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HEALTH CARE EXPENDITURE AND MATERNAL MORTALITY IN AFRICA

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ABSTRACT

Maternal health has continued to generate some serious concerns across the world, especially in the area of child delivery and the associated complications which largely account for several maternal deaths in most developing countries. The study, therefore, assessed the combined impact of healthcare expenditure, access to safe drinking water and sanitation services on maternal mortality in selected 30 African countries spanning 2000-2017. The retrospective design was adopted to examine the statistical associations between the dependent and the independent variables of the study. In the panel regression model analysis, the robust fixed effect estimator was preferred to the random effect model as was determined by the result of the Hausman test. The findings from this study showed that out-of-pocket

expenditure had a 0.09 percent significant effect on maternal mortality in the robust fixed-effect model. Also, the domestic government general health expenditure had a 0.05 percent significant effect on maternal mortality in the region. Moreover, access to basic drinking water services exerted a significant negative effect (-0.01) on the maternal mortality ratio in the selected countries. However, access to at least basic sanitation services had no significant effect on maternal mortality. Therefore, the authors concluded that a multi-sectoral approach was required to tackle maternal mortality by paying attention to some health-related sectors like water and sanitation services.

Keywords: Health-care Expenditure, Maternal Mortality, Basic Water, Basic Sanitation.

1. INTRODUCTION

The currency and resurgence of interest in the issue of maternal mortality cannot be over-emphasized in 21st century Africa. This is against the backdrop of the invaluable roles that women, especially mothers have played in the cultural, socio-economic and political developments of the African continent. Women have been recognized over the years as a key development partner in any society, be it urban or rural setting; developed or developing world. For example, women facilitate peace in their respective communities toward sustainable development and good governance (Ohaegbuchi, 2014). Beyond the traditional role of reproduction and child-rearing, some married

women work informally to augment the incomes of their husbands. In this case, they play the dual role of being a mother as well as economic providers in the family institution and this usually happens most times in the face of some prevailing harsh economic realities (Bennett, 1998; Arsal, Basri & Tono, 2017). However, the engagement of women in paid employment or active economic activities to boost family income may depend on the socio-cultural disposition and orientation of the husbands to allow such latitude for their wives to do so in a patriarchal society like Africa.

Furthermore, with the advent of rapid industrialization and globalization, some





mothers' roles have become expanded as they now act as the “breadwinner”, relationship managers, schedule keepers, housekeepers and caregivers. Interestingly, these roles are amenable, dynamic and flexible over time (Lantara, 2015; Galick, 2016). Despite the silent but important multiple roles that mothers play in the development of any society, there still exist and persist some primordial, cultural, social, economic, political, geographical and religious limitations embedded in the social structure that continue to undermine their respective health statuses (Koroma, 2014; Bayeh, 2016) thereby leading to a perennial rise in numerous maternal deaths around the world, with Africa recording the worst scenarios.

Maternal mortality according to the World Health Organization (WHO) is the death of a pregnant woman or that which occurs within 42 days of termination of pregnancy, the duration and site of the pregnancy notwithstanding but within the confines of a pregnancy-related issue (Ezugwu, Agu, Nwoke & Ezugwu, 2014). Maternal health has continued to generate some serious concerns across the world, especially in the area of child delivery and the associated complications which largely account for several maternal deaths in most developing countries. The World Health Organization (2020) averred that, even though maternal mortality has declined globally, Sub-Saharan Africa grossly accounted for 66% of the deaths. This implies that Africa still has the highest number of maternal deaths across the world. Beyond this account, it has been noted that there is even unequal maternal mortality distribution among the African countries (Kruk, Galea, Prescott & Freedman, 2007; Girmu & Wasie, 2017). At the country level, Nigeria has been identified as contributing 19% and 14% of maternal deaths consecutively to the global maternal mortality as of 2015 and 2017 (World Health Organization, 2015; African Population and Health Research Centre, 2017). In short, all the

countries with frightening maternal mortality scenarios are located in Africa. Yet, between 2014 and 2019, 60% of births were attended to by skilled medical personnel in Sub-Saharan Africa (World Health Organization, 2020).

Traditionally, it has been noted that pregnancies and child deliveries ought to evoke joy and celebration (Owoseni, Eboh & Akeredolu, 2017) but in most African countries, including Nigeria, it seems to be a “short-cut” to death for several women and mothers. The progressively disturbing maternal mortality rate that characterizes almost all the African countries might not be unconnected to the health care system financing. The mortality trend has always been linked to access to basic drinking water and sanitation services among the generality of people (Alvarez, Gil, Hernández & Gil, 2009), especially mothers. Access to maternal health care, safe drinking water and sanitation services in terms of availability, proximity and affordability remains a huge challenge to most pregnant women in rural settlements. For example, inadequate access to basic water and sanitation services has been linked to about 80% of the health problems especially in the developing countries of the world (Ohwo & Agusomu, 2018). However, Hopewell and Graham (2014) opined that there has been increasing access to improved water and sanitation in many cities around Africa recently.

Quantitatively, the negative impacts of maternal mortality on any society are very disturbing and devastating, especially on the African continent with dysfunctional healthcare systems. It is on this note that this study assessed the combined impact of healthcare expenditure, access to safe drinking water and sanitation services on maternal mortality in selected African countries. However, the specific objectives are to assess the effect of Out-Of-Pocket expenditure (OOPE) on the Maternal Mortality Ratio



(MMRT); assess the effect of Domestic Government General Health Expenditure (DGGHE) on MMRT; assess the effect of People with at least Basic Drinking Water Service (PBDWS) on MMRT; assess the impact of People with at least Basic Sanitation Service (PBSS) on maternal mortality rate. The plausible gap in the literature that this study bridged is the assessment of the combined impact of healthcare expenditure, access to safe drinking water and sanitation services on maternal mortality. Meanwhile, the selected African countries for the study include Nigeria, the Gambia, Ghana, Benin, Senegal, South Africa, Kenya, Morocco, Tanzania, Rwanda, Zambia, Madagascar, Angola, Chad, Congo Democratic Republic, Algeria, Tunisia, Botswana, Namibia, Mozambique, Malawi, Burkina Faso, Sierra Leone, Togo, Ethiopia, Mauritania, Uganda, Central African Republic, Congo and Gabon.

2. LITERATURE REVIEW

The body of the extant literature has revealed that maternal mortality has clinical, cultural, political, institutional and socio-economic causes that make it a very complex problem to address. Clinically, maternal death has been directly identified with hemorrhage, eclampsia and unsafe abortion. Other co-morbid conditions associated with maternal deaths are hepatitis, anemic pregnancy, meningitis, HIV/AIDS and acute renal failure (Ujah, Aisien, Mutihir, Vanderjagt, Glew & Uguru, 2005). Also, the nature of a country's healthcare system governance structure and management is grossly associated with the phenomenon of maternal mortality (Sageer, Kongnyuy, Adebimpe, Omosehin, Ogunsola & Sanni, 2019). In other words, healthcare system financing directly or indirectly influences maternal health outcomes. In terms of healthcare spending, Sub-Saharan Africa expended 6.1% of its total GDP on health care. This is a far cry as compared to the 9.5% of GDP

that the countries of the Organization for Economic Co-operation and Development (OECD) spend on healthcare (National Research Council (US), 2012).

Economically, the cost implications of maternal mortality are quite humongous to bear. It has been estimated that maternal mortality of a single mother through some trajectories reduces annual Gross Domestic Product (GDP) (Kirigia, Oluwole, Mwabu, Gatwiri & Kainyu, 2006). In addition, some of the multi-faceted implications of maternal mortality include increased burden of caregiving on the bereaved family; increase in social vices among orphaned children; reduction of human capital creation and health vulnerability of the infants and under-5 children (Kirigia et al., 2006). For instance, the costs of burial ceremonies associated with some maternal deaths within the African context have been described as outrageous as compared to the maternal health care spending (Kes, Ogowang, Pande, Douglas, Karuga, Odhiambo, Laserson & Schaffer, 2015). Furthermore, a couple of different but related studies revealed that some orphaned children who were products of early maternal deaths were several times likely to be at the risk of dying when juxtaposed with those whose mothers survived (Houle, Clark, Kahn, Tollman & Yamin, 2015; Molla, Mitiku, Worku & Yamin, 2015; Miller & Belizán, 2015). The foregoing statement of fact, therefore, demonstrates the inseparable connection between maternal and child health.

As a proxy for the progress assessment of Millennium Development Goal (MDG) 5, maternal the mortality rate was matched with the proportion of births attended by skilled health personnel (Africa Progress Panel, 2010; World Health Organization, 2019). The outcome of the assessment showed that as of 2015 MDG timeline, most African countries failed to meet the target of the maternal death reduction. It could be largely inferred that the



inability of most African countries to achieve the MDG 5 in 2015 might be linearly related to the chronic under-funding of the health sector by the central governments of those affected countries, an issue that Eboh, Abba and Fatoye (2018) earlier pointed out using Nigeria as a unit of analysis.

A robust and functionally efficient healthcare system is a function of its financing base. It is taken for granted that healthcare financing influences health outcomes, including maternal mortality. This is in addition to other complex factors and issues that impact on health statuses of people. The above assertion is underscored by the fact that access to qualitative maternal healthcare services can help to minimize the incidence and prevalence of maternal mortality. However, the forms of health care spending that are reviewed in this study include government-based health expenditure and out-of-pocket payment. Unfortunately, while governments are expected to take the lead drive in healthcare spending in Africa, it has been noted that out-of-pocket health spending remains the mainstay of Africa's health care expenditure due to a lack of commitment to the health sector.

A study was carried out in the region of the Middle East and North Africa (MENA) by Akinci, Hamidi, Suvankulov and Akhmedjonov (2014). The study was titled "Examining the impact of health care expenditures on health outcomes in the Middle East and North Africa (MENA) region". The authors deployed Pooled Ordinary Least Regression, Random effects and Hausman instrumental variable models to investigate the relationship between health expenditures and selected health outcomes covering the period 1990-2010. Among other findings, it was discovered that both government and private healthcare spending significantly improved maternal mortality in the region. Specifically, a percentage increase in per capita government expenditure reduced

maternal mortality by 26.0-26.3 per 100,000 live births. It was, therefore, concluded that the reduction in maternal mortality was majorly attributed to both government and private healthcare spending. Similarly, Ashiabi, Nketiah-Amponsah and Senadza (2016) documented the effect of public and private health spending on selected maternal-child health outcomes in 40 African countries covering 2000 to 2010. The authors used a fixed-effect estimator for the analysis and reported that public health spending had no significant impact on maternal mortality.

However, using Co-integration and Error Correction Modelling technique, Igbinedion and Olele (2018) found that the maternal mortality rate declined with an increase in both government and private health care spending in West African sub-region

Manyika, Gonah, Hanvongse, Shamu and January (2019) conducted a study titled, "Health financing: the relationship between public health expenditure and maternal mortality in Zimbabwe between the years 1980 to 2010". The authors used a retrospective research design and multiple linear regression model to analyze the survey panel and annual data beginning 1980 to 2011. Meanwhile, the focus of the analysis was to examine the association between government health expenditure and maternal mortality in Zambia. The findings indicated that public spending on health had a significant association with maternal mortality. This further substantiates the proposition that government health expenditure was a major determinant of maternal mortality. It also means that increasing government health expenditure contributes to a significant decline in maternal mortality rate. Similarly, a weak negative but insignificant correlation was noted between access to improved sanitary conditions and maternal mortality. In contrast, a different but related study involving 161 countries, Rana, Alam and



Gow (2018) carried out a study titled, "Health expenditure, child and maternal mortality nexus: a comparative global analysis". The study utilized a heterogeneous method of investigating the causal relationship between health expenditure and health outcomes spanning 1995 to 2014. The authors conducted some tests like panel unit root, panel co-integration and panel granger causality. It was discovered that health expenditure had no causal relation with maternal mortality at all income levels.

Also, in a 30-year (1981-2010) study involving 24 European countries, Maruthappu, Williams, Atun, Agrawal and Zeltner (2015) determined the association between declines in government healthcare spending and maternal mortality. The authors used a retrospective study design involving the multivariate regression analysis. After controlling for the confounding variables, a fixed effect estimator was preferred. Findings emanating from the study showed that a reduction in government healthcare spending led to a significant increase in maternal mortality. In other words, successive reductions in public spending on health had a significant association with increased maternal mortality.

Furthermore, Nwankwo (2018) examined the effects of public health spending on maternal mortality in 25 Nigerian states for the period of 25 years (2003-2015). The study made use of instrumental variable strategy to address any likely endogeneity in the econometric analysis. After controlling for other relevant covariates, it was realized that public health expenditure was instrumental to reducing incidences of maternal mortality in the country. Similarly, Nketiah-Amponsah (2019) incorporated both the descriptive and empirical methods to conduct a study involving 46 African countries covering a period of 1996 to 2015. The study aimed to investigate the core macroeconomic and social determinants of health expenditure as well as the

effect of health expenditures on select critical health outcomes, including maternal mortality. Among other things, the author discovered that a one percent increase in health expenditure per capita produced a corresponding 0.06 percent fall in maternal mortality. That is, health expenditure had a positive and significant effect on maternal mortality. In a related development, a study examined the effects of health care expenditures on health outcomes in West Africa, with a focus on 14 countries from 2000-2018. The author used the panel data estimation model and found that government health expenditure did not have a significant effect on maternal mortality while an increase in domestic private health expenditure lead to a reduction in maternal mortality rate. Similarly, external health expenditure in the form of received foreign aid per capita had a negative impact on maternal mortality. However, the author noted that the coefficient was not statistically significant (Kilanko, 2019).

Apart from the associational influence of healthcare expenditure on maternal mortality as reviewed above, this study further considered the impacts of access to safe drinking water and sanitation services. For example, according to the World Health Organization, women have been identified as being at risk of dying from a disease like sepsis if adequate and clean water is in short supply (Sommer, Shandra, Restivo & Coburn, 2015). So, water and sanitation service provisions usually reflect in the national goals of virtually all the countries of the world. It is to such an extent that both the Millennium Development Goals (MDGs), as well as the Sustainable Development Goals (SDGs), have recognized and incorporated the necessity of access to safe drinking water and sanitation services. In line with the above, Sommer et al. (2015) examined the effect of access to improved water supply sources and sanitation services on maternal and neonatal mortality. The data spanned 1990 to 2005 and covered 32



African countries. The study utilized a two-way fixed effects regression model with robust standard errors for the analysis and found that access to both improved water and sanitation facilities was significantly associated with a decline in maternal mortality. Furthermore, Benova, Cumming and Campbell (2014) in a systematic review and meta-data analysis assessed the relationship between water and sanitation environment On one hand, and maternal mortality on the other hand. The review relied on published articles from several credible online sources since 1980. The results extrapolated from four studies showed that poor sanitation was associated with increased maternal mortality. Also, six other studies found poor water supply sources to be associated with rising maternal mortality. The authors, therefore, concluded that both sanitation facilities and water supply sources were associated with maternal mortality. In some sense, it was noted that access to improved drinking and sanitation services has improved over the years across the world. However, the Sub-Saharan African people are still lagging in this respect (United Nations Children's Fund (UNICEF) and World Health Organization, 2019). In a study involving sub-Saharan Africa, Alvarez et al. (2009) established a significant negative correlation between access to an improved water source and maternal mortality in the sub-region. That notwithstanding, the authors noted a significant positive relationship between maternal mortality and access to sanitation. More recently, Girum and Wasie (2017) also discovered that improved sanitation and water supply services had inverse correlational relationships with maternal mortality. That is, improved access to sanitation and water services led to a decrease in the mortality ratio.

THEORETICAL FRAMEWORK AND MODEL SPECIFICATION

Political Economy Theory of Health-care

Expenditure and Maternal Mortality

The theoretical anchorage of this study is a political economy that deals with the question of uneven distribution of maternal deaths across the world. That is, maternal mortality is not incidental as there is an underlying dynamic interplay of politics, economy and social forces influencing its occurrence. As a branch of social sciences, the theory takes its explanatory cue from disciplines like economics, political science and sociology (Balaam & Veseth, 2014). It is equally viewed as a totalizing theoretical tool of analysis that seems to provide explanations to a wide range of issues, phenomena, policies, including the behaviours of political and social actors, voices and forces in society (Momoh & Hundeyin, 2015). A historical insight into the disciplinary origin of the contemporary field of Economics reveals political economy as its bedrock (Mazi-Mbah, 2007). The theory advocates the incorporation of political and economic frameworks in analyzing the social system. Over the years, the theory has become diverged into classical, Neoclassical and Marxian perspectives. However, this very study restrains itself from examining the divergent arguments of the various political economy theorists by narrowing down to the Marxian perspective due to its contextual currency and relevance. Some of the major proponents of the classical and neoclassical political economy are Adam Smith, Thomas Malthus, David Ricardo, David Hume and John Stuart Mills.

Marxian political economy was largely postulated by Karl Marx. The perspective is a frontal reaction to the assumptions of the classical political economy that places more emphasis on the growth of the economy through the forces of demand and supply; with the state playing a minimal interventionist role, usually to the neglect of the welfare of the citizenry. Profit maximization is construed to be the premeditation, preoccupation and driving force

behind the major assumptions of the classical political economy perspective. In contrast, the Marxian political economy abhors exploitation of the masses using the instrumentality of the state that mainly allocates resources to the various economic sectors, including the health care system and access to safe drinking water and sanitation services. In contrast, classical political economists opined that people ought to pay to enjoy qualitative maternal health care services and other social goods regardless of their socio-economic wherewithal. Consequently, stretching this theoretical posture too far may impose on the poor mothers and pregnant women the risk of mortality due to the outrageous cost of out-of-pocket health expenditure.

In a counter-position, the Marxian political economists may argue that the central governments of the African countries should evolve a policy to reflect sufficient annual budgetary allocations to the health, water and sanitation services provisions. This may go a long way in further reducing the current maternal mortality trend in the region. It may also reduce the burden of catastrophic health spending usually associated with out-of-pocket health payments among indigent pregnant women and mothers in the affected countries.

Model Specification

Econometrically, the study model was patterned after some previous studies by Maruthappu et al. (2015), Rana and Goli (2017), Ashiabi et al. (2016), Nwankwo (2018), and Kilanko (2019) respectively. It is thus functionally stated thus:

General Panel Linear Model

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + e_{it} \quad (1)$$

$$\ln MMRT = F(OOPE, DGGHE, PBDWS, PBSS) \quad (2)$$

Econometric model:

$$\ln MMRT_{it} = \alpha + \beta_1 OOPE_{it} + \beta_2 DGGHE_{it} + \beta_3 PBDW_{it} + \beta_4 PBSS_{it} + e_{it} \quad (3)$$

Where:

$\beta_1 - \beta_4$ = parameters to be estimated with a priori expectations.

$\ln MMRT$ = logarithm of Maternal Mortality Rate (dependent variable).

$OOPE$ = Out-Of-Pocket Expenditure (independent or explanatory variable).

$DGGHE$ = Domestic Government General Health Expenditure (independent variable).

$PBDW$ = People with at least Basic Drinking Water (independent variable).

$PBSS$ = People with at least Basic Sanitation Service (independent variable).

α = Constant

e = Error term

i = countries

t = Period

Note: MMRT was in the natural log form to correct the problem of heteroskedasticity as well as the non-normality distribution of the data.

METHODOLOGY

The study adopted the retrospective study design involving the use of panel data of 30 African countries to examine the statistical association between the dependent and the independent variables spanning 18 years (2000-2017). The authors made use of the robust fixed effect model and multiple regression analysis techniques to analyze the data respectively. The study population comprised 30 African countries being assessed retrospectively in terms of maternal mortality rate, health care expenditure and access to basic drinking water and sanitation services. The filter or inclusion criteria for the selection of countries were based on data available concerning the study variables and meeting the diagnostic test requirements for the analysis. The data for the study were sourced from the annual reports and accounts of the



World Bank on World Development Indicators (WDI) terminating in 2018. Statistically, the authors made use of multiple regression analysis techniques to assess the impact of Out-Of-Pocket Expenditure (OOPE), Domestic Government General Health Expenditure (DGGHE), People with at least Basic Drinking Water (PBDW) and People with at least Basic Sanitation Service (PBSS) on Maternal Mortality Rate (MMRT) in the selected countries.

Moreover, as recommended by Hair, Tathan and Anderson (2005), the diagnostic test involving the pairwise correlation matrix was conducted to determine the presence or otherwise of multicollinearity among the independent variables. The test was further validated by the Variance Inflation Factor (VIF). Also, the Breusch Pagan/Cook-Weisberg test was applied to establish whether the residual variance of a variable in the regression model is heteroskedastic or homoskedastic while the Shapiro-Wilk normality test was used to check for the normal distribution of the central mean around the variables. Similarly, to determine the estimator to be applied, the Hausman specification test was conducted as suggested by Ashiabi et al. (2016) and the robust fixed effect was considered appropriate. The hypotheses were tested at the 5% level of significance while the analysis of the data was facilitated by the deployment of the STATA 12 version software.

4. PRESENTATION OF RESULTS AND EMPIRICAL ANALYSIS

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
MMRT	540	536.1519	357.0456	43	2480
OOPE	540	36.86273	19.02795	2.993242	77.76534
DGGHE	540	34.37497	15.8358	3.916131	76.6942
PBDWS	539	59.2457	18.48342	18.69521	96.25471
PBSS	539	32.79106	22.9945	3.403843	90.92139

Source: Researchers' Computation using STATA 12.0 software

The descriptive statistics in Table 1 show that the average maternal mortality rate among the selected 30 countries in Africa for the period of 18 years (2000-2017) was 536.15 per 100, 000 live births. Similarly, the minimum and the maximum maternal mortality rates were 45 and 2480 per 100, 000 live births respectively. When juxtaposed with the MMRT, out-of-pocket expenditure (% of current health expenditure) accounted for 36.86% on average. The minimum and the maximum OOPE were 2.99% and 77.76% accordingly. Averagely, government general health expenditure amounted to 34.37% while People with at least Basic Drinking Water Service (PBDWS) and People with at least Basic Sanitation Service (PBSS) averaged 59.24% and 32.79% respectively.

Furthermore, the minimum amount expended as government general expenditure stood at 3.91% while the maximum was 76.69%. Table 1 equally shows the average number of people with at least basic drinking water service which stood at 59.24%. Similarly, an average of 32.79% accounted for people with at least basic sanitation services. On the minimum scale, 17.49% were people with at last basic drinking water service while the maximum access stood at 79.98%. Also, people with at least basic sanitation services make up a minimum of 18.48%. It has been shown from the same Table 1 that people with at least basic sanitation service reached a maximum of 96.25% for the period under review. However, the standard deviations of all the variables (MMRT, OOPE, DGGHE, PBDWS and PBSS) showed slow growths during the period when compared to their respective mean values.



Table 2: Correlation matrix Test for Multicollinearity

Variable	MMRT	OOPE	DGGHE	PBDWS	PBSS
MMRT	1.0000				
OOPE	0.4899	1.0000			
DGGHE	-0.4897	-0.5002	1.0000		
PBDWS	-0.5532	-0.2532	0.5255	1.0000	
PBSS	-0.5363	-0.2422	0.5562	0.7554	1.0000

Source: Researchers' Computation using STATA 12.0 software

Table 2 shows the results of Pearson correlation coefficients of all variables included in this study. The table revealed that a moderate negative relationship of 50% existed between Domestic Government General Health Expenditure (DGGHE) and Out-Of-Pocket Expenditure (OOPE). It is also noted that out-of-pocket expenditure and People with at least Basic Drinking Water (PBDWS) show 25% weak negative correlation. Similarly, the Table indicated that PBDWS had a moderate 52% positive relationship with DGGHE. Moreover, there was a 24% negatively weak relationship between People with at least Basic Sanitation Service (PBSS) and OOPE.

It was further shown that a moderate 55% positive relationship existed between PBSS and DGGE. On the other hand, people living with at least basic drinking water were highly positively correlated with PBSS by 75%. It could be deduced that there is a correlational positive relationship between PBDWS and PBSS. However, it has been averred that 75% correlational relationship does not necessarily imply the presence of multicollinearity (Hair, Tathan & Anderson, 2005). For further validation, it became necessary to subject it to the test of the Variance Inflation Factor (VIF) to determine if the high correlational relationship would inflate the over results.

Table 3: Test for Multicollinearity using Variance Inflation Factor (VIF)

	DGGHE	OOPE	PBDWS	PBSS
VIF	1.88	1.34	2.42	2.54
1/VIF	0.533178	0.745716	0.413065	0.393179

Source: Researchers' Computation using STATA 12.0 software

Table 3 shows the results of Variance Inflation Factor (VIF) values of less than 10 for the variables. This was an indication that the high correlational relationship between people with at least basic sanitation service and people with at least basic drinking water service as reflected in the correlation value of 75% did not inflate the overall results. Therefore, Table 4 shows a complete absence of multicollinearity among the components of the independent variables.

Table 4: Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity

chi2(1)	134.43
Prob > chi2	0.0000

Source: Researchers' Computation using STATA 12.0 software

The Breusch Pagan/Cook-Weisberg test established whether the residual variance of a variable in the regression model is constant. That is, heteroskedastic. The result in Table 4 further showed that the null hypothesis of the presence of heteroskedasticity from the Breusch Pagan/Cook-Weisberg test in the model is accepted. This was because the chi2 (1) value of 134.43 and a probability value of 0.0000 for the model were statistically significant at 1% alpha level (p-value < 0.05). It implies that there was a problem of heteroskedasticity in the model thereby violating the fundamental OLS linear regression assumption of homoskedasticity (no constant variances). Therefore, the authors adopted the robust fixed effect regression to estimate the model to address the



heteroskedasticity problem.

The normality distribution using the Shapiro-Wilk test conducted on the following variables, namely: MMRT, OOPE, DGGHE, PBDWS and PBSS indicated the central means with their Prob<Z values of less than 0.05 level of significance. On this basis, it could be deduced that another fundamental assumption of the general linear regression technique requiring normal distribution of series has been violated hence the adoption of the robust fixed effect regression model to correct this pitfall. Similarly, the study applied the Hausman specification test to determine the suitable estimator to be used because of the panel data involved. The outcome of the Hausman test shows that the robust fixed effect model was appropriate for this study as reflected in the chi2 value of 11.64 and the significant Prob. Chi2 of 0.0202.

Table 5: Robust Fixed Effect Regression

	Coef.	Robust Std. Err.	T	P> t
LOGMMRT				
OOPE	.0091636	.0026732	3.43	0.002
DGGHE	.0050073	.0018601	2.69	0.012
PBDWS	-.0196898	.005595	-3.52	0.001
PBSS	-.0107331	.0103007	-1.04	0.306
_cons	7.054239	.3250746	21.70	0.000
Overall R-sq	0.5945			
F-Statistic	19.97			
Prob. >F	0.0000			

Source: Researchers' Computation with STATA 12

The result from Table 5 shows the overall coefficient of determination of 0.5945. This means that the proxies of the independent variables (OOPE, DGGHE, PBDWS and PBSS) had an approximately 59% combined effect on the systematic variations in the dependent variable (MMRT) during the period under review. In other words, some 41% of extraneous factors not being accounted for in this study influence a change in maternal mortality rate concerning the selected African countries. Also, the F-statistic probability value of 0.00 indicates

that the model was fit and admissible for decision-making.

The result in Table 5 above indicates the t-value of 3.43 and the corresponding probability of 0.002. This shows that Out-Of-Pocket Expenditure (OOPE) had a significant positive effect on effect maternal mortality rate in the selected African countries for the period under review. On the strength of this, the null hypothesis one which holds that OOPE has no significant effect on Maternal Mortality Ratio (MMRT) in the affected countries is hereby rejected. Also, Domestic Government General Health Expenditure (DGGHE) had a significant positive effect on maternal mortality rate as reflected in the t-value (2.69) with the probability of 0.012. Based on this premise, null hypothesis two which states that DGGHE has no significant effect on MMRT in the selected countries is equally rejected.

Furthermore, the variable PBDWS had a significant negative impact on maternal mortality in the affected countries as reflected in the t-value (-3.52) and the probability of 0.001. Relying on the strength of this result, the null hypothesis three is hereby rejected. However, the t-value of -1.04 and the corresponding probability of 0.306 indicated that PBSS had no significant impact on the maternal mortality rate. Based on this, null hypothesis four which holds that PBSS does not significantly impact on maternal mortality rate is accepted.

Discussion of Findings

It is apposite at this point to reiterate the main objective of this study; which was to assess the impacts of healthcare expenditure, access to safe drinking water and sanitation services on maternal mortality in selected African countries. Against the backdrop of this objective, it was revealed that Out-Of-Pocket Expenditure (OOPE) had a significant positive effect on the maternal mortality rate. This means that if other



variables were held constant, a 1 percent increase in out-of-pocket expenditure will produce a significant decrease in maternal mortality by 0.09 percent in the robust fixed-effect model. This finding is in tandem with a couple of previous studies by Akinci et al. (2014) and, Igbinedion and Olele (2018) who discovered in their separate but related studies that private health expenditure contributed significantly in reducing maternal mortality. However, Ashiabi et al. (2016) noted that private health expenditure did not significantly reduce maternal health mortality. Theoretically, Ashiabi et al. (2016) align with the Marxian political economy assumption which suggests that out-of-pocket health expenditure which is a form of private health spending, might worsen the maternal health status of the already impoverished mothers in Africa.

Moreover, Domestic Government General Health Expenditure (DGGHE) had a significant positive effect on maternal mortality. That is, a 1 percent increase in DGGHE will produce a 0.05 decrease in maternal mortality rate if other variables were held constant. The finding reinforces a couple of previous studies (Maruthappu et al., 2015; Rana et al., 2018; Nwankwo, 2018; Manyika et al., 2019 and Nketiah-Amponsah, 2019) except Kilanko (2019) that found no significant effect of government health expenditure on maternal mortality.

In addition, the effect of People with Basic Drinking Water Service (PBDWS) on maternal mortality was examined. The finding established that PBDWS had a significant negative effect on maternal mortality in the affected countries. In other words, if other variables are held constant, a 1 percent increase in access to basic drinking water services will produce -0.02 percent reduction in maternal mortality. This finding re-affirmed the studies conducted by Benova et al. (2014), Alvarez et al.

(2009); Sommer et al. (2015) and, Girum and Wasie (2017) found that access to both improved water and sanitation facilities were significantly associated with a decline in maternal mortality. It was also noted in agreement that access to improved water and sanitation services could reduce the chances of contracting communicable diseases (Alvarez et al., 2009). This current study also showed that access to basic sanitation services has no significant effect on maternal mortality. The finding is at variance with all the studies reviewed.

Test of Hypothesis

Ho1: Out-Of-Pocket expenditure (OOPE) has no significant effect on the Maternal Mortality Ratio (MMRT) among the 30 selected African countries.

Ho2: Domestic Government General Health Expenditure (DGGHE) has no significant effect on MMRT in the selected countries.

Ho3: People with at least Basic Drinking Water Service (PBDWS) have no significant impact on MMRT in the affected countries.

Ho4: People with at least Basic Sanitation Service (PBSS) do not significantly impact on maternal mortality ratio in the countries.

5. CONCLUSION AND RECOMMENDATIONS

This study has revealed that maternal mortality in Africa is influenced by several non-clinical factors such as Out-of-Pocket health expenditure, public health expenditure, access to at least basic safe drinking water and sanitation services. It has been revealed in that except for access to sanitation services, all the factors considered in had negative significant effects on the maternal mortality rate in the selected African countries.

Therefore, we recommend as follows:

- I. That general health expenditure by the respective central governments of the



- selected African countries should be scaled up to further strengthen existing efforts aimed at reducing the incidence of maternal mortality in the region.
- ii. That access to basic sanitation services in the selected countries should equally be given high priority attention because a multi-pronged approach is required to tackle the problem of maternal mortality.
 - iii. More healthcare models, other than the Out-of-Pocket Model should be developed for the selected Africa countries, so as to remove the burden of care from the poor families.
 - iv. Government should also employ more health extension workers to continuously give health awareness to the rural dwellers, and encourage coinsurance and copayments for health among them.

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