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**Health Expenditure Targeting, Financial Protection and  
Maternal Mortality in Sub-Saharan Africa.**

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**Abstract:** The slow reduction in maternal mortality rate in Sub-Saharan Africa is a serious cause for policy concern. This has not only retained the sub region in the web of leading region in high rate of reproductive health challenges but spells signals of poverty and low economic growth. The study therefore, examined the efficacy of health expenditure targeting and financial protection in reducing maternal mortality in 44 Sub-Saharan Africa countries. The study adopts fixed effect panel data modelling technique. Results show that financial protection is correctly signed but not statistically significant while relative health expenditure targeting is both correctly signed and statistically significant in reducing maternal mortality. Recommendation is that health expenditure should generally be increased so as to increase the slope of decrease in maternal mortality rate in Sub-Saharan Africa and health expenditure should be more targeted against GDP as common denominator.

**Keywords:** Maternal Mortality; Health Expenditure Targeting; Financial Protection; sub-Saharan Africa

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**Introduction**

In the annals of health care financing, the role of government cannot be neglected. This is so because, government is the possessor of the largest ability to spend on behalf of the citizens and the major macro-economic goal of any government anywhere in, the world, is to attain health for the populace. This has been emphasised by millennium and sustainable development goals 3 and 5 respectively, (WHO 2010). The government can attain optimum provision of healthcare through the systematic control of government expenditure through the budget or tax system. This is referred to as Fiscal policy (Gordon Scott, 2020). Fiscal policy is of different variants depending on the purpose the government intends to achieve. Fiscal policy could be targeting or protective in its application to the health sector.

Health expenditure targeting is the process by which a given proportion of the budget is marked out for spending on health sector of the economy with a view to achieving a given level of reduction in a particular negative health outcome. A typical example of negative health outcome is maternal mortality. Targeting varies with different economies, so there is no standardised value that achieves the health indicator earmarked. Health expenditure targeting could be relative or absolute. The relative health expenditure targeting is the type that fixes the amount to be spent against a given denominator such as GDP. According to Jowett, Brunal, Flores and Cyclus, (2016) an economy would need to spend at least 4 - 5% of GDP to achieve the sustainable development goal on health. Absolute targeting is the specification of a fixed amount to be spent on the health sector of the affected economy. For example, World Health Organisation (WHO, 2010) specified that at least, US\$60 should be spent by each economy of the world to be able to meet up with sustainable development goal on health. Financial protection, on the other hand, is the increased public health expenditure so as not to expose the populace to impoverishing catastrophic health expenditure. It is normally calculated as the proportion of health expenditure out of total expenditure.

World Health Organisation, WHO, (2019) declares that between, 2000-2017, 295,000 women died from avoidable childbirth related incidences. Out of this figure, Sub-Saharan Africa and Southern Asia accounted for 254,000 (86%). From this, Sub-Saharan Africa accounted for 196,000 (77%) while the remaining 58,000 (23%) belongs to Southern Asia. By 2017, Southern Asia has mitigated her figure by 60% (384, 000 – 157,000) Sub-Saharan reduced hers by less than 40%. This declaration implies, among others that, the Sub-Saharan African countries has a very high proportion of the world maternal mortality. That, efforts at reducing this health risk in the Sub region is not proportional to the prevalence rate of the health challenge and therefore, inadequate. In 2001 the World Health Organisation (WHO) Conference at Abuja declared that economies of the world should target 15% of their annual budget for their health sectors, so as to reduce most of the health challenges they face, including maternal mortality. WHO, (2019) observed that only 29% and 14% of the upper and upper middle and lower and lower middle classes economies where able to achieve this. This portrays a suspected weakness in the potency of this variant of fiscal health policy. In short, divergent financial policies have been proposed, globally, towards attending to maternal mortality challenge. Among these is the health expenditure targeting which aims, majorly, at reducing maternal mortality to a targeted level by spending a given amount. A desirable benefit from this action is the cloaking of the populace from catastrophic expenditure that generates poverty. Jowett, et'al, (2016) concluded in their study that *relative health financial targeting to GDP* is more effective in generating Universal Health Service Coverage convergence rather than *financial protection*. Enquiring into the efficacy of this policy discourse in the context of Sub-Saharan Africa is pertinent, so as to find relatively adequate financial response to the slow decline in maternal mortality challenge in the sub region of Africa.

For another thing, the *assessment* given to WHO, (2019)'s declaration by the countries in the Sub-Saharan African economies should be reflected in the level of attention given to it by the affected economy. To some economies, over population is a threat, thus maternal mortality is natural provision to stem it while to others, the mothers are national assets and they are threatened by the risk of maternal mortality, their children are future labour force and army of the economy and as such, should be protected. (Nathanson, 1996). Perhaps this accounts for the different variants and levels of fiscal attentions given by the different

economies to their health sectors. This is evidenced by rather sluggish reduction in maternal mortality in the Sub-Saharan economies, in spite of the purported increasing health expenditures, whose adequacy is the question. Most studies have explored maternal mortality in diverse dimensions but almost none tends to be bothered by getting the appropriate fiscal instrument attention to mitigating the slow reduction of maternal mortality in the Sub-Saharan Africa. Even though Jowett, (2016) focussed on efficiency in the use fiscal health resources, one of its main conclusions is that financial protection could not attain Universal Health Services Coverage convergence but rather the GDP-Relative Health Expenditure Targeting did. Could this policy model be testable in the Sub-Saharan African economies, in the frame work of a panel data analysis? This is the bother of this study. Looking towards the Sustainable Development goals, a lot of fiscal health policies were proposed and executed between 2010 and 2015. Thus 2009 to 2017 mark the time scope of the study, in order to encompass and examine the effects of such policies. The rest of the study is: section 2, literature review, section 3, theoretical frame work, section 4, presentation and discussion of results and section 5, summary and conclusion.

### ***Trend of the Major Variables.***

Maternal mortality ratio (MMR), government health expenditure out of total expenditure (GHEXTE) and government health expenditure-to-GDP ratio (GHEX\_Y) are the major variables of this discourse. In this sub-section, effort is made to examine the trend of these variables. In order to accomplish legibility and economy of space, a few countries with similar characteristics in terms of economic size and location are selected. One thing is, however, assured that their statistical characteristics approximate that of the rest Sub-Saharan countries being considered but not selected for this illustration. The countries selected include, Nigeria, Ghana (West Africa), Ethiopia, Kenya and Tanzania (East Africa), Angola and South Africa (Southern Africa), Sudan (northern Africa) and central Africa (for the centre).

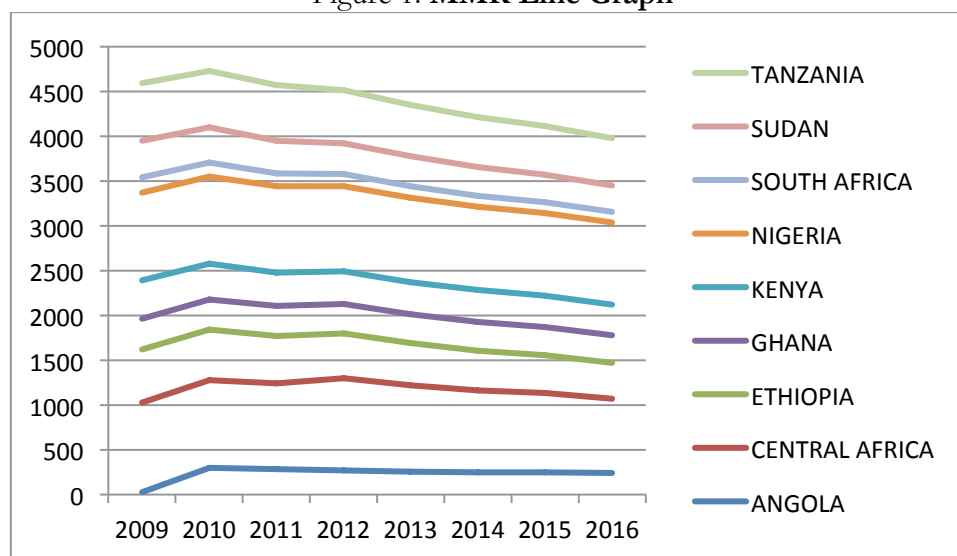
### ***MMR Trend.***

Maternal mortality is pregnancy related death that occurs 42 hours after birth but not by accident (Ibrahim,2016). It is caused by many factors, which could be related to, biological, medical, socio-cultural, literacy rate and economic issues, (Muoghalu, 2010 in Olawale, Tomike, Oluwatobi and David,2017). Maternal mortality is different from maternal morbidity which is debility of pregnant women. This could be as a result of other ailments such as malaria. Morbidity can increase the chance mortality of pregnant women. (World Health Organisation, (WHO) 2013; United Nation Education and Science Commission (UNESCO), 2018; International Children and Emergency Fund (UNICEF), 2015 and Aluko-Arowolo, 2015; Grossman, 1972 ).

There have been several policy emphases on the challenges of maternal mortality, especially in Sub-Saharan Africa. Such emphases have been marched with policy efforts channelled through myriads of socio-economic routes such as educational enlightenment, advocacy and fiscal policy. In all these, maternal mortality in the sub region only shows marginal decline. Table 1.1 shows the line graph of the trend of maternal mortality among the nine countries, from 2009 to 2017. Each of them maintains a near constancy in decline. The margin of decline is faintly visible across the nine years, in each of the economies. This is shown in the line graphs of the respective economies represented. South Africa, for

example, declines gradually from 171 per 100,000 births in 2009, 161 in 2010, 143 in 2011 to 119 in 2016. Nigeria, on her part, also presents very marginal decline. For example, MMR amounts to 978 deaths per 100,000 births in 2009, 972 in 2010, 963 in 2011, 951 in 2012 and 917 in 2016. Similar is the picture for Tanzania that has; 644 in 2009, 628 in 2010, 615 in 2011, 593 in 2012 and 524 in 2016. Angola maintains the same gentle declining slope as the figures slide gently from, 300 in 2010, 281 in 2011, 269 in 2012 and 241 in 2016. Please see appendix 1.

Figure 1. MMR Line Graph



Thus it, can be seen that the graphs generally have gentle slopes with a few exception to economies like Tanzania, Sudan and South Africa, with some slight measure of steepness. The rest are much gentler. There is no value for 2017 hence the graphs stopped at 2016. The picture here is that maternal mortality generally decline at a very slow rate.

**GHEXTE Trend.**

The Abuja 2001 declaration requires that economies globally reserve 15% of their annual budgets to the health sectors of their economies. According to Jowett et’al, (2016), only 29% of the upper and upper middle as well as 14% of the lower and lower middle incomes economies met this requirement. Figure 1.2 shows the component bar graph of this variable for a nine year interval (2009 – 2017). From it, values of the bars do not show clear increase but constant mixed with decreasing sizes. Thus even though the values fluctuate, they are generally more on the decreasing pattern than increasing growth. For example Tanzania declined from 12% of total expenditure in 2009 to 6% in 2010 and rose, marginally, to 7% in 2017, Nigeria wobbled from 5% in 2009 through 4% in 2011, 2% in 2013, to 5% in 2017. Angola rose marginally from 4% in 2009 to 5% in 2010, dropped to 4% in 2011 and retained this position till 2015 dropped to 3% and rose again to 5% in 2017. South Africa which seems to come close to Abuja recommendation did not go beyond 13% having recorded 11% from 2009 to 2010. See appendix 1.

Figure 2. GHEXTE Component Bar Graph

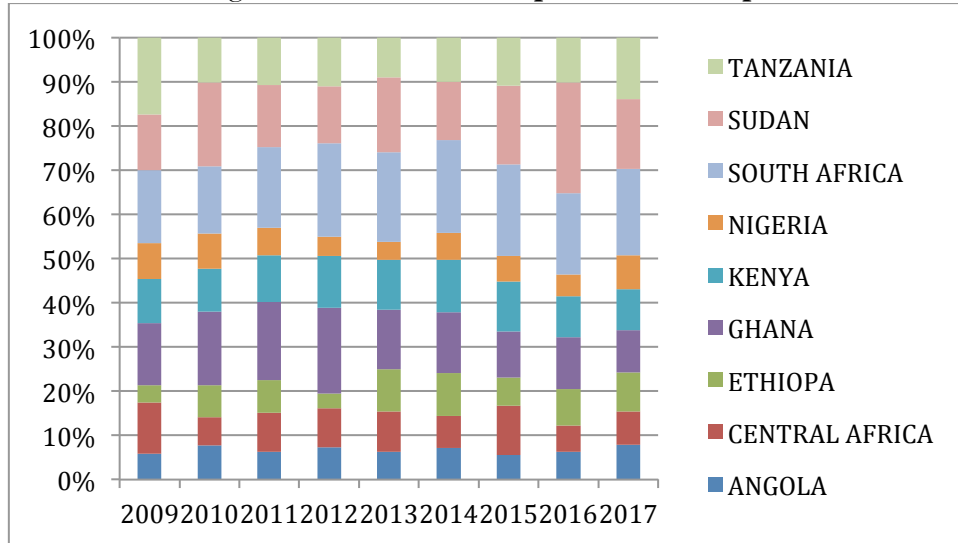


Figure 3. GHEXTE Line Graph

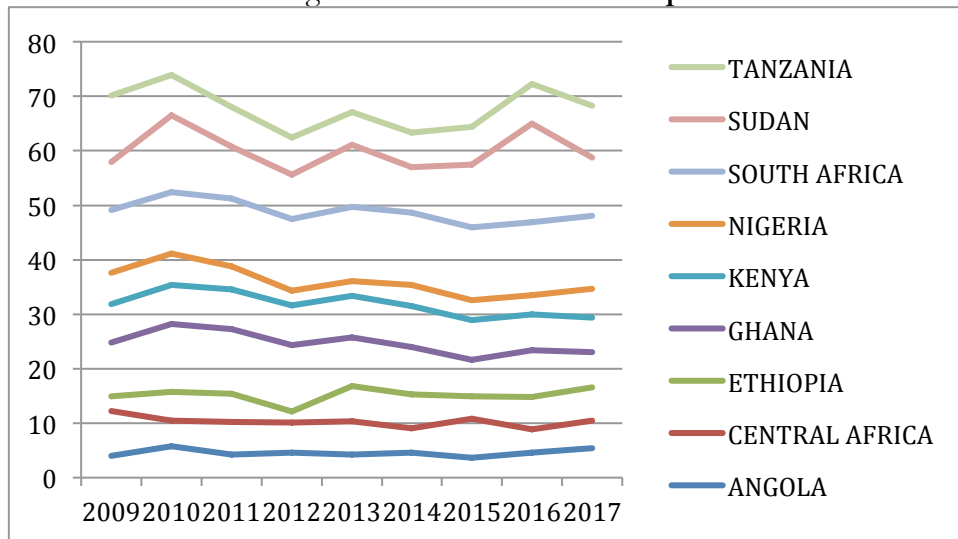


Figure 1.3 is the line graph presentation of figure 1.2. It shows that the graphs have steady fluctuations that exhibit slight decline in some cases. This portrays weak or no efforts at improving on health spending by Sub-Saharan countries. This also underscores the slow decline in maternal mortality in the sub region. It is important to note that paying serious attention to health spending generally shields the populace from impoverishing catastrophic spending and also ensures the mitigation of negative health outcomes, such as, maternal mortality. While the upper and upper middle income economies may play down on this and still remain in safe health outcome gaps, the sub-Saharan countries cannot do same and remain safe. This is so because; the former have well established health insurance culture and network whereas the later does not have.

**GHEX\_Y Trend.**

This is the percentage of the economy’s GDP spent on her health sector. It reflects both the level of priority placed on health in the economy and the fiscal content of the policy by its structure. It also measures the size of the government relative to the economy. It is the variable that actually reflects on the wellbeing of the populace by its national income orientation. This shows that this variable would reflect more real socio-economic implication. Thus the more policy attention this receives, by increased ratio, the higher would be the gradient of decline in maternal mortality graph. WHO, (2019) declares that it will require a GHEX\_Y ratio of not less than 5% to step up the rate of decline of maternal mortality of an economy that wants to meet up the Sustainable Development Goal of reducing maternal mortality by 2030. Figure 1.4 shows the composite bar graph of this variable across the 9 year period of 2009 to 2017 for the 9 economies. The graph shows a general decline in this ratio between 2009 and 2011 for most of the economies. This could be attributable to the global economic meltdown that affected the finances of most economies globally. The graph also shows that, apart from South Africa, most of the rest economies had very low GHEX\_Y ratio. South Africa, for example, gradually increased the ratio from 11% in 2009 through 2010, 12% in 2011 and stabilised at 13% all through to 2017. The rest of the economies had low and fluctuating values. Nigeria for example, had 0.8% in 2009. This declined to 0.6% in 2010 and then wobbled between 0.4% and 0.5% for the rest of the time. The picture is not different for the rest economies. See appendix 1.

**Figure 4. GHEX\_Y Component Bar Graph**



Figure 5. GHEX\_Y Line Graph

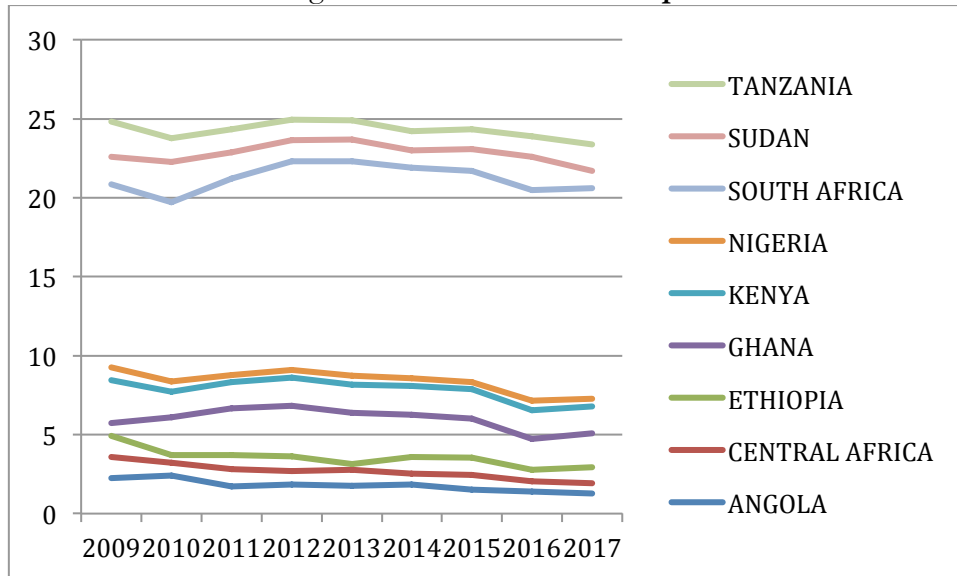


Figure 1.5 is a line graph version of figure 1.4. It presents the same pattern of flow of the composite graph. It shows low and fluctuating graphs for the economies. South Africa has a sort of plateau shape graph that reflects the pattern of spending. Thus generally, apart from South Africa, the observation is that the Sub-Saharan economies do not yet seem to comply with the efficacy of fiscal policy, particularly, relative expenditure targetin, in reducing maternal mortality.

## Literature Review

### *Theoretical Literature*

#### **The Eager Model**

Eager, (2004), essentially asserts that modern policy practices normally evolve from old policy practices. It also states that both foreign and domestic interests and modern time's realities determine the focus of the new policy order. The Eager model employs the social construct framework to actualise the realisation of a new policy order. In its emergence, it passes through five phases. These are: i) Existence of an articulate group that oppose the existing order. ii) Existence of clearly articulated justifications for the non-acceptability of the existing order and capacity of enforcement by the articulate group. iii) Existence of a *critical state* and international documents for justifying and effecting the new order. iv) Existence of both domestic and foreign support for the new order. v) Existence of broad base network of local, national and foreign activists to aid the popularisation of the new order. The case study is a women interest group that advocated the preference of a women reproductive health compliant policy than a pro-population control reproductive policy. The group utilised the 1974 Bucharest international Conference, member of G-77 to present her observations on the ill effect of the population control policy (the old order that ran between 1960-1965)) to request for a change and transformation to a new population control policy that recognises the need to address the old order's negative

effects, of maternal mortality and women morbidity, on women generally. The declaration of 1975-1985 as women decade by the United Nation, created apple opportunity for the success of the advocacy that yielded the new reproductive health policy that is women's rights and health compliant.

**The Nathanson Risk Model**

Nathanson, (1996) in Eto, (2016) states that, government and social activism are very crucial in the development of efficient public health policy that mitigate the mortality and morbidity of the populace of any economy. According to Nathanson, (1996), effective public health policies are the results of deliberate and concerted efforts from government and socio-political activism that focuses on, risk identification and construction. The health risk model is based on three principal assumptions which are: i) Existence of a firm and centralised government that prioritises the wellbeing of the populace to high extreme. ii) Existence of an active socio-political activism that mobilises a strongly wielding *grass-root* oriented movement. iii) Existence of culturally credible risk. Credibility of risk refers to the compatibility of the orientation of the public health policy with the cultural background of the economy in view. The first assumption implies the existence of a transformation actor, in this case, the centralised government, that has the authority to identify, define and describe the public health challenge. This could be achieved by the government articulating an optimal aggregate health care demand through a systematic budgetary and tax control. Thus according to Keynes, (1936) increased health care expenditure leads to increased aggregate demand that will create increased national output which leads to increased economic growth. This is where fiscal policy comes into health care regulation and hence maternal mortality control. The second assumption implies the existence of a causal link that explains the cause of the health risk while the third assumption implies the identification of the targeted victims of the risk. To exemplify her discourse, Nathanson, (1996) in Eto, (2016) by comparing the mortality and child death policies of France and the United States of America. According to her, the public health policy of France succeeded because France identified the maternal mortality and child deaths as risk that targeted the mothers and children. The policy saw the mothers as government assets that produced the nourishment of France population and the children as the replenishment and sustenance of France army. The United States of America, on the other hand, saw the public health challenge (maternal mortality and Child death) as a threat to immigration and so was less active than the French government.

**The Grossman Model**

Grossman, (1972) asserted that demand for health care is a derived demand because individuals demand for health care as a result of the desire to stay healthy. To him, utility derived from health depends on total health stock of the individual. This, on its part, depends on; the initial health endowment, healthy time consumed out of total health stock, other assets owned by the individual and other factors of production owned by the individual. Thus;  $U(H_t) = H_t$

and  $H_t = f(H_0, \varphi H, Z, X)$  -2 U  
 is the utility argument,  $H_t$  is the total health stock of the given individual,  $H_0$  is the initial health endowment the individual is born with,  $\varphi$  is the proportion of the total health stock the individual is able to consume on work and  $\varphi H_t = h_t$  where  $h_t$  is the healthy time of the individual.  $H_0$  is seen as exogenously given at birth while  $h_t$  is seen as endogenous as it can be influenced by policy to cultivate healthy habits.  $Z$  is the assets owned by the



individual and X is the factors of production for producing the resources. Without loss of generality, the imperative here is that, Total health stock can be seen as a function of, initial health stock assets and factors of production owned by the individual. All these can be influenced by government policy that empowers the individual through increased aggregate demand that alleviate poverty as well as education enhancement that enhances building of positive health habits through enlightenment.

The import from the fore going is that there has to be a consensus that there is a risk, that is, a threat to the need for good health stock for the populace and that there is an affected target, this time, the pregnant women, and that there has to be an articulate and stated readiness to advocate and tackle the risk by, the existence of firm and willing central government and effective advocacy. Thus all the theories asserted above revolve around these facts. The framework of this study is thus informed by the thoughts above.

### *Empirical Literature*

Literature is replete with studies on maternal mortality, there is, however, a dearth of literature on the level of significance of domestic and foreign health expenditure on maternal mortality, that will mitigate maternal mortality significantly, inSub-Saharan Africa. For example, Catherine M., T. Amartdeep, R. Bridget, and T Amanda (2019) employing the Demographic Survey data between 2008 and 2013, examine the determinants of maternal mortality in Southern and Northern Nigeria. The motivation of the study is the persistent rise in maternal mortality in the country. The study finds out that maternal mortality is higher in the northern region than the south within the period of study. It therefore concludes that media enlightenment, education, house type, community and poverty are associated with maternal mortality in Nigeria. Catherine et'al, (2019) emphasise socio-economic variables while this study queries the efficacy of health expenditure targeting and health protection expenditure fiscal efforts at improving on the rate of decline in maternal mortality in Sub-Saharan Africa.

Farid M., S. Beckerb and H. Berendes (1998), investigated the risk factors associated with maternal mortality in sixteen districts of Balochistan and North-West Frontier province of Pakistan. The study uses a nested-case control study to compare 261 cases of maternal death and also employs the contextual analysis to interact the biological risk factors with district level factors The findings are that women under age 19 or over 59, those having their first birth and those with previous birth-fatality history are more likely to face mortality in pregnancy. Peripheral distribution of health facilities and access to essential obstetric care are strong associates with maternal mortality. Again Farid, et'al (1998) emphasise biological and medical factors in their study whereas, this study is focussed on the efficacy of expenditure efforts at reducing maternal mortality in sub-Saharan Africa.

Cameron L., S. Contreras, D. Suarez and K. Cornwel (2019) investigate the determinants of maternal mortality in Indonesia using the country's census data. The study shares the country into low and high performing regions, it also employs the multiple-logistic regression method to test the hypothesis that access and quality of care have serious effect on maternal mortality in Indonesia. The motivation of the study is the desire to meet up with the sustainable development goal 3.1 of reducing maternal mortality ratio to 70 per 100,000 by 2030. The result of the study show, inter alia, the availability of doctors, midwives in community and village health facilities as well as distance, as strong associate

of maternal mortality. The United Nation Population Fund UNPF, (2012), corroborates this conclusion. It asserts that the chances of a woman not encountering pregnancy related death in Sub-Saharan Africa is strongly associated with her social economic status, norms and values of her community and availability of personnel and quality of attention.

Jowett M., M.P. Brunal, G. Flores and J. Cyclus (2016), examine the effects of health sector spending targets on the achievement of Universal Health Coverage (UHC) in 83 low and medium countries. The study adopted Data Envelopment Analysis (DEA) methodology. It concluded that there is no particular set target that can effect UHC but that as public health expenditure increases there is also increased improvement in universal service coverage and its convergence is attained faster by increased health expenditure. The study also noted that *financial protection* varied widely among the economies under study. This study raised critical issues in the annals of health sector financing, particularly in the mitigation of serious negative health outcomes, such as maternal mortality, in sub-Saharan countries. The question is should it be financial protection or health expenditure targets? If it is the later, what variant of it should be adopted? Though Jowett et'al (2016) adopted the DEA Method, this study adopts the Fixed effect model to look at this question in 44 sub-Saharan African countries.

Christopher E.N, (2018), examines the effect of public health expenditure on maternal mortality in Nigeria. The motivation of the study is the escalating rates of maternal mortality in the country. It employs the panel study to analyse data from 25 states of the country. Results shows that public health expenditure is significant in mitigating maternal mortality in Nigeria. Olawale O., I. Tomike, J. Oluwatobi and T. David (Undated), examine the socio-economic development implication of maternal mortality and Maternal Health care in Nigeria. It employed the functionalist perception as the basis of its theoretical framework. It concludes that direct and indirect medical causes, socio-cultural and socio-economic factors are responsible for maternal mortality in Nigeria. It also concludes that this is also responsible for weak economic development in the country. Achem F. and C. Agboghroma (2014), observed that in the case study report by Smith H., C. Ameh, and N. Broek that maternal health care facilities are inadequate, not maintained and that most of the facilities lack appropriately trained health care staff. This has accounted for the high rate of maternal death in Nigeria to the tune of her accounting for 14% of global maternal death in 2008.

Williams C., R. Atun, P.Agrawal and T. Zeltner (2014), employ a multivariate regression analysis to examine the association between government health spending and maternal mortality in 24 European Union countries. Result shows that reduction in government health expenditure has significant association with increase in maternal mortality in the European Union countries.

Karlsen S., L. Say, J.P.Souza, C.J. Hogue, D.L. Calles, A.M. Gulmezoglu & R. Raine (2011) examined the relationship between low level education and maternal mortality in 24 countries in Africa, Asia and Latin America. The results show that there is significant relationship between low women education and high maternal mortality. It therefore recommends that more attention be paid to social factors in order to combat maternal mortality effectively. Weitzman A. (2017) examines the effect of women's education on maternal health in Peru. The study employs instrumental regression discontinuity on the data collected. The study concluded that women higher education is associated with



model exhibits its exogeneity in the model. It reflects the amount of maternal mortality that would exist, on its own, outside the other factors that can affect maternal mortality.

***The Empirical Model***

Following Nathanson , (1996) the empirical model is given as follows:

$$MMR_{it} = \beta_0 + \beta_1 LGHETE_{it} + \beta_2 LEXHE_{it} + \beta_3 LPSE_{it} + \beta_4 LGHEX\_Y_{it} + \beta_5 NM\_THP_{it} + \mu_{it} \tag{7}$$

Equation 7 is applied on 44 sub-Saharan African countries in this study. In order to have a clearer understanding of the values of the parameter estimates, the study interprets them in percentages. To achieve this, each of the variables was evaluated in their logarithmic values. Thus equation 7 is specified in its econometric format as:

$$MMR_{it} = \beta_0 + \beta_1 LGHETE_{it} + \beta_2 LEXHE_{it} + \beta_3 LPSE_{it} + \beta_4 LGHEX\_Y_{it} + \beta_5 NM\_THP_{it} + \mu_{it} \tag{8}$$

MMR is maternal mortality rate, GHETE, is government health expenditure out of total expenditure, EXHE, is the external health expenditure, PSE, is primary school enrolment, GHEX\_Y, is government health expenditure out of GDP, NM\_THP, is number of nurses and midwives per thousand persons and  $\mu_{it}$  is the error term.

***Methodology***

The scope of study cuts across 44 sub-Saharan African countries. Thus it has 44 cross sectional units and ranges between 2009 and 2017 which implies a time series of 9 years. Panel data analysis is therefore adopted for the study. The series feature of the data is rid of possible presence of unit root by the process of Levin, Lin and Chu (LLC), Im Pesaran and Shi (IPS) and Hadri (HR). The existence of cointegration between the dependent and the independent variables is handled by Pedroni and Kao statistic with the Engle and Granger base process. For accuracy in results of analysis, there is need for precision in method of analysis. The dilemma is avoiding problems of loss of degree of freedom and associated multicollinearity when fixed effect model is adopted for the study, Meanwhile, subsuming the dummy ignorances in the Error Component Model (ECM) creates the temptation of falling into the risk of using a method infested with correlation among the individual errors of the series or errors among cross section. Where however, the two methods yield result of equal accuracy, it gives the assurance of obtaining robust parameter estimates in the study with either of the methods. Thus the null hypothesis for this test is that there is no difference between the random and the fixed effect model estimates. For this study, the Hausman test statistic is adopted in confirming this hypothesis. For this study, the Hausman statistic is statistically significant at 5%, thereby failing to accept the null hypothesis and hence the fixed effect model is estimated. If the Hausman statistic is significant at the given significance level, then the study adopts the fixed effect model for its estimation but if otherwise, then the error component model is adopted for analysis.

***Definition of Variables.***

Abbreviation	Full Meaning	A priori Expn	Source
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LMMR	Log of Maternal Mortality Rate. It is the object of investigation and so the dependent variable of the study.	N.A	World Bank Human Development Indicators.
LGHEXTE	Log of government health expenditure as a ratio of total expenditure. It was taken so as to reflect the level priority the sub-Saharan economies place on health.	-ive	World Bank Human Development Indicators.
LGHEX_Y	Log of government expenditure as a proportion of National income (GDP). This is a measure of the degree of compliance with Abuja declaration by World Health Organisation (WHO).	-ive	World Bank Human Development Indicators.
LEHEX	Log of external expenditure. External expenditures on health are composed of different foreign transfers and foreign transfers distributed by government encompassing all financial inflows into the national health system from outside the country.	-ive	World Bank Human Development Indicators.
LNМ_THP	Log of number of nurses and midwives per thousand persons	-ive	World Bank Human Development Indicators.
LPSE	Log of primary school enrolment. This is taken to proxy literacy rate.	-ive	World Bank Human Development Indicators.

## Findings

### *Descriptive Statistics*

Table 1. **Descriptive Statistics**

Variables	LMMR	LGHEX TE	LEHEX	LGHEX_ Y	LNМ_T HP	LPSE
<b>Mean</b>	5.615356	0.388600	0.490720	0.633252	-0.784431	4.099468
<b>Median</b>	5.594711	0.369366	0.492303	0.609489	-0.605136	4.312845
<b>Maximum</b>	5.786897	0.561921	0.721903	0.884529	-0.269187	4.357016
<b>Minimum</b>	5.505332	0.250977	0.233228	0.415810	-2.087474	3.750426
<b>Std. Dev.</b>	0.094480	0.088481	0.135590	0.150499	0.563463	0.267743
<b>Skewness</b>	0.585759	0.517658	-0.248708	0.409597	-1.605866	-0.298060
<b>Kurtosis</b>	2.083453	2.980713	3.102408	2.058880	4.250569	1.120595
<b>Jarque-Bera</b>	28.39392	13.76055	3.309859	19.97877	152.4491	49.88984
<b>Probability</b>	0.000001	0.001028	0.191106	0.000046	0.000000	0.000000
<b>Sum</b>	1729.530	119.6887	151.1418	195.0415	-241.6049	1262.636

<b>Sum</b>	<b>Sq.</b>	2.740412	2.403451	5.644127	6.953546	97.46953	22.00777
<b>Dev.</b>							
<b>Observatio</b>		308	308	308	308	308	308
<b>ns</b>							

Table 1, presents the variables in their log form. This means that the values can be read in their natural form, such as percentages. From the table, the measures of central tendency (mean and median) of the data, show the average value of performance, of each of the variable, for the period of study. Apart from the values of nurses and mid-wives per thousand people, each of the other variables have no significant difference for their mean and median values. Thus approximately, results show that, the mean values of maternal mortality rate stands at 6%, government health expenditure as a percentage of total expenditure is 0.37%, external expenditure on health is 0.49%, the percentage of GDP spent on health, in the sub region, is 0.63%, and primary school enrolment rate is 4% respectively. The mean and median values of number of nurses and midwives per thousand people are -0.78 and -60 respectively. The poor values of the nurses and mid-wives per thousand people, only reflects the gross inadequacy of these medical personnel in sub-Saharan Africa while an average maternal death of 6% for the period is quite high and worrisome. The measure of dispersion of the data (standard deviation) is a measure of consistency in trend flow of the variable concerned. A small value of standard deviation implies consistency of the trend the affected variable while a high value implies an erratic fluctuation in the trend of the variable. Apart from the values of nurses and mid-wives per thousand people and that of primary school enrolment, the rest show negligible values. this implies consistency in the distribution structure of the values of the variables. The skewness structure of the data generally confirms closeness to the centre while kurtosis and Jacque Berra statistics also confirms an approximate normality in the distribution of the data. This therefore gives the assurance of reliability of the parameter estimates from the regression analysis.

**Table 2. Panel Unit Root and Cointegration Test Results**

Variable	Unit Root @ Levels			Unit Root @ First Difference		
	LLC	IPS	HD	LLC	IPS	HD
LMMR	12.16	8.88	14.19	29.37*	5.90*	11.90*
LGHEXTE	4.10	2.16	1.60	40.31*	3.10*	0.39*
LEHEX	5.86	1.68	2.90	6.50*	1.95*	0.28*
LGHE_Y	1.88	2.96	14.79	1.92*	3.11*	0.58*
LNМ_THP	14.08	4.33	9.22	13.24*	12.99*	1.83*
LPSE	9.52	1.80	9.70	14.64*	18.94*	1.53*

Source: Author’s computation. From e-views 9.0. Note: \* denotes 5% significance level of stationarity of variable and hence rejection of null hypothesis of presence of unit roots.

**Panel Unit Root**

Table 2 shows the results of the unit root tests for each of the variables. It shows that the variables are integrated of order 1. This therefore, assures the fact that the parameter estimates of the panel regression would be efficient and consistent.

**Panel Co-integration Results**

**Table 3. The Pedroni Co-Integration Test Outcome**

Within-dimension	Stat.	Prob
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Panel v-Statistic	5.04	0.0000
Panel rho-Statistic	-9.80	0.0062
Panel PP-Statistic	-10.73	0.0000
Panel ADF-Statistic	-3.56	0.0002
<b>Between-dimension</b>		
Group rho-Statistic	13.49	0.6520
Group PP-Statistic	- 8.47	0.0000
Group ADF-Statistic	-7.18	0.0014

Table 4. **Kao Co-integration Result**

ADF	Statistic	Prob
		-3.65

Source: Author's computation

Tables 3 and 4, present the Pedroni panel and Kao, co-integration test reports respectively. The results confirm the existence of cointegration between the regressand and the regressors in the model. This therefore necessitates the rejection of the null hypothesis. The null hypothesis normally states that, there is no co-integration among the variables. Hence the result above implies the existence of cointegration among the variable of the study. This, thus, implies that there is a long run relationship among the variables used for the study.

#### *Hausman Decision Test.*

Table 4. **Correlated Random Effects - Hausman Test**

**Equation: Untitled**

**Test cross-section random effects**

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	10.621331	5	0.0594

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LGHEXTE	-0.004040	0.015913	0.000301	0.2503
LGHEX_Y	-0.202457	-0.222922	0.000380	0.2936
LEHEX	-0.006432	-0.004820	0.000139	0.8913
LNМ_THP	-0.181607	-0.197740	0.000097	0.1021
LPSE	-0.457925	-0.508167	0.000801	0.0758

Table 4, shows the Hausman test results. The first part shows the estimated chi value of 10.62 for 5 degrees of freedom and it is significant at 5% level. This implies that the null hypothesis is not true. If it were true, the probability of obtaining a chi value as high as 10.62 would have been zero. To buttress this, the second part of the table compares the differences between the fixed effect and Error Component Models. The result shows differences. Thus the study fails to accept the null hypothesis. This, therefore, necessitates the adoption of the fixed effect model in the analysis.

### Regression Results

In order to confirm the above conclusion, on the null hypothesis, estimations on both the random effect and the fixed effect models were obtained. The results are as presented in table 5.

Table 5. **The Fixed Effect Model regression results.**

Variable	Fixed Effect Model		Error Component Model	
	Coefficients	Probability	Coefficients	Probability
C	7.964219	0.0000	8.15040	0.0000
LGHEXTE	-0.004040	0.9444	0.015913	0.7734
LEHEX	-0.202457	0.8537	-0.222922	0.8832
LGHE_Y	-0.006432	0.0002	-0.004820	0.0000
LNМ_THP	-0.181607	0.0000	-0.197740	0.0000
LPSE	-0.457925	0.0000	-0.508167	0.0000
Adj. R <sup>2</sup>	0.7923		0.6711	
F-Stat.	26.353		25.057	
Dependent Var: LMMR				

Source: Author's computation.

From tables 4 and 5, the two results are different, thus emphasising the uniqueness of the cross sectional peculiarities of sample units. This further buttresses the need to reject the null hypothesis. LGHEXTE (a measure of financial protection) and external health expenditure (LEHEX) are not statistically significant at 5% level, even though correctly signed. This could be attributed to the inadequacy of health expenditure in sub-Saharan Africa. Government health expenditure as percentage of GDP, GHEX\_Y, (a measure of relative health expenditure targeting), is correctly signed and statistically significant at 5% level. This confirms Jowett et'al, (2016) that financial protection cannot be adopted as a health fiscal policy instrument as it varies with economies but that health expenditure as a percentage of GDP adequately captures the state's priority attention to health as well as, being able to reflect the size of the government relative to the economy. Primary school enrolment, as a proxy for literacy, is correctly signed and statistically significant at 5% level. This corroborates Karlsen et'al, (2011) that, women illiteracy has a strong positive association with high maternal mortality. The number of nurses and midwives per thousand persons is correctly signed and statistically significant.

The result therefore, shows that 1% increase in GHEX\_TE, EHEX, NM\_THP and PSE will cause approximately, 0.004%, 0.006%, 0.181% and 0.45% reduction in MMR in sub Saharan Africa respectively. The average intercept value for the 44 countries is approximately 7.96%. This shows that on the average if, all other explanatory variables in the model are held constant, maternal mortality in the sub region would still be 7.96%. This does not include the fact that individual countries might have their intercepts either lower or higher than the average. The value of the intercept is statistically significant at 5% level. The vital statistic of coefficient of determination and F-statistic are approximately, 79% and 26.3. The F-statistic is statistically significant at 5%. This shows a high level of goodness-of-fit of the model. It implies that the variables are dependable in modelling maternal mortality in the sub-Saharan Africa.



### ***Policy Implication***

From the foregoing the following can be seen as key connotations for policy:

- i) Relative Health expenditure targeting measured as, Health expenditure-to-GDP ratio is a clearer and crucial policy instrument for mitigating maternal mortality.
- ii) Amount of nursing and mid wives per thousand people is also very critical policy variable for controlling maternal mortality.
- iii) Increased external health expenditure and domestic government expenditures are very significant in reducing maternal mortality in the sub Saharan Africa.
- iv) Education, too, is very significant in reducing maternal mortality in Sub Saharan Africa. This perhaps could be attributed to the plausible effect of enlightenment in health management.
- v) World Health Organisation's, Health Financing Working Paper Number 1 is confirmed.

### ***Discussion***

The major enquiry of the study, is to know between financial protection and expenditure targeting which is more efficient in reducing maternal mortality in sub-saharan Africa. The key variables of the study are: Government health expenditure as percentage of total expenditure (GHEXTE) which is financial protection, health expenditure as a percentage of GDP (GHEX\_Y) which is relative health expenditure targeting, external health expenditure and maternal mortality. The results show that the variables are correctly signed and that while expenditure targeting GHEX\_Y is statistically significant financial protection is not at 5% level of significance. The result therefore shows that health expenditure targeting, particularly targeting against a common denominator (GDP) is more adequate. It also confirms the fact that maternal mortality reduction is strongly associated with increase in health expenditure generally. This goes to confirm the fact that fiscal policy is generally, crucial in mitigating maternal mortality in sub Saharan Africa but that it will be more effective when fiscal attention is given to, focussing such expenditure against a common denominator as GDP. This calls for serious need for improvement in health expenditure and in particular, the percentage of GDP, spent on maternal health. Truth is that all other factors that affect maternal mortality such as, biological and social factors would always be successful given an adequate fiscal base. A case wear the medical personnel are not adequately remunerated and as a result, encourages brain drain in the medical sector, actually show the critical position of adequate fiscal consideration in modelling maternal mortality in sub Saharan Africa. Primary school enrolment is another critical variable to consider in the annals of maternal mortality in the sub region. It was correctly signed and statistically significant. This implies that the role of education and enlightenment in carrying out health instruction and formation of health habits is very crucial in combatting maternal mortality in the sub region.

The adjusted coefficient of determination showed that, approximately, up to 79% systematic variation in maternal mortality in the sub region for, the period under investigation is explained by these explanatory variables in the model. The F-statistic also confirms the existence of simultaneous relationship between maternal mortality and its explanatory variables in the model and it is statistically significant at 5% level. The D.W statistic on its part, confirmed the absence of serial correlation among the error terms. This

implies that the parameter estimates are efficient and can be relied upon for predicting maternal mortality. This therefore, shows that, if the problem of maternal mortality would be nipped in the bud in sub-Saharan Africa, the need for adequate fiscal attention should not be toyed with as it is currently.

### ***Policy Recommendation***

Based on the above the following are the recommendations for policy in modelling maternal mortality in the sub-Saharan Africa:

- i) Let health expenditure be increased generally.
- ii) Let expenditure targeting be against GDP as a common denominator
- iii) Let the number of nurses and midwives available in the hospitals be increased
- iv) Let there be improved access to education especially, for the population of child producing age.

### **Conclusion**

The study investigated the efficacy of financial protection and expenditure targeting in increasing the rate decrease in maternal mortality in Sub-Saharan Africa. Results show that increased health expenditure is generally, expedient for reducing maternal mortality but that relative health expenditure targeting is more statistically significant. Other specified control variables in the model are also found to be statistically significant in modelling maternal mortality in Sub-Saharan Africa. It is also alluded that all such variables are to a very large extent influenceable through fiscal policy. Thus for there to be increased speed in the rate of decrease in maternal mortality in Sub-Saharan Africa, health expenditure should be generally increased and should be targeted at a common denominator (GDP).

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