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Analysis of Determinants of Maternal Mortality in 50 Selected Countries Worldwide

Gebbe Ndari

Chad, Central Africa.

gebbe08ndari@gmail.com

***Corresponding Author:** Gebbe Ndari, Chad, Central Africa.*

Abstract

In the Sub-Saharan Africa, a woman has 1 in 12 chance of dying during pregnancy or childbirth compared to 1 in 4,000 in developed countries. Women die as a result of complications during and following pregnancy and childbirth but the reasons surrounding the cause of death regional may be influenced by various governance, economic and socio-demographic variables other than poor health systems. The study aimed at investigating the factors affecting maternal mortality in selected World Health Organization countries.

The design of the study was ecological and used secondary data from recognized data bases to model the effect of governance and economic variables on maternal mortality.

The data was summarized into descriptive statistics using SPSS version 24 and Multiple Linear regression was used for the analysis of the predictive abilities of governance, economics, and quality of health care, socio-economic and human development variables on the selected countries with level of significance set at P<0.05.

The findings of the study revealed that at each increase of 1% of GII contributes to an increase of MMR by 583.215%. Each increase of population with at least some secondary education contributes to a decrease of 4.95% or otherwise, MMR decreases by 4.95 with each 1%population with at least secondary education. Switzerland recorded the lowest maternal mortality rate of 5 per 100000 with Sierra Leone recording the highest 1360 per 100000 live births recorded by Sierra Leone. Education of women and for that matter women empowerment was found significant contributing greatly to the reduction of maternal mortality of a country.Countries must invest in the empowerment of women for and will impact on the maternal health of the society.

Keywords: *Maternal mortality, Governance, Gender Inequality*

Background

Maternal mortality is a key indicator of health and development of a country. The World Health Organization (WHO) defines maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

According to the WHO report released in 2016 [1], approximately 830 women die every day from preventable causes related to pregnancy and childbirth. The report further identified that, 99% of these deaths occur in developing countries. Maternal mortality is also reported to have higher occurrence among women of rural dwellers and the prevalence is more associated with poorer communities [2]. The risk of complication and death is higher among young adolescents. Though the global maternal mortality dropped between 1990 and 2015 by about 44%, the strategies towards its reduction is projected at mortality ratio of less than 70 per 100 000 live births between 2016 and 2030 agenda of the Sustainable Development Goals (SDG). Maternal mortality is recognized as a priority health problem, particularly in developing countries [3]. It mainly enables the measurement of development level of the country. The development of a country to a large extent is linked on the rate of maternal death in that particular

country and therefore, it is identified as one of the determinants of performance in the health system of a country. It is also possible that, several factors account to the increase of maternal mortality of a country. It is worth researching into these factors though there is paucity of research on the issue.

Maternal mortality is one of the target for the SDG. It is a global problem and strategy geared towards finding solutions will to a large extent save a lot of the global economic loses. Many populations have lost most of the reproductive age women as a result of this condition. It is therefore estimated that, the increase of skilled health care incorporated before, during and after childbirth is appropriate to save the lives of women during pregnancies and child birth. The fight against maternal mortality remains a challenge most especially in low-income and developing countries, despite various interventions aimed at curbing the menace. It is a relatively important phenomenon as general mortality. International statistics [4] show that per 100,000 live births, an average of 480 maternal deaths occur in developing countries worldwide and less than 7 in developed countries. In the Sub-Saharan Africa, a woman has 1 in 12 chance of dying during pregnancy or childbirth compared to 1 in 4,000 in developed countries [4]. Women die as a result of complications during and following pregnancy and childbirth but the reasons surrounding the cause of death regional may be influenced by various factors including governance, economic and socio-demographic variables other than poor health systems. Research has proven that, most of the complications of pregnancy causing death could actually be prevented or treated. Say *et al* [5] further cited that, other complications which may exist before pregnancy are mainly worsened during pregnancy, especially if not managed as part of the woman's care. They identified various complications which are classified as major to be responsible for the death of a pregnant woman. These include postpartum haemorrhage, infections (usually after childbirth, pre- and eclampsia, delivery complications and unsafe abortion. All these complications are likely to be associated with economic and political development of countries. Though not much literature has explored this relationship, the current study is aimed to explore the determinants associated with maternal mortality in fifty (50) selected countries. The study would want to provide solutions to the following question: What is the influence of governance, sociocultural, health and economic variables on maternal mortality? It is believed that, the findings of this review would help inform policy and strategize to effectively combat the maternal mortality situations of countries.

Conceptual Framework

Understanding the determinants of maternal mortalityis a complex task because maternal deathsare influenced by many different categories of events or conditions. Biology, economics, culture, social, governance, demography and the distribution and effectiveness of health services all contribute. This explains the complexity of the factors affecting maternal mortality. Several studies have been conducted on the determinants of maternal mortality [6-8].

Several approaches have tried to understand maternal mortality. Some studies are based on socio-cultural factors, others on economic, environmental, and contextual or health factors [6, 8]. The model for the analytical framework of this study was inspired by the UNICEF policy on macro, meso and micro level analysis of the factors for maternal and neonatal mortality and morbidity[1] Though this framework attempted to explore the framework, it failed to explore the implications of governance on maternal mortality. It is therefore the main focus of this current study.

Methods

Study Design

The study used an ecological study design. Ecological studies are studies of risk-modifying factors on health or other outcomes based on populations defined either geographically or temporally. Both risk-modifying factors and outcomes are averaged for the populations in each geographical or temporal unit and then compared using standard statistical methods. The study defined the observational study by the level at which data are analysed, namely at the individual country or group level in clusters.

Secondary data was retrieved from the World Bank and United Nations Development [9] and Population (UNDP) [10] data bases.

Study Sample

Fifty (50) WHO countries were selected based on the human resource development of the countries. They consisted high, medium, low and very low human

resourced countries from across the world as per the following percentages: Low (52%), Medium (30%), High (12%) and Very High (6%) Human Development by choice to enable comparison among groups (UNDP, 2016). This was to aid comparison among various groups of countries with focus on most developing countries. A country was added if all the data required for the analysis from the selected variables were available. The focus of the researchers was also more on the developing countries. All the developing countries included presented all data for the various variables of interest in this study.

Data Cleaning and Transformations

Data collected from different sources was cleaned. This was performed by ensuring that countries that do not have majority of the indicators (Human development Index, economic variables, governance variables, health system variables) were rendered ineligible for inclusion

Transformation of data was done to some of the independent variables as well as cleaning of the entire data to cater for all missing values for the study. A country was included if all the data variable was present. Countries which have missing data for any variable of interest was excluded and replaced in order to have the required sample of 50.

To further understand the terminologies of the current study, maternal mortality rate (MMR) is expressed by dividing the average annual number of maternal deaths in a population by the average number of women of reproductive aged 15 to 49 years multiplied by one hundred thousand. Gender Inequality Index was also expressed as a composite measure reflecting inequality in achievement between women and men in three dimensions: reproductive health, empowerment and the labour market and Gross Domestic Product (GDP) per capita growth is a measure of the total output of a country that takes gross domestic product and divides it by the number of people in the country.

The GII was categorized into [0.68; highest [= 3 connotes worst, [0.34; 0.67] = 2 implying worse and [0.04; 0.33] = 1 depicting the best

Explanatory Variables

The explanatory or independent variable exploit at least one variable under various domains. These were share of seats in parliament measured as a percentage of seats held by women (Governance variable), GDP measured as the addition of consumption, investments, and government expenditure with the sum of the imports deducted from export (Economic Variable), the public health expenditure (Health System Variable) and gender inequality index and population of women with at least some secondary education representing sociocultural variables.

Sociocultural Determinants

Education

Education is proven to empower women and enlighten them on their fundamental rights. It helps women to be able to live independently and play major part in societal decision making. It is investigated that, lower levels of maternal education were associated with higher maternal mortality even among women who were able to access facilities providing intrapartum care [8]. More attention should be given to the wider sociocultural determinants of health when devising strategies to reduce maternal mortality and to achieve the increasingly elusive SDG for maternal mortality.

Gender Inequality Index

According to Chirowa*et al* [11], all countries with high GII and MMR had lower expenditure on health as contrasted against countries that spent more on health. Thus, the higher GII value, the more disparities between females and males and the more loss to human development.

Economic Determinants

Gross Domestic Product (GDP)

According to the World Bank [9], countries with high GDP growth rates recorded higher MMR figures and related economic growth to mitigating health problems including maternal mortality. It is not enough to parade high GDP figures to portray successful growth over the years. These figures must have a reflection on the health system of the country.

Health System Variable

Public Health Expenditure

This refers to the current and capital spending on health from government (central and local) budgets, external borrowing and grants (including donations from international agencies and nongovernmental organizations) and social (or compulsory) health insurance funds and this is expressed as a percentage of GDP.

Governance Variable

Share of Seats in Parliament (% Held by Women)

This represents the proportion of seats held by women in the national parliament expressed as percentage of total seats. For countries with bicameral legislative systems, the share of seats is calculated based on both houses.

Data Analysis and Management

Data Management

The data was well sorted from different sources and integrated by matching and integrating them on a spreadsheet and later exported into SPSS version 24 for the analysis.

Descriptive Analysis

Descriptive statistic was use to present frequencies and medians in tables. Bivariate analysis was done to establish colinearity. Bivariate analysis was also used to measure the strength of association between two variables and the direction of the relationship was identified. Multiple Linear regression was used for the analysis of the predictive abilities of governance, economics, and quality of health care, socio-economic and human development variables on the selected countries. This was chosen because multiple regression requires that the dependent variable is a continuous variable (MMR) with the data for the independent variables reasonably normally distributed. Multiple linear regression was also undertaken to establish the effect of each independent variable on the MMR to avoid the problem of multilinearity.

Linear correlation models were used to find out the relationship between each of the sub constructs of the predictor variables with that of the dependent variable (Maternal Mortality Rate) and level of significance set p-value less than 0.05.

Ethical Requirement

The study observed all appropriate ethical issues and duly acknowledged all sources and used citations as appropriately. The data used have been gathered under ethical requirements necessary for national data. Ethical approval was sought from the University of Ibadan Ethical Review Committee.

Findings

The findings of the study is presented in table 1 below. The country with the highest level of MMR is 1360 per 100 000 recorded by Sierra Leone and that with the lowest recorded 5 per 100 000 in Switzerland. The overall means calculated for the 50 selected countries were presented.

Table1. *A summary of descriptive statistics*

Variables	Observation	Mean	Standard Deviation	Minimum	Maximum
Maternal mortality	50	357.20	285.479	5	1360
Share of seats in parliament (% held by women)	50	22.144	12.4793	2.2	57.5
Gender Inequality Index	49	0.51578	0.174281	0.040	0.948
GDP	50	559334.72	2765905.348	0.3550	1942
Population with sec education	50	38.344	25.8257	1.7	96.1

Source: UNDP

Test of Correlation

There was a relationship between MMR and GII. The higher GII, the higher the maternal mortality rate.

Again, there is negative relationship between MMR and Population with at least secondary education. The lower the population with at least secondary education (as presented in Table 2)

Table2. *Correlations between dependent and independent variables*

		Maternal mortality Rate	Gender Inequality Index	Share of seats in parliament	Population with at least some secondary education	GDP
Maternal mortality Rate	Pearson Correlation	1	0.651**	-.266	-.639**	-.219
	Sig. (2-tailed)		.000	.062	.000	.126
	N	50	49	50	50	50
Gender Inequality Index	Pearson Correlation	0.651**	1	-.427**	-.586**	-.306*
	Sig. (2-tailed)	0.000		0.002	0.000	.033
	N	49	49	49	49	49
Share of seats in parliament	Pearson Correlation	-.266	-.427**	1	.001	-.030
	Sig. (2-tailed)	0.062	0.002		0.993	.835
	N	50	49	50	50	50
Population with at least some sec. Educ	Pearson Correlation	-.639**	-.586**	0.001	1	.355*
	Sig. (2-tailed)	0.000	0.000	.993		.011
	N	50	49	50	50	50
GDP	Pearson Correlation	-.219	-.306*	-.030	.355*	1
	Sig. (2-tailed)	.126	.033	.835	.011	
	N	50	49	50	50	50

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 3. *Correlation matrix*

	Unstandardized Coefficients	**Standardized Coefficients**	**Unstandardized Coefficients**		
	B	Std. Error	Beta	t	Sig.
(Constant)	298.030	210.646		1.415	0.164
Gender Inequality Index	583.215	249.419	0.353	2.338	**0.024**
Share of seats in parliament	-2.589	2.772	-0.113	-0.934	0.355
Population with at least some sec. Educ	-4.947	1.508	-0.449	-3.281	**0.002**
GDP	4.721E-6	0.0001	0.046	0.411	0.683

a. Dependent Variable: Maternal mortality Rate

Data Interpretation

Each increase of 1% of GII contributes to an increase of MMR by 583.215%

Each increase of population with at least some secondary education contributes to a decrease of 4.95% or otherwise, MMR decreases by 4.95 with each 1%population with at least secondary education.

Discussion

The study aimed at investigating the factors influencing maternal mortality of selected WHO countries. Countries were selected based on those with available variables of interest. The study revealed that, gender inequality index and education were the main factors affecting a country's maternal mortality. We could therefore infer from that finding that, a more educated population of women with at least secondary education leads to increasing empowerment. In Karlsen*et al* [8] research on the effect of education on maternal mortality, they reported that, more maternal mortality is prevalent among women with lower education. This was not different from this current finding as the data was consistent and revealed a negative significance.

We could therefore conclude that, increasing education of women could actually make women assume cadres in the societal decision making where they are likely to take major decisions concerning their lives. It is also estimated that; education eradicate poverty which is mainly associated with maternal mortality. In Keita and Toure[12] report, they alluded that poverty is one of the key factors in maternal mortality. The study further reiterated that, if poverty is taken care of in a population mainly through women empowerment, it will drastically add to the reduction of maternal mortality. In addition, women's economic status determines, to a large extent, their access to reproductive health care before pregnancy, prenatal care during pregnancy, care during delivery and during the postpartum period.

The study also identified gender inequality index to have a direct influence on maternal mortality. This was no surprising that maternal mortality has reduced rates in the more developed countries than poor countries where there is better GII. The current study findings was consistent with several other studies on the issue of increase gender equality and maternal mortality will be reduced [12-14].

It must also be remembered that the low political commitment, the quantity and quality of financial resources allocated to maternal health and poor governance (corruption) indirectly affect women's health. It is therefore appropriate that, country governments must focus on improving health systems and channel more attention to women empowerment, developing health protocols, increasing skilled health personnel and importantly improving the economy in general. This will in long run affect all area of the country and hence, the fight against maternal mortality could be won.

Conclusion

Maternal mortality was seen to be influenced by GII and Population with at least secondary education. Though other independent variables in these current study were insignificant, there is the need for a more elaborate exploratory design inculcating larger samples to establish the true relationships likely to exist. That notwithstanding, it is expected that the current findings will help policy makers strategize to improve on the systems to help reduce the menace.

"Women do not die because of diseases that we cannot treat, they die because society has not yet decided that their lives deserve to be saved." Mahmout Fathalla, Chair of the WHO Advisory Committee on Health Research and also as stated by the UN General Secretary, countries must gear sufficient resources to combating the factors which are not helping the treatment of women and preventing maternal death. It is clear therefore as this statement is still relevant today. Maternal health indicators remain degraded, despite the efforts of governments and social partners. Hence the need to identify the determinants and act on them for good care and health of women during pregnancy and delivery.

Availability of Data and Materials

The datasets generated and/or analysed during the current study are available in the UNDP Database repository, http://hdr.undp.org/en/composite/GII.

Authors' Contributions

ELT and GN searched and retrieved all the data used in this study. ELT and GN analyzed and interpreted the data regarding the factors influencing maternal mortality under the supervision of OO. GN prepared and contributed significantly to the manuscript and OO reviewed all the manuscript. All authors read and approved the final manuscript

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