Official Development Assistance for Health and Maternal Mortality in Sub-Saharan Africa

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Abstract

Purpose: Maternal mortality in Sub-Saharan Africa (SSA) is extremely high. Attention is being given to the key health indicators (as means for achieving human development) among which is maternal mortality towards achieving the global development goals. In a bid to ensuring that the targets are met in SSA, there have been influx of official development assistance for health (ODAH) into the sub-region. Meanwhile, little attention is usually paid to maternal mortality in the study of effects of foreign aid for health despite the multiple consequences of maternal death, hence, the need for the present study.

Methodology: Data from 2000 to 2023 covering 46 SSA countries were obtained from Organization for Economic Cooperation and Development, World Development Indicators, World Governance Indicator and the UNICEF. These were analyzed using system Generalized Method of Moment (sGMM) while the Pooled OLS and the Fixed Effect models were analyzed to confirm robustness of the estimated model.

Findings: Results revealed that ODAH, domestic health expenditure and per capita GDP significantly reduced maternal mortality while fertility rate and corruption significantly increased it. It is appropriate to note that trade openness which is a reflection of globalization did not improve maternal death. It was concluded that though ODAH significantly reduced MMR the effect was small. The AR(1) and AR(2) tests confirmed the validity of the estimated sGMM model while the Sargan and the Hansen tests established the validity of the instrumental variables used in the estimation.

Implication/Recommendation: The study recommended effective use of ODAH, determination and political will to curb corruption in governance especially in the health sector and increased domestic public health spending in order to achieve improved maternal health outcome in the region.

Introduction

United Nations member states came together in 2000 to foster development and thus adopted a package of development plan named the Millennium Development Goals (MDGs). The assembly recognized health as a major input into the development of any nation which cannot be overemphasized. Thus, the declaration of the MDGs consisted of three separate but inter-related health goals. They included MDG4- "*child mortality*", MDG5-"*maternal health*" and MDG6- "*HIV/AIDS, malaria and tuberculosis*". It was realized that most developing countries may not be able to make significant progress towards the goals at the target date. Hence, the assistance of the international community was thought to be needed (Radelet, 2004). The industrialized countries' commitment to donate as much as 0.7% of their GNP towards development in developing countries earlier made in the early 1960s was reawakened. The SDGs succeeded the MDGs and this is a more ambitious initiative towards achieving development where it has been low especially in developing countries such as those in SSA. The inflow of foreign aid for health has therefore increased since the inception of MDGs and beyond. The total inflow of foreign aid for health into the region has increased greatly between 2001 and 2021 (OECD Creditor Reporting System, 2023).

The MDG aimed at reducing the global maternal mortality ratio by three-quarters by 2015 (United Nations, 2000). The succeeding global development agenda the Sustainable Development Goals (SDGs) which was launched in September 2015 further emphasized maternal health as a priority, with an explicit target of reducing the global MMR to less than 70 per 100,000 live births by 2030 (United Nations, 2015).

World Bank (2020) reported that official development assistance (ODA) has made noticeable contributions to improving maternal health in Sub-Saharan Africa. It asserted that programs supported by international donors have over time contributed significantly to improvement in essential maternal health services such as availability of skilled birth attendance, antenatal care, postnatal care, and family planning services. For example, the Global Fund to Fight AIDS, Tuberculosis, and Malaria, as well as bilateral donors such as the United States Agency for International Development (USAID), have directed a lot of resources towards the success of a number of maternal health programmes, with declines in maternal mortality rates in some countries and regions of the world.

Meanwhile SSA's major health indicators such as maternal mortality have been poor compared with other developing regions of the world. Maternal mortality which represents the death of a pregnant woman or within 42 days succeeding the end of pregnancy due to causes related to or aggravated by the pregnancy, has been one of the most serious problems facing the health sector in SSA. World Bank (2019) asserted that high maternal mortality has been one of the challenges confronting developing countries and became more worrisome when the MDG failed to achieve its health target at the end of 2015. Although, the entire world has made noticeable progress in reducing maternal death it is still high in the region. For instance, World Health Organization - WHO, (2023) reported that in 2021, about 66 percent of the global maternal deaths occurred in SSA with an MMR of 542 deaths per 100,000 live births. This is more than the world average of 211 per 100,000. According to the United Nations Population Fund - UNFPA (2022), there are complex interconnections among factors responsible for this dire maternal mortality situation. These include poor health infrastructure, poor budgetary allocations, low socioeconomic status of the populace, lack of good emergency care, lack of enough skilled birth attendants among others. Most of the maternal deaths occurring in SSA are obviously preventable with the right medical assistance. However, many women in this region still lack access to skilled birth attendants, emergency obstetric care, and essential maternal health services, particularly in rural and underserved areas (Pison *et al.*, 2017).

Notwithstanding the surge in ODA into the health sector, the SSA continues to lag behind in achieving steady progress in maternal health outcomes. Although, a number of countries such as Ethiopia, Malawi and Rwanda have made considerable progress in reducing death of pregnant women and deaths associated with pregnancy, others, such as Nigeria, Sierra Leone and Chad are still experiencing high maternal mortality rates (WHO, 2023). More specifically for instance, in 2017, maternal mortality ratio (MMR) was 917 per 100,000 live births in Nigeria while it was 334 in Kenya. These are too high compared with 145 in India, 12 in Kuwait and 6 in the European Union.

There have been concerns about the effectiveness, especially in the long term, of ODA including ODAH, and its sustainability. Some authors such as Moyo (2009) have argued that ODA has not always been aligned with the priorities of recipient countries, leading to inefficiencies in aid distribution and challenges in ensuring that health improvements are sustainable over time. Burnside and Dollar (2000) argued for good policies in recipient countries to provide fertile ground for aid effectiveness.

In the light of the above there is a need to empirically assess the effect of foreign aid for health on maternal mortality in the SSA region. Moreover, maternal mortality has always been neglected in empirical investigation in the region. The study therefore aims to assess the effect of ODA for health on maternal health outcomes in SSA. Such endeavour will guide policy makers and international donors on the likely impact of future aid and directly contribute to the global goal of reduction in maternal death and indirectly results in improved participation in economic activities and its growth.

Methodology

Data Sources and Scope: Data on health aid were collected from the OECD Creditors Reporting System while those of maternal mortality ratio, physician density, health expenditure share of GDP, secondary school completion rate, population, trade openness, and GDP per capita were obtained from the World Bank's World Development Indicator (WDI) website. Data on corruption index and government effectiveness were obtained from the World Governance Indicators (WGI) and access to improved drinking water from the United Nations International Children's Emergency Fund (UNICEF). Data collected were for years 2000 to 2023.

Estimation Technique: The preferred estimation procedure is the system-Generalized Method of Moment (System-GMM). It has been found that aid and human development (which include health outcomes such as maternal mortality) have a simultaneous relationship which has led to the problem of endogeneity. A well-suited technique to deal with such endogeneity issue is the GMM methodology and it combines in a system the relevant regressors expressed in first differences and in levels. There are Differenced GMM and System GMM but the System GMM is the preferred method in this study as it has been shown to correct unobserved country heterogeneity, omitted variable bias, and potential endogeneity (Blundell & Bond, 1998).

The GMM model is specified as:

$$\begin{aligned} MMR_{it} = {} & \alpha_0 + \alpha_1 MMR_{it-1} + \alpha_2 HDN_{it} + \alpha_3 SSER_{it} + \alpha_4 HEXP_{it} + \alpha_5 POP_{it} \\ & + \alpha_6 TOP_{it} + \alpha_7 CORR_{it} + \alpha_8 GOV_{it} + \alpha_9 AIW_{it} + \alpha_{10} GDPC_{it} + \alpha_{11} PHY_{it} \\ & + \alpha_{12} FET_{it} + \eta_i + \mu_t \\ & + \varepsilon_{it} \qquad (1) \end{aligned}$$

Where MMR means Maternal Mortality Rate (measured as death per 100,000 livebirths); HDN= Health aid as share of GDP (the health aid component was measured in USD 2010= 100); SSE = Secondary School Completion Rate (in percentage); HEXP = Health expenditure as percentage of GDP; POP = Population; TOP = Trade Openness (import + export as percentage of GDP); CORR = Corruption Index (index ranges from -2.5 (high corruption) to +2.5 (low corruption); GOV = Government Effectiveness Index (index ranges from -2.5 to +2.5); AIW= Access to Improve Water (percentage of population with access to improve clean drinking water); GDPC = GDP per capita (US Dollar); FET = Fertility Rate (number of children per woman); PHY = Physician Density (Physicians per 1000); η = Country specific effect; μ = Time specific effect; ε = Error term; α = slope co-efficient; i = Cross section of countries; t = time period

Post-Estimation Tests

The post-estimation exercise in GMM methodology requires testing for serial correlation, overall validity of instruments and assessment of the robustness of the model by estimating the pooled OLS and Within-group (fixed effect model) for the model to provide a useful bound check for the lagged dependent regressors whose good estimate must lie between its OLS and within-group estimate. The reason for carrying out the serial correlation test in GMM estimation was emphasized by Arellano & Bover (1995) and Blundell & Bond (1998). Arellano and Bond (1991) developed a test for autocorrelation in the idiosyncratic disturbance term v_{it} that may render some of the lags invalid as instruments. The test for autocorrelation of the first order in the differenced error term is called AR(1) whose null hypothesis of "no autocorrelation" is expected to be rejected while that of AR(2) which tests for second order autocorrelation is expected to be accepted for validity of the model. The validity of the instrumental variables was assessed using the Sargan and Hansen tests. The null hypothesis of both Sargan and Hansen tests is that all instruments as a group are exogenous. Therefore, a higher p-values are desirable (acceptance of the null hypotheses). According to Bond (2002), the good estimate of the lagged dependent regressor should lie between its OLS and Within-group (Fixed Effect) estimates. Thus, these estimates provide a useful check on result. Therefore, the present study estimated the pooled OLS and the fixed effect model in order for a good assessment of the GMM results.

Results

Preliminary Assessment of Study Data: Tables 1 and 2 contain results of the descriptive analyses of the study data. Table 1 presents the means, media, minimum and maximum values of the dataset of each variable as well as measures of dispersion and normality while table 2 contains the result of pairwise correlation among the variables. The correlation results showed that the coefficients were not high enough to envisage multicollinearity among the study variable.

Table 1: Descriptive statistics of study variables

	MMR (/100,000)	HDN (share GDP)	GDPC (US$)	FERT	HEXP (share GDP)	CORR	GOV	AIW (%)	PHY (/1000)	POP	SSER (%)	TOP
Mean	547.48	0.3484	2290.4	4.85	5.14	3.11	-0.71	72.64	0.24	17820385	42.0616	72.05
Median	509.50	0.18	989.57	4.99	1.58	3.21	-0.74	72.42	0.10	10409229	38.5623	62.04
Maximum	2480.00	5.39	20533	7.68	7.12	4.33	1.05	99.87	2.53	1.91E+08	99.9039	311.4
Minimum	53.00	2.33E-07	194.87	1.36	0.04	1.28	-1.88	24.58	0.008	81131.00	6.1116	16.67
Std. Dev.	319.59	0.5163	3193.3	1.23	1.17	0.62	0.61	14.90	0.38	27421484	21.1982	37.44
Skewness	1.21	3.59	2.57	-0.49	1.37	-0.69	0.53	-0.29	3.25	3.56	0.6551	1.80
Kurtosis	6.33	23.48	10.12	3.18	5.12	2.91	2.79	2.77	15.21	18.19	2.8043	8.60
Jarque-Bera	650.14	17998	2952.6	37.81	455.7	70.22	42.76	15.12	2919.14	10783.17	49.5841	1617.
Probability	0.0000	0.0000	0.0000	0.00	0.00	0.00	0.00	0.0005	0.0000	0.0000	0.00000	0.000
Observation	920	917	919	920	910	874	874	915	366	920	678	877

Source: Authors' computation, 2024

Table 2: Correlation Analyses of the study variable

	MMR	AID	GDPC	FERT	HEXP	CORR	GOV	AIW	PHY	POP	SSER	TOP
MMR	1											
AID	0.04	1										
GDPC	-0.56	-0.42	1									
FERT	0.72	0.30	-0.80	1								
HEXP	-0.48	-0.14	0.58	-0.53	1							
CORR	0.68	0.08	-0.61	0.64	-0.54	1						
GOV	-0.13	-0.28	0.24	0.17	0.18	-0.35	1					
AIW	-0.61	-0.29	0.70	-0.73	0.46	-0.57	0.41	1				
PHY	-0.49	-0.32	0. 69	-0.72	0.29	-0.44	0.14	0.57	1			
POP	0.29	-0.10	-0.14	0.22	-0.33	0.32	0.31	-0.24	-0.06	1		
SSER	-0.60	-0.27	0.63	-0.73	0.36	-0.54	0.39	0.68	0.62	-0.14	1	
TOP	-0.30	-0.15	0.47	-0.50	0.27	-0.40	0.26	0.30	0.37	-0.37	0.49	1

Source: Authors' computation, 2024

Result of the impact of health aid on maternal mortality in SSA

In a bid to achieving the main objective of the present study, equation 1 was estimated using the system GMM and the results are presented in Table 3. Results revealed that previous year maternal mortality ($P<0.01$), health aid ($P<0.05$), public health expenditure ($P<0.05$) corruption ($P<0.05$), GDP per capita ($P<0.01$) and fertility rate ($P<0.05$) all had significant effects on maternal mortality (proxied by maternal mortality ratio –MMR). The lagged MMR returned a significant positive coefficient value of 0.8684 which implied that increase in the previous year MMR by 1 percent increased contemporaneous maternal mortality by 0.8684 percent. In line with *a priori* expectation, foreign aid targeted at the health sector had negative and significant effect on maternal mortality. It also answered the main research questions and achieved the main objective of the study. An increase in health aid by 1 percent decreased maternal mortality by about 0.1 percent point in SSA during the study period. The finding agrees with theory especially the augmented Solow model where investment in human capital (including from external sources) is expected to raise output and other social welfare indicators.

The coefficient of government health expenditure was negative and significant, implying that increase in public health expenditure decreased maternal mortality in line with *a priori* expectation. A percent increase in health expenditure decreased maternal mortality by 0.07 percent. Income is usually a key factor in health demand. GDP per capita came up with significant negative coefficient in line with *a priori* expectation. A percent increase in income decreased maternal mortality by 0.24 percent. Corruption is known to impede service delivery as resources are likely to be diverted away from intended purpose in a corrupt society. Corruption as a variable came up with a significant positive effect. A unit increase in corruption perception score increased maternal mortality by 0.11 percent. Finally, fertility rate had significant positive effect on maternal mortality with a percent increase in fertility rate resulting in 0.54 percent increase in maternal mortality in line with a priori expectation.

Discussion of the results

The result of the model estimating the effect of health aid on maternal mortality ratio (MMR) in SSA is presented in Table 3. The significance of the lagged dependent variable revealed some degree of persistence in MMR in the region. The result showed that foreign aid to the health sector had significant negative effect on MMR in SSA. The MMR decreasing effect of health aid might have been from improved and subsidized maternal healthcare, increased availability of birth attendants, improved on-the-job training for health workers etc which in turn reduced mortality among mothers of new born and pregnant women. The results of this study are in line with that of Banchani and Swiss (2019) which analyzed the effects of aid on maternal health in a sample of 130 low- and middle-income countries from 1996 through 2015 and reported that the effects of total foreign aid on maternal mortality are limited, but that aid allocated to the reproductive health sector and directly at maternal health is associated with significant reductions in maternal mortality.

Government health expenditure returned a negative and significant coefficient implying that increase in government spending on the health sector decreased MMR in the region. Governments are supposed to be the driver of healthcare delivery in countries around the world and the amount of resources committed to the health sector is expected to have significant impact of the health outcomes of the people. The result of this study aligns with that of Nwankwo (2018) from a study which adopted panel data from 2003-2015 for selected 25 States in Nigeria and reported that public health expenditure was a vital factor in reducing incidences of maternal mortality in Nigeria. The result also corroborates the finding of Akinbode and Sam-Wobo (2020) in a study that assessed the effect of government health expenditure on maternal health outcome (proxy with MMR) in Nigeria using data from 1980-2018 and reported a significant long and short run effects of government health expenditure on maternal mortality. Increase in GDP per capita significantly decreased MMR in SSA during the study period. This explains why most high-income countries have low maternal mortality ratio. For instance, as at 2019, per capita GDP in the United States was $55,753.14 while maternal mortality ratio was 19 per 100,000 livebirths and the average GDP per capita was $1,656.70 in SSA and maternal mortality ratio was 534 per 100,000 livebirths. The finding reported in this study aligned with that of Kwao (2017) from a study which assessed the relationship between education, per capita income and maternal mortality using data from 43 SSA countries from 1980-2010 and reported that significant relationship existed between education, per capita income and maternal mortality.

The results revealed that corruption increased MMR. The finding aligned with Toffolutti *et al*. (2021) which assessed the effect of corruption in SSA by linking individual and regional data from 135 regions in 17 Sub-Saharan African countries over the period 2002-2018 and reported that a 10 percentage points increase in the percentage of people who had first-hand experience in bribery was associated with a 17.3% increase in the number of women who died during pregnancy or within two months of giving birth. Nations that are perceived as less corrupt have better public service among which is healthcare delivery which impart directly on maternal health. The positive and significant coefficient of fertility rate suggested that fertility is inimical to maternal health. It evolves from the fact that having many children possibly without adequate child spacing weakens women physically and psychologically thereby resulting in increased maternal death. For instance, in 2019, fertility rate in the European Union was 1.52 while maternal mortality ratio was 6 per 100,000 livebirths compared with fertility rates of 1.82 and 4.62, and maternal mortality ratio of 69 per 100,000 livebirths and 534 per 100,000 livebirths for East Asia and the Pacific (EAP) and SSA respectively. The finding in this study is in line with that of Jain (2011) which reported that decline in maternal mortality for India, Pakistan and Bangladesh was attributable to decline in fertility rate from 1990-2008.

Table 3: Results of the Maternal Mortality Model
Two-Step System GMM

	Coefficient	Standard Error	t-value
Const.	0.9227	1.2142	0.76
L1.MMR	0.8684***	0.1066	8.15
HDN	-0.0968**	0.0475	-2.04
SSER	0.0014	0.0029	0.47
HEXP	-0.0723**	0.0336	-2.15
InPOP	-0.0181	0.0301	-0.60
TOP	0.0017	0.0021	0.81
CORR	0.1067**	0.0536	1.99
GOV	0.2542	0.2922	0.87
AIW	0.0060	0.0085	0.71
InGDPC	-0.2434***	0.0912	-2.67
InFERT	0.5445**	0.2556	2.13
InPHY	0.1452	0.1708	0.85
AR(1) p-value	0.041	-	-
AR(2) p-value	0.567	-	-
Hansen test p-value	0.246	-	-
Sargan test p-value	0.183	-	-
F-Stat (Prob)	519.16(0.0000)	-	-
No. of instruments	15	-	-

S.E = Standard Error; *, ** and *** implies significant at 10%, 5% and 1% respectively
ABS = Average absolute value of the off-diagonal elements; L1.MMR= One period lag of MMR
Source: Authors' Computation, 2024

Post Estimation Assessments

The validity of the estimated GMM model was assessed using the AR(1) and AR(2) results which accompanied the main GMM results. The p-value of the AR(1) which tested the presence of first order serial correlation in the series of the differenced error term (0.041) suggested the rejection of the null hypothesis of "no first order autocorrelation" which is theoretically expected and of no consequence. The AR(2) which assessed the presence of second order autocorrelation in the differenced error term revealed the acceptance of the null hypothesis of "no second order autocorrelation" in line with the requirement for the validity of the GMM model given the p-value of 0.567. Therefore, the estimated model was adjudged to be valid (Table 3).

In order to ascertain the validity of the instrumental variables adopted in the estimation of the system GMM model, the Sargan and the Hansen tests were carried out. If the instrumental variables are not valid estimates of the GMM model are not likely to be consistent and this has a lot of implications on the usefulness of the parameter estimates. The Sargan and the Hansen tests are both tests of over-identifying restrictions, which test the validity of the instrumental variables. The null hypothesis was that "all instruments as a group were exogenous or were valid". The probability value of the Sargan and Hansen tests were 0.183 and 0.246 respectively (Table 3). Therefore, the instrumental variables used in the GMM estimation were valid.

Robustness Check: In order to establish the robustness of the estimated GMM model, it is required that the pooled OLS and fixed effect models were estimated. Bond (2002) asserted that the estimated coefficient of the lagged dependent variable must fall between its values in the Pooled OLS and the Fixed Effect Models. Table 3 showed that the coefficient of the lagged MMR in the two step system GMM lies between its values in Fixed effect and pooled OLS estimates in Table 4, i.e. $0.7887 < 0.8684 < 0.8991$. Hence, the estimated GMM model was confirmed to be robust.

Table 4: Maternal Mortality Model Robustness Check Results

	Pooled OLS model			Fixed Effect Model		
	Coeff.	S. E.	t-value	Coeff.	S. Error	t-value
Const.	-0.0272	0.0824	-0.33	0.0489	0.1165	0.42
L1.MMR	0.8991***	0.1669	5.39	0.7887***	0.2293	3.44
HDN	-0.0130**	0.0060	-2.19	-0.0113*	0.0065	-1.73
SSER	0.0003	0.0002	1.41	0.0024	0.0028	0.86
HEXP	-0.0036**	0.0019	-1.91	-0.0026	0.0038	-0.67
InPOP	-0.0021	0.0030	-0.68	-0.0013	0.0433	-0.03
TOP	0.0112	0.0124	0.90	0.0544	0.1432	0.38
CORR	0.0181	0.0114	1.59	0.0103	0.0123	0.84
GOV	0.0117	0.0112	1.04	0.0082	0.0141	0.58
AIW	0.0442	0.2947	0.15	0.0048	0.0401	0.12
InGDPC	0.0010	0.0072	0.14	-0.3693***	0.0947	-3.90
InFERT	0.0242*	0.0126	1.92	0.1374**	0.0630	2.18
InPHY	0.0026	0.0521	0.05	0.0068	0.0568	0.12
R_2	0.9978	-	-	-	-	-
Adj. R^2	0.9976	-	-	-	-	-
F-Stat (Prob)	8878 (0.0000)	-	-	-	-	-

Source: Author's computation, 2024

Note: *L1.MMR = One year lag of maternal mortality ratio*

Summary And Conclusion

The results of the estimated model revealed that lagged MMR, fertility rate and corruption significantly increased MMR while health aid, domestic health expenditure and per capita GDP significantly reduced MMR. The validity of the GMM model was confirmed by the AR(1) and the AR(2) test results as indicated by their p-values. The results of the Sargan and the Hansen tests established that all the instrumental variables used as a group were exogenous which is desirable. Finally, the robustness of the MMR system GMM model estimated was confirmed with the results of the Pooled OLS and the Fixed Effect models. A major conclusion from this study is that health aid contributes significantly to the reduction of MMR in SSA. In addition, government health expenditure and income (GDP per capita) reduced maternal death while fertility and corruption aggravated maternal death in the region. The study recommended that governments in SSA should increase domestic health expenditure to complement the contribution of health sector aid. More efforts to curb corruption is also advocated. Finally, renewed efforts towards fertility control through effective campaign and uptake is also recommended.

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