship between corruption control and private health expenditure among SSA countries



Source: Authur's computation using data from WDI (2016)

A positive relationship is demonstrated between the control of corruption and the proportion of government expenditures devoted to health. Overall, the results indicate that better governance leads to increases in governments' allocation to health provision and a drop in the proportion of income spent on health by the private sector for all SSA countries.

Fig. 4: Relationship between corruption and government health expenditure among SSA countries

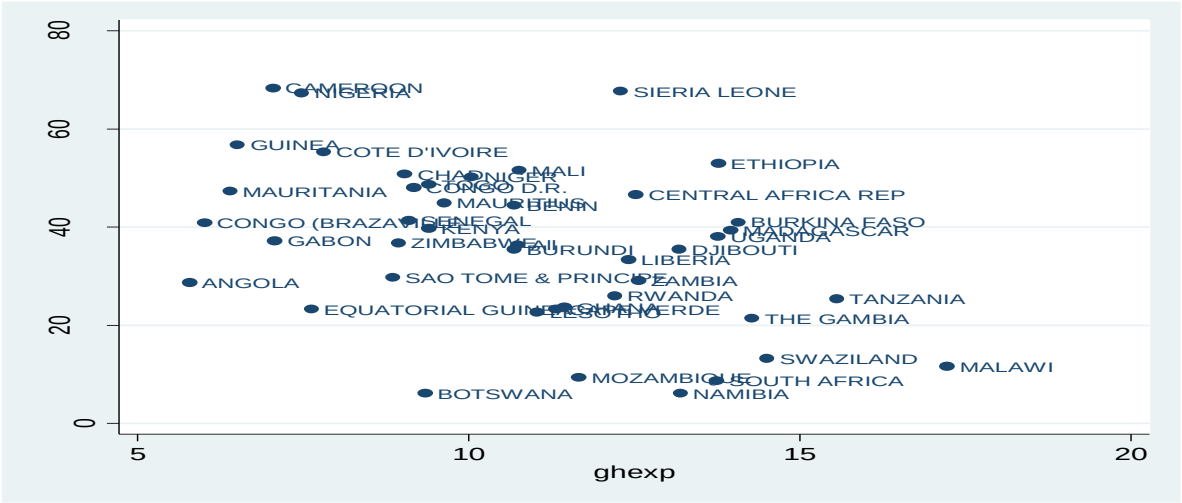


Source: Authur's computation using data from WDI (2016)

We report the relationship between government health expenditure and private expenditure on health for the SSA countries in Figure 5.8. There is a dense concentration of countries within the middle of the correlation line, suggesting that many of the countries have similar shares of health expenditures both for government and private sector. An essentially positive correlation can be

seen between the two expenditure structures in Figure 5.8. Apparently, expenditures on health both by public and private sectors move in the same direction.

Fig. 5: Relationship between government health expenditure and out of pocket expenditure among SSA countries



Source: Authur's computation using data from WDI (2016)

5.2 Dataset Properties: Test for Stationarity and Panel Cointegration

The stationarity status of the data is determined based on both the homogeneous tests (using the Lin, Levin and Chu [LLC] and Breitung methods) and the heterogeneous tests (using the Im, Peseran and Shin [IMP] and the Augmented Dickey Fuller-Fisher tests). From the results, the variables in levels report outcomes that imply that the null hypothesis of the unit roots for the panel data for most of the variables cannot be rejected at the 5 percent level of significance. For the first differences, all variables pass the stationarity test (at the 5 percent significant level), hence the hypothesis of unit roots cannot be rejected. Apparently, the variables are only stationary after first-differencing in both the homogenous and heterogenous dimensions of the tests. Since the variables became stationary after first difference, the next step is to investigate the long run properties of the data using the cointegration tests.

Table 2: Unit Root Tests of Variables

Variables	Homogeneous Unit Root Process				Heterogeneous Unit Root Process			
	Level		1st Diff		Level		1st Diff	
	LLC	Breitung	LLC	Breitung	IPS	ADF-Fisher	IPS	ADF-Fisher
MMR	-4.34**	0.83	-3.71**	-4.99**	4.17	79.12	-2.13*	123.9**
GHEXP	-4.02**	1.92	-10.57**	4.72**	-2.27*	109.9*	-9.98**	225.2**
OPKT	-2.51**	1.22	-8.29**	4.31**	-0.37	86.2	-7.55**	215.2**
COR	0.55	2.09*	0.02	3.38**	-2.31*	115.7*	-7.17**	197.8**
GEFF	-4.02**	1.99	-1.57	4.19**	-2.21*	115.8*	-10.22**	265.2**
GDPPC	-5.51**	1.17	-7.39**	84.33**	1.56	89.11	-4.94**	164.1**

Source: Author's computation. Note: **, and * indicate significance at 1 and 5 percent levels respectively; MMR= Maternal Mortality ratio, GHEXP= Government health expenditure, OPKT= Out of Pocket health expenditure, CC= Control of Corruption, GEFF= Government Effectiveness, GDPPC= GDP per capita

The outcomes of Pedroni's and Kao panel cointegration tests are reported in Table 5.4. The results show that for the Pedroni test, at least one of the coefficients (i.e., the Group PP) was significant for each of the equations. Moreover, the Kao test (which focuses on time series within the cross sections in the panel is used to test for cointegration for the complete models) in each of the cases passed the significance test at the 5 percent level, thereby confirming that the null hypothesis of no cointegration cannot be accepted for both of the equations. Thus, a long run relationship is shown based on the cointegration test and a dynamic analysis of the data is justified.

Table 3: Panel Cointegration Test Results

Series for Cointegration Test: Maternal Mortality Ratio (MMR)					
Within-Dimension			**Between-Dimension**		**Kao (ADF)**
	Statistics	**Weighted Statistics**		**Statistics**	
Panel v	0.582	-2.444	Group rho	8.338	2.511***
Panel rho	6.829	6.669	Group PP	-3.449**	------
Panel PP	21.715*	1.728	Group ADF	1.469	------
Panel ADF	9.936	3.714			

Source: author's computation. Note: **, and * indicate significance at 1 and 5 percent levels respectively; and PP= Phillip-Perron, ADF= Augmented Dickey Fuller

5 Discussion

The results of the estimates are presented in a step-wise form with governance variables being included together with other control variables in sequential forms. The results are presented in terms of equations with government health expenditures, private health expenditures, and a combination of both expenditure patterns. This enables us to disentangle the different effects of the various expenditure structures on health outcome, especially when considered along with governance influences. In Table 2, the result of government health expenditure, governance and *MMR* is presented. The coefficient of the over-identifying restriction test statistic for the system GMM estimates possess the expected values (i.e. greater than 0.1), indicating that the instruments used in the estimation are valid. The Arrelano and Bond first and second order serial correlation tests also possess the relevant structures in terms of size and signs.

The tests show that the first order statistic is statistically significant and has the expected negative sign. The second order statistic is significant (in line with a priori expectation), suggesting that the transformed error terms are serially uncorrelated. It can be seen that the coefficient of the lagged dependent variable is highly significant at the 1 percent level and are also positive in each of the cases. The size and sign of the lagged dependent variables show that there is long run mean-reversion though the large values suggest that adjustment to equilibrium is slow. From the results, the coefficient of government health expenditure is significant and positive with robustness across each of the estimation pattern. This result shows that government health expenditure significantly reduces maternal mortality in SSA, with a 1 percent rise in such expenditure having the capacity of reducing *MMR* by up to 0.031 percentage points. This result implies that larger spending on health by governments in SSA improves both maternal and child health in the SSA region.

Table 4: Government Health Expenditure, Governance and Maternal Mortality Ratio (MMR)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$lmmr_{t-1}$	0.977***	0.991***	0.985***	0.977***	0.887***
lgdppc	-0.108***	-0.075***	-0.006	-0.052***	0.046
lghexp	-0.042***	-0.051***	-0.314***	-0.040***	-0.072*
cor		-0.08***		-0.02***	
geff		-0.05***		-0.08***	
*cc*ghexp*			-0.01***	-0.01***	-0.08***
*geff*ghexp*			-0.01***	-0.01***	-0.02
lfltr					0.091
lflfpr					-0.948***
lmipr					0.036
lpisn					-0.272**
loda					-0.029***
labrt					0.024*
ltfr					-0.024*
Overidentifying restriction (Hansen J-prob)	0.611	0.471	0.433	0.449	0.458
Arrelano-Bond AR(1)	-0.03	-0.12	-0.021	-0.04	-0.12
Arrelano-Bond AR(2)	0.96**	0.91**	0.77*	0.91**	0.93**
No. of observations	588	588	588	588	588

Source; Author's computation.

Thus, there is need for increasing budgetary allocations to the health sector since the positive effects spread over different outcomes as also shown in Danquah and Ouattara (2014). The impact of government health expenditure on maternal health is however much larger than the impact on child health as demonstrated by the coefficients of the *lghexp* variable. Thus, public health expenditures appear to be more related to improving maternal health than in improving child health. A major aspect of the results in table 5.8 is with respect to the coefficients of the governance and interaction variables which are all negative and largely significant. This shows that improved governance tends to lead to decreases in maternal mortality ratios among the countries in SSA. This result is profound considering that even the interaction variables also exhibited negative elasticities. Apparently better governance actually reduces maternal mortality ratio just as it improves child health among the SSA countries. Unlike the estimates for child mortality where the GDP per capita variable was positive and largely insignificant, the coefficient of GDP per capita is negative and significant for the *MMR* estimations. This shows that income levels have significant negative impact on MMR, or income growth tends to improve maternal health in SSA region. The coefficients of female labour participation rates and access to medical personnel are also significant in the model, with both having negative coefficients. This shows that the more women participate in the labour market, the less maternal mortality rates in SSA. Also, access to medical personnel also tends to reduce maternal mortality. Other social facilities are again shown to play extra positive roles in promoting maternal health among SSA countries.

The effects of private health expenditures on maternal health are shown in the results in Table 3. Overall, the results are generally impressive, the probability values of the Hansen J-statistic is appropriate and justifies appropriateness and effectiveness of the instruments selected for the estimation. In addition, the Arrelano-Bond autocorrelation statistic is significant which indicate the absence of second level serial correlation in the results. The coefficient of the lagged dependent variable is also significant and positive in each of the estimation cases, suggesting long run stability. The coefficient of private health expenditure is significant in each estimation and positive. This implies that as private health expenditure increases, maternal health also improves.

It is therefore seen that private health spending has more relevant effects on maternal health than on child health. This result extends the earlier finding that government expenditure has stronger effects on maternal health than on child health. The coefficients of the governance variables are also all positive, showing that governance reduces maternal health even when private health expenditures are considered. The negative effect of governance levels on maternal mortality highlights the fact that expenditures and outcome need closer consideration in order to observe there relationships extensively as demonstrated in Adegboye and Oziegbe (2018).

Table 5: Private Health Expenditure, Governance and Maternal Mortality Ratio

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
lmmr(-1)	1.009***	1.092***	0.993***	0.974***	0.792***
lgdppc	-0.127**	-0.115	-0.107***	-0.109	-0.025
lopkt	-0.087**	-0.150	-0.045***	0.069***	-0.028
cor		-0.07***		-0.04**	-0.06**
geff		-0.04		-0.07***	-0.04**
cc_ghexp			-0.01***	-0.01*	
geff_ghexp			-0.01***	0.000	
lfltr					-0.047*
lflfpr					-0.559*
lmipr					0.006*
lpisn					-0.549**
loda					-0.024**
abrt					0.023*
ltflr					0.123*
Overidentifying restriction (Hansen J-prob)	0.998	0.001	0.449	0.783	0.533
Arrelano-Bond AR(1)	-0.17	-0.09	-0.22	-0.03	-0.12
Arrelano-Bond AR(2)	0.87**	0.91**	0.79**	0.77**	0.91**
No. of observations	588	588	588	588	588

Source; authors computation using eviews 8. Note: ***, **, and * indicate significance at 1, 5, and 10 percent levels

Finally, the results of the combination of expenditure variables is presented in Table 5.10. The results show the negative effects of both public and private expenditures on health on maternal mortality even when both expenditures are taken together. In the same vein, the results show that the impacts remain unchanged even when the two expenditure variables are included in the model.

The coefficients of the governance variables are still all negative again confirming the negative impact of governance on maternal mortality ratio in SSA countries. In the result in column 5, only the coefficients of female labour force participation rates and access to medical personnel passed the significance tests among the control variables.

Table 6: Combined Results for Maternal Mortality Ratio

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
$lmmr_{t-1}$	1.024***	1.014***	1.019***	0.974***	0.866***
lgdppc	-0.124***	-0.105***	-0.023	-0.100	0.080
ghexp	-0.071***	0.022**	-0.331***	-0.051*	-0.451*
lopkt	-0.114***	-0.095***	-0.104***	-0.075**	-0.122**
cc		-0.010***		-0.02*	
gef		-0.035***		-0.07***	
cc_ghexp			-0.001***	-0.001*	-0.001
geff_ghexp			-0.001***	-0.001	-0.001
lfltr					0.015
lflfpr					-0.898*
lmipr					0.027*
lpisn					-0.395
loda					-0.027**
labrt					0.011
lflt					0.170
Overidentifying restriction (Hansen J-prob)	0.283	0.497	0.801	0.666	0.415
Arrelano-Bond AR(1)	-0.17	-0.09	-0.22	-0.03	-0.12
Arrelano-Bond AR(2)	0.67*	0.94**	0.82**	0.61*	0.96**
No. of observations	588	588	588	588	588

Author's computation using. Note: ***, **, and * indicate significance at 1, 5, and 10 percent levels

A major policy implication of the study is that the establishment and sustenance of quality institutions in terms of governance among SSA countries is the major means of attaining effective linkages between health input (government health expenditure) and health outcome (maternal mortality ratios) in the health sector. The long-standing challenges of poor health outcomes within the SSA region can be largely addressed by focusing on strengthening governance institutional capacity. Essentially, health system strengthening by curbing corruption and fostering bureaucratic quality have been proven to be key to drastically improve maternal and child health as better governance would undoubtedly lead to resource efficiency which will ultimately lead to meeting the sustainable development goal of reducing maternal mortality ratios to 70 per 100,000 live birth by the year 20230.

5. Conclusion

The study examines the link between government health expenditure, governance and maternal mortality rate (MMR) in Sub Saharan Africa (SSA) and utilizes panel dataset of forty-two countries for the period 2001 to 2016. It was noted that although the advocacy for increases in government health expenditure to reduce maternal deaths seems irrefutable, the interaction between health interventions and governance in relation to maternal and under-five mortality has not been fully studied. The GMM technique was used for the empirical relationship between government health expenditure and the maternal mortality rates for the countries. Moreover, the effects of interaction of the expenditures with governance indicators were also observed in the study. Based on the empirical analysis in the study, it was found that a strong negative relationship exists between government health expenditure and maternal mortality ratio (MMR) in SSA. Moreover, the quality of governance was shown to have a significant negative impact on MMR. Thus, reduction in corruption and improvements in government effectiveness both tend to promote reductions in MMR across the SSA region. In the same vein, the interaction of government health expenditure with governance provides a plausible explanation for the variation of health outcome across sub Saharan African countries. Countries with better governance quality tend to experience better outcomes in terms of the effectiveness of expenditures on health and maternal mortality reduction in particular. The study also showed that out-of-pocket health expenditure still plays strong roles in reducing MMR for SSA countries, while female literacy rate, female labour force participation rate, and malaria incidence are major factors that also explain MMR outcomes among SSA countries.

There is therefore the need to strengthen the implementation of the Abuja Declaration through policy and collaborative support. A strong aspect of the implementation of the Declaration is stronger government commitments to increasing health shares in annual budgets and ensuring proper monitoring of such resources. In the quest to win the fight against corruption, the AU will need to call for visible commitment to anti-corruption from all of its leaders. A comprehensive anti-corruption strategy must also include actions to prevent and control the laundering of corruption proceeds. The intensification of the war against corruption and money laundering is vital in order to overcome the problem of diversion of resources away from public health programs and projects in SSA. Focus on spending patterns should also consider efforts provision of safe water and improved sanitation especially at the rural areas where a vast majority of the people still drink water from streams and defecate in the open. This will strengthen the capacity of promoting sustainability of maternity health at all levels. Finally, programmes and policies that empower and promote women status should be given adequate attention. This include education and creation of legislation that foster equal right for both male and female in gaining employment.

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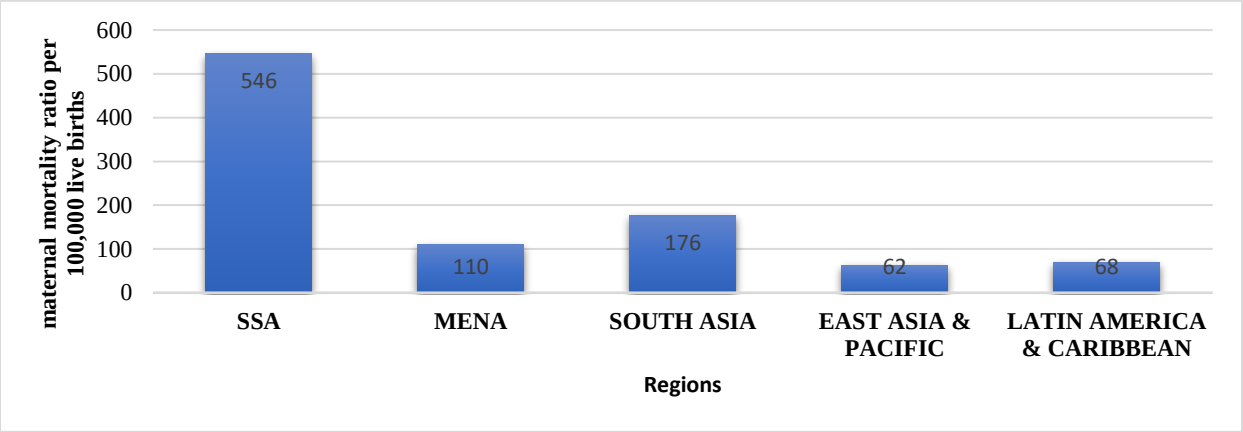
Figure in page 2: Maternal Mortality Ratio across regions in the World



Sources: World Health Organization (WHO, 2016)

APPENDIX 1: Data Description and Variable Sources

Name of Variable	Description of Variable	Data Sources
Maternal mortality Ratio (MMR)	expressed as the number of maternal deaths during a given time period per 100,000 live births during the same period:	World Development Indicators (WDI)
Public Health Expenditure (GHEXP)	consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Measured as the total public health expenditure.	WDI
Private Health Expenditure (OPKT)	includes direct household (out-of-pocket) spending, private insurance, charitable donations, and direct service payments by private corporations. Measured as total private health expenditure.	WDI
Income per Capita	Based on purchasing power parity (PPP) and data are in constant 2005 US$.	WDI
Control of corruption (CCC)	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate of governance (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance)	World Governance Indicators (WGI)
Government effectiveness (GEFF)	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. As a proxy for bureaucratic quality	WGI
Female Literacy rate (FLTR)	Level of education attainment by a woman	WDI
Adolescent fertility rate	Adolescent birth rate (per 1,000 women aged 15–19 years)	WDI
Total fertility rate (TFR)	Average children a woman of reproductive age between 15-49 can have in	WDI
Malaria incidence prevalence rate (MPR)	Malaria incidence (per 1000 population at risk)	WDI
Population with improved sanitation (PISN)		WDI
Adolescent Birth Rate (ABRT)	Birth Rate of girls between 15 and19 years per one thousand	WDI
ODA	Official Development Assistance	WDI