

Determinants of Maternal Mortality in Somalia.

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ABSTRACT

Maternal mortality is the probability or percentage of mothers dying as a result of pregnancy related complications or post-delivery complications every year. In this paper, effort was made to investigate the influence of gross domestic product per capital, total fertility rate, and HIV/AIDS prevalence rate (termed as determinants) on maternal mortality of Somalia in the period 1990-2012. Secondary data collected from the publications of United Nations Statistics Division (UNSD) and World Health Organization (WHO) were used. The trend was examined to detect their movements and changes with time. In order to determine the relationship between GDP per capital, total fertility rate and HIV/AIDS prevalence rate as explanatory and maternal mortality ratio as dependent variable and the influence of independent variables on maternal mortality, Pearson correlation coefficient and ordinary least square (OLS) regression estimates were computed.

The findings showed that the trend of GDP per capital of Somalia was not predictable and there were fluctuations over time. GDP per capital of Somalia experienced decreasing trend within some periods and increasing trend in the other periods. The trend of the total fertility rate of Somalia from 1990 up to 2000 was an increasing trend while in the last decade from 2001 to 2012 was declining. In HIV/AIDs prevalence rate, there was generally rising trend of HIV/AIDs prevalence rate in Somalia within the period. The maternal mortality ratio of Somalia in the period exposed increasing trend in the period covered by the study under consideration. Consequently, the extent of maternal mortality ratio is as high as 978 deaths per 100,000 live births. It was also shown that GDP per capital, TFR, and HIV/AIDS

prevalence rate have strong relationship to the maternal mortality ratio as R^2 coefficient of determination was found as 81%.

The study concluded that GDP per capital, TFR and HIV/AIDS prevalence rate have high influence on the maternal mortality and therefore, it is in line with the demographic transition theory. Based on these findings, it was therefore, recommended that incomes of the population among them vulnerable groups should be elevated by giving microfinance to poor families, put forward policies to reduce fertility rate such as education and employment opportunities given to the women, and Community awareness campaign to be taken to warn people the ways that HIV/AIDS spreads.

(Keywords: maternal mortality, gross domestic product, GDP, fertility rate, HIV, AIDS)

INTRODUCTION

Improving maternal health is 1 out of the 8 Millennium Development Goals (MDGs) adopted by the international community in 2000. Under MDGs, countries were committed to reducing maternal mortality by three quarters between 1990 and 2015. Since 1990, maternal deaths worldwide have dropped by 45%. In Sub-Saharan Africa, a number of countries have halved their levels of maternal mortality since 1990. In other regions, including Asia and North Africa, even greater headway has been made. However, between 1990 and 2013, the global maternal mortality ratio (number of maternal deaths per 100,000 live births) declined by only 2.6% per year. This is far from the annual decline of 5.5% required to achieve MDGs (WHO, 2013).

Reproductive health is a major problem in Somalia, with a maternal mortality ratio of 1,044 per 100,000 live births placing Somali women among the most high-risk groups in the world. The child and maternal mortality rates for Somalia are among the highest in the world; one out of every ten Somali children die before seeing their first birthday. While comprehensive information is not available, it is believed that leading causes of infant and child mortality are poverty, diseases such as pneumonia, diarrhea, and measles, HIV/AIDS, neonatal disorders as well as higher fertility rate (UNICEF, 2013).

Globally, the lifetime risk for women of maternal death is 1 in 74. In industrialized countries, this risk is 1 in 2,800. In the least developed countries, they face a 1 in 16 chance of dying in childbirth in their lifetime (DFID, 2004). The fifth Millennium Development Goal is to improve maternal health, with a target to reduce the maternal mortality ratio by three quarters, between 1990 and 2015. Yet maternal mortality in developing countries has barely decreased over the past decade, and in parts of Africa it has increased. The national target was to reduce the 1990 maternal mortality rate of 740 per 100,000 live births by 3/4 to 185 per 100,000 live births by 2015.

According to Nour (2008), the number of pregnancy-related deaths/100,000 of reproductive age; the number of maternal deaths related to childbearing divided by number of live births—number of live births + fetal deaths in a year.

Maternal Mortality Ratio (MMR) is the ratio of the number of maternal deaths per 100,000 live births from any cause related to or aggravated by pregnancy or its management, excluding accidental or incidental causes. MMR includes deaths during pregnancy, childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, for a specified year. The MMR is used as a measure of the quality of a health care system (Gallup and Sachs, 2001).

In 2010, countries with highest maternal mortality were Chad (1,100), Somalia (1,000), Central African Republic (890), Sierra Leone (890), and Burundi (800). In the United States, the maternal death rate averaged 9.1 maternal deaths per 100,000 live births. "Lifetime risk of maternal death" accounts for number of pregnancies and risk. In sub-Saharan Africa the lifetime risk of

maternal death is 1 in 16, for developed nations only 1 in 2,800 (Kirigia *et al.*, 2014).

Hogan and Foreman (2010) assessed levels and trends in maternal mortality for 181 countries and found out that in the absence of HIV, there would have been 281,500 maternal deaths worldwide in 2008. The report concluded that, although substantial progress has been made towards MDGs, only 23 countries are on track to achieving a 75% decrease in MMR by 2015 and that countries such as Egypt, China, Ecuador, and Bolivia have been achieving accelerated progress.

Worawan *et al.* (2010) undertook a study aimed at using multiple sources of data to calculate the maternal mortality ratio (MMR). Their result shown that, the number of maternal deaths declined from 362 in 2004 to 269 in 2009. The country's MMR declined from 44.5 to 35.2, a 21% reduction. Their conclusion was that, using matching technique together with individual data, policy makers can get reliable information about the causes of maternal death.

Gross Domestic Product (GDP) is one of the main national output measures. GDP is the sum of total value of consumption expenditure; total value of investment expenditure; government purchases of goods and services; and net exports (i.e., exports minus imports of goods and services). Alternatively, it can be viewed as the total value of consumption expenditure; gross private saving (business saving + personal saving + depreciation); net tax revenues (tax revenue minus domestic transfer payments, net interest paid, and net subsidies); and total private transfer payments to foreigners (Oluwole, 2004).

Fertility is the ability of an individual or couple to reproduce through normal sexual activity. About 90% of healthy, fertile women are able to conceive within one year if they have intercourse regularly without contraception. Normal fertility requires the production of enough healthy sperm by the male and viable egg by the female, successful passage of the sperm through open ducts from the male testes to the female fallopian tubes, penetration of a healthy egg, and implantation of the fertilized egg in the lining of the uterus. A problem with any of these steps can cause infertility (Costello *et al.*, 2013).

Prevalence is contrasted with incidence, which is a measure of *new* cases arising in a population over a given period (month, quarter or year). The difference between prevalence and incidence can be summarized thus: prevalence is "how many people have this disease right now" and incidence is "how many people per year newly acquire this disease"? (UNSD, 2012).

Objectives of the Study

The objectives considered in this paper were to:

1. Determine the trend of GDP per capital, total fertility rate and HIV/AIDS prevalence rate of Somalia.
2. Determine the trend of maternal mortality of Somalia.
3. Establish the significant influence of GDP per capital, total fertility rate and HIV/AIDS prevalence rate on maternal mortality of Somalia.

Research Hypotheses

The following hypotheses were used to guide the study:

1. There is no significant negative impact of GDP per capita on maternal mortality of Somalia.
2. There is no significant positive influence of total fertility rate on maternal mortality of Somalia
3. There is no significant positive effect of HIV/AIDS prevalence rate on maternal mortality of Somalia.

MATERIALS AND METHODS

This study followed a descriptive, retrospective and time series designs. Ordinary Least Squares (OLS) regression analysis was used to estimate the relationships among variables, modeling and analyzing of the variables.

Based on the research variables under study the following model given as Equation (1) was developed:

$$MMR = \beta_0 + \beta_1 GDPPC + \beta_2 TFR + \beta_3 HIVPR + \varepsilon_t \quad (1)$$

Where:

MMR is maternal mortality ratio

GDPPC is gross domestic product per capita

TFR is the total fertility rate

HIVPR is human immune deficiency virus prevalence rate

ε_t is error term

Pearson correlation coefficient r is calculated using Equation (2) as:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}} \quad (2)$$

Where n is number of the data set, x and y are the variables to be related.

Pearson correlation coefficient was used to determine the relationship between each of the explanatory variables i.e. GDP per capita, total fertility rate and HIV prevalence rate with the maternal mortality ratio then the significance of each relationship was checked by comparing the P-value and the level of significance as given by Equations (3) - (6):

$$GDPPC_t = \beta_0 + \beta_1 t + \varepsilon_t \quad (3)$$

$$TFR_t = \beta_0 + \beta_1 t + \varepsilon_t \quad (4)$$

$$HIVPR_t = \beta_0 + \beta_1 t + \varepsilon_t \quad (5)$$

$$MMR_t = \beta_0 + \beta_1 t + \varepsilon_t \quad (6)$$

Where β_0 is constant, β_1 is the rate of change of the dependent variable (GDPPC, TFR, HIVPR, and MMR) with the change of time in one year. t is time and e_t is the error term.

If β_1 is significantly different from zero we say that the variable at hand is changing with the time change and there is trend. If β_1 is not significantly

different from zero means there is no trend as the variable is not changing with time.

The null hypothesis was that none of the explanatory variables (GDP per capita, total fertility rate and HIV prevalence rate) has significant effect on the dependent variable (maternal mortality ratio). This test can be written in symbolic form as given in Equation (7):

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0 \quad (7)$$

H_1 : Not all the β 's are 0

Rejecting H_0 implies that one or more of the independent variables is useful in explaining variations in the dependent variable. However it does not identify which regression coefficients is not zero.

RESULTS

Figure 1 depicts that GDP per capita of Somalia sharply declined in the years 1991 and 1992. This decline can be explained that as a result of the fall down of central government in the early 1991,

almost all the economic sources such as the agriculture sector, livestock, export and import of the different seaports, airports, factories among others were stopped working. In addition to that, severe civil war broke out which caused extensive displacement and the problem was even worse in 1992.

From 1993 to 1998 the GDP per capita was gradually increasing and despite experiencing civil unrest, Somalia has started an informal economy based mainly on livestock, remittance/money transfer companies and telecommunications.

Unfortunately, the GDP has again turned down because before 1999 the people had expectations of returning law and order in the country such that they will continue their activities but when it reached to 1999 and the situation is becoming worse they disappointed that may be the reason why the GDP was declining in the years 1999 to 2002. After 2002 there was a little hope of returning government which may be the cause of steady increase of GDP in the period 2003 to 2008 although there was some drop down in 2005.

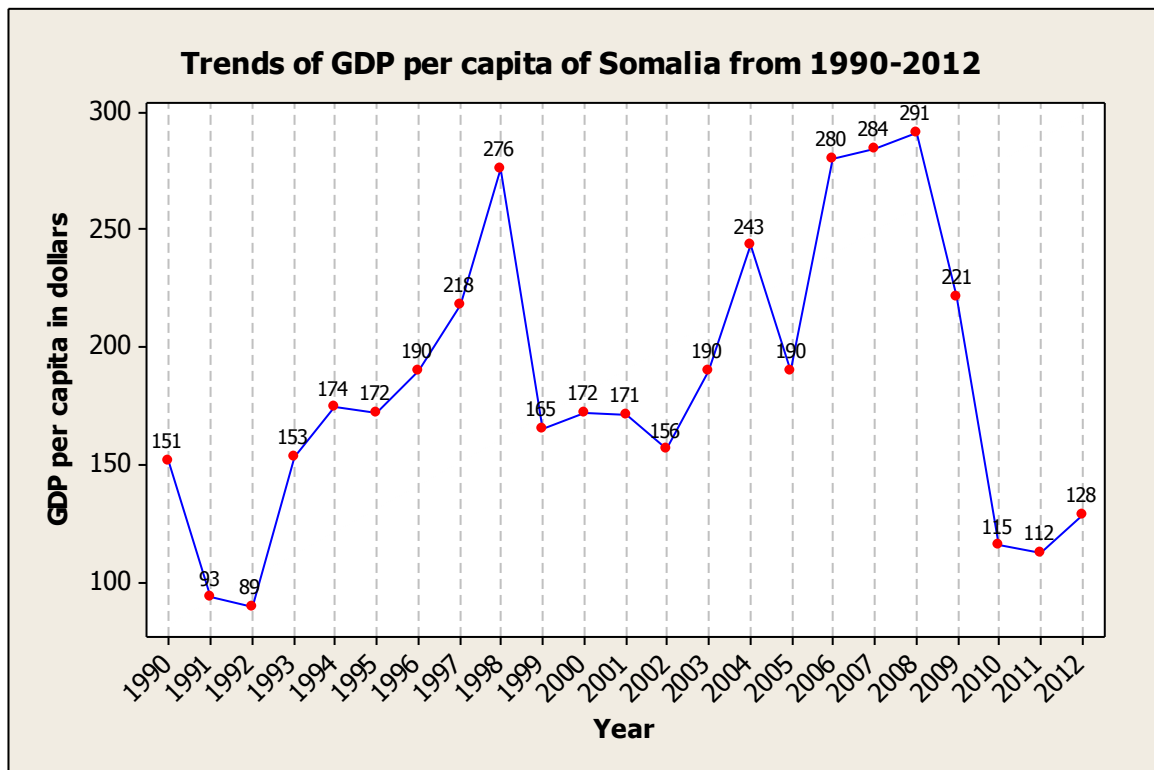


Figure 1: Trend of GDP per Capital from 1990 to 2012
Source: Results of the Analysis (2015)

As the figure above is showing there was sharp decline of the GDP in the last three years of the period under study. Although there are many factors caused this decline but the major two factors were due to renewed fighting in the southern part of the country and two consecutive missed rainy seasons precipitated the worst drought in East Africa seen in 60 years. Belated and sub-average harvests, high food, water and fuel prices, and depleted grazing and farm lands caused by an estimated 25 percent drop in rainfall led to a large severe decline in the economy of the country. In July 2011, the United Nations officially declared a famine in several regions of southern Somalia, a situation reportedly exacerbated by a temporary ban on relief supplies imposed by Islamist militants.

Table 1: Linear Trend Model to Test the Trend.

GDPPC	Coef.	Std.Err.	t	P-Value
Year	2.251976	1.940116	1.16	0.259
_cons	-4317.77	3882.286	-1.11	0.279

Source: Results of the Analysis (2015)

Results in Table 1 revealed that regression of GDP per capita on time variable (year) to assess the trend of GDP per capital with time. From Table 1, the linear trend model is given as Equation (8).

$$GDPPC_t = -4317.77 + 2.25t \quad (8)$$

This means that GDP per capital changes 2.25 as time changes one year but according to the table P-value (1.16) is greater than all conventional levels 0.01, 0.05 and 0.1 and therefore the trend is not significantly different from zero. That is there is no predictable trend of GDP per capital in the 23 years under study which is in line with the line graph.

Figure 2 depicts a general upward trend from 1990-2000 of total fertility rate, This portion being mainly post statehood collapse, the period immediately after the military rule has fallen. The explanation of this trend is that following the falling of the military government all of the governmental policies including family planning strategy was shattered while there was an extensive displacement of the people from main cities and they settle villages and refugee camps in the country and outside of the country mainly in the neighboring countries (i.e., Kenya, Ethiopia, and Djibouti).

In the refugee camps as well as villages there were wide spread jobless which caused men and women to sit in their homes all the time waiting humanitarian aid which in turn increased the chance of meeting of the couple raising the fertility.

In the period 2001-2012 although there were some fluctuations, Figure 2 shows a general downward trend which was characterized by number of factors. In the late of 2000 the first interim government was setup after a decade of lack of government. Although it was less efficient, that government showed returning of statehood of Somalia and reformed some policies among them family planning policies. In spite of steady increase between the years of 2005 and 2009 where many regions of the country experienced wars and lawlessness, the total fertility rate of Somalia has been decreasing in the last decade. Although there is general decrease, the total fertility rate is still one of the highest in the world which may cause deaths of number of mothers.

The model developed from the parameter estimates in Table 2 is given in Equation (9) as:

$$TFR_t = -30.820 + 0.187t \quad (9)$$

As the coefficient of t reveals, total fertility rate increases 0.187 as the time which is in year's changes one unit. The P-value (0.004) shows that the coefficient of t is significantly different from zero as 0.004 is less than even 0.01 that is 99% significance level. In conclusion there is an increasing trend of total fertility rate with respect to the time.

Figure 3 depicts a general increase of HIV prevalence rate in the period under study although there were some fluctuations. After the collapse of military government, clan-based wars started in the capital city of Somalia, Mogadishu which spread all over the country. Consequently, many people displaced in the villages as many others reached to the neighboring countries. Because the lack of adequate health service many people developed diseases among them HIV AIDs. This massive displacement also led the Somali people to interact with different communities with different backgrounds some of them are carriers of communicable diseases such as HIV AIDs.

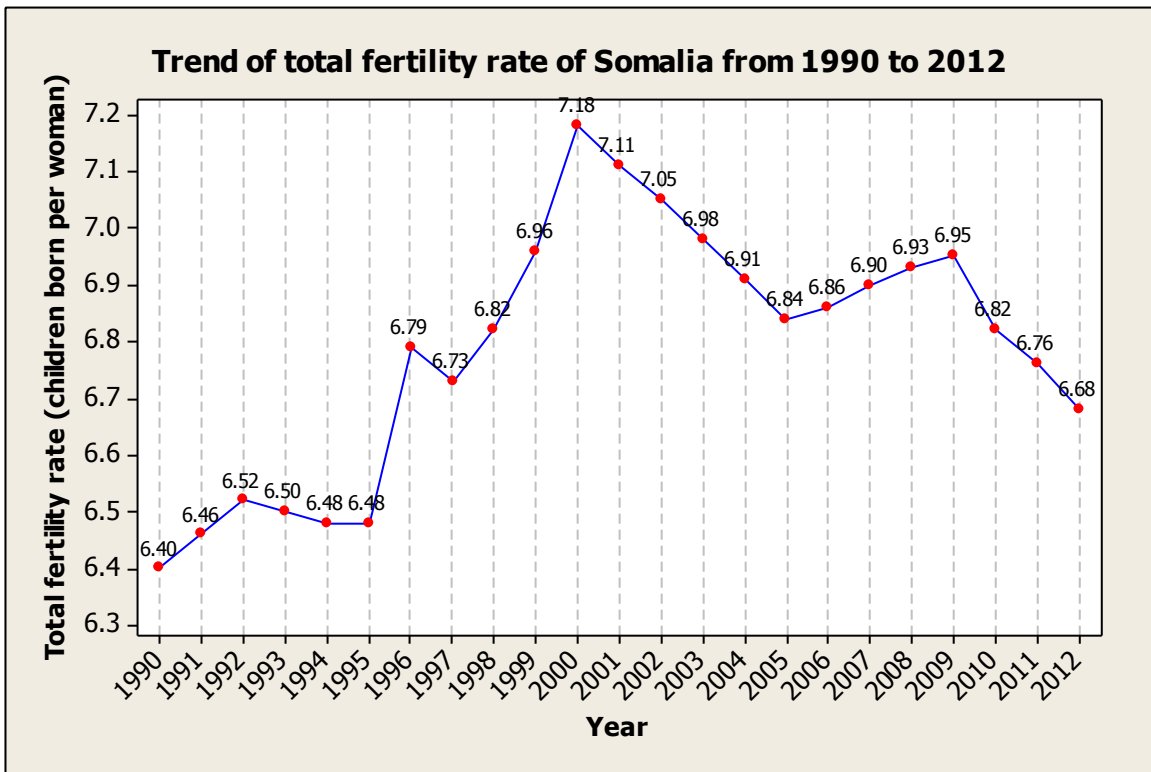


Figure 2: Trend of Total Fertility Rate of Somalia from 1990 to 2012.
Source: Results of the Analysis (2015)

Table 2: Linear Trend Model to Test the Trend.

TFR	Coef.	Std.Err.	t	P-Value
Year	0.018795	0.00589	3.19	0.004
_cons	-30.8203	11.78512	-2.62	0.016

Source: Results of the Analysis (2015)

The fluctuations shown by the graph can be explained that there were some humanitarian agencies that helped the people as there were regular programs to raise community awareness.

Results in Table 3 showed output which is the regression of HIV prevalence rate over time and the trend model is given in Equation (10):

$$HIVPR_t = -26.286 + 0.014t \quad (10)$$

This model (equation 10) is showing that HIV prevalence rate is changing with the time with a rate of 0.014 and therefore there is an increasing trend of HIV prevalence rate as time increases with one year.

The P-value of 0.000 which is very small from all conventional levels is illustrating that the trend is significantly different from zero.

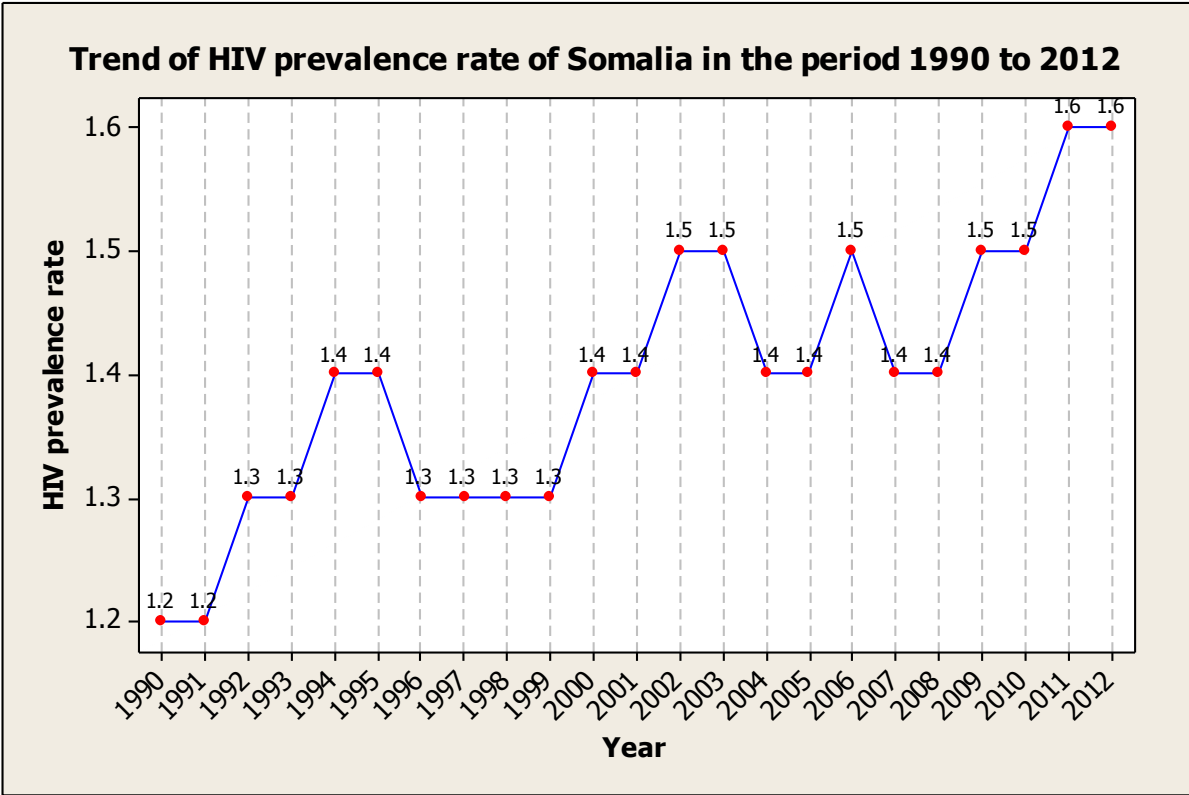


Figure 3: Percentage of Adults Living with HIV/AIDS.
Source: Results of the Analysis (2015)

Table 3: Linear Trend Model to Test the Trend.

hivpr	Coef.	Std.Err.	t	P-Value
Year	0.013834	0.00189	7.32	0.000
_cons	-26.2862	3.78129	-6.95	0.000

Figure 4 depicts a general increase in maternal mortality ratio during the period under study. There are rise and fall in the graph as maternal mortality ratio increased very extensively from 1990 to 1992 where maternal death increased in those two years by 73/100,000 live births. This sudden rise can be explained that in 1991 was the fall of the government of Somalia followed by civil wars, destruction of social service infrastructure such as hospitals, schools, universities among others, massive displacement, and famine in 1992-1993. As a result, mother death was very high since the mothers cannot get skilled workers

during the birth or even if they get they could not pay the money that skilled worker demands.

From Figure 4, although Somalia's public healthcare system was largely destroyed during the ensuing civil war, the maternal mortality ratio decreased from 1993 to 1999 because informal providers have partially filled the vacuum and replaced former government monopoly over healthcare, with access to facilities witnessing a significant increase. Many new healthcare centers, clinics, hospitals and pharmacies have in the process been established through home-grown Somali initiatives. During these years many private schools and universities have been established consequently literacy rate has increased. During this period gross domestic product of the country has increased as private business increased.

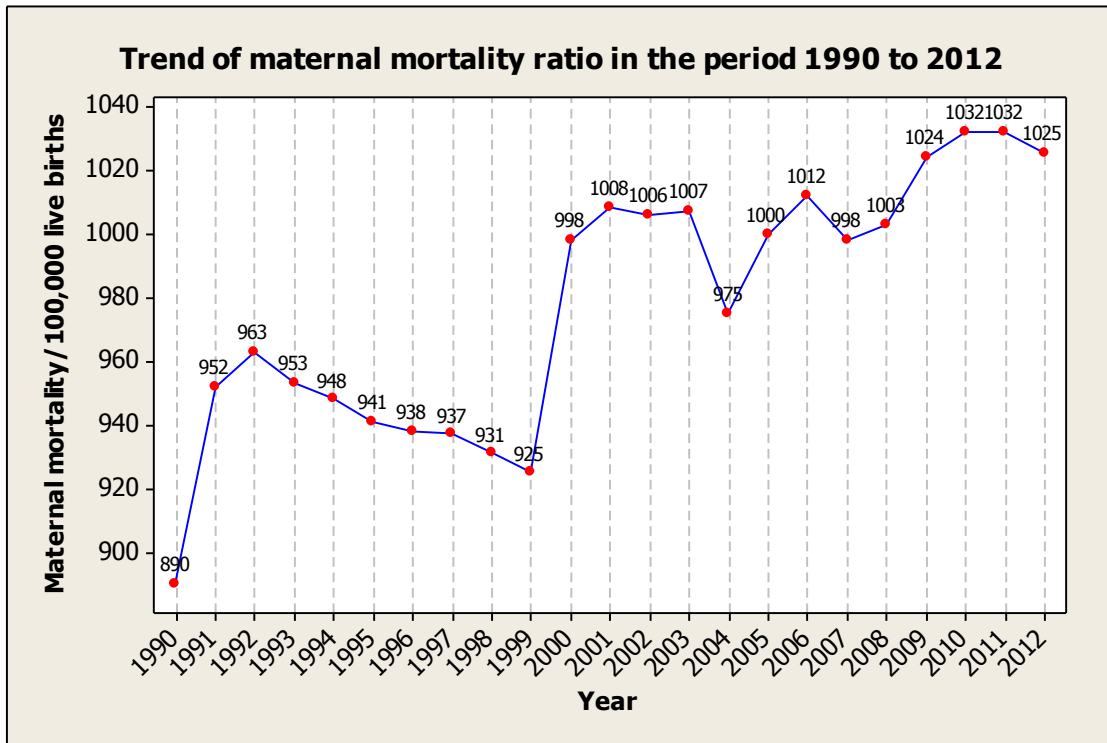


Figure 4: Trend of maternal Mortality Ratio of Somalia 1990-2012.

Table 4: Linear Trend Model to Test the Trend.

MMR	Coef.	Std.Err.	t	P-Value
Year	5.066206	0.672763	7.53	0
_cons	-9159.3	1346.206	-6.8	0

Unfortunately, the maternal mortality ratio again increased from 1999 up to the last year of the study period although there was slight drop downs in some years such as 2004 and 2007. This increase of maternal mortality ratio can be illustrated that many parts of the country such as the capital city, Mogadishu experienced again instability as warlords divided the civilians into clan based parts. Although the period of warlords ended in 2006, the war has got new phase as Islamist groups emerged and started fighting with the successive interim governments and that war is still going on.

Because of that long term instability, the production of the country, health care and education sectors were very low. In addition to the above mentioned problems, during this period the insurgent groups seized most of the country and

expelled humanitarian agencies which were helping the disadvantaged people. As a consequent of these accumulated troubles maternal mortality ratio reached in one of the highest measures in the world.

In conclusion, there is general increase in the maternal mortality ratio of Somalia from 1990 to 2012 and the worst years were 2010 and 2011 which can be explained by the droughts and fierce fighting during those years.

$$MMR_t = 0.916 + 5.066t \quad (11)$$

From the model it can be seen that maternal mortality increases 5.066 units as time increases one year. Considering the significance that rate of change which is the trend of maternal mortality ratio with time, it seems that the coefficient is significantly different from zero as P-value of 0.000 is less than all significant levels been used in this study i.e. 0.01, 0.05, and 0.10 and it can be concluded regardless of the fluctuations that there is increasing trend of maternal mortality in the period under study.

Table 5: Pearson Correlation Coefficient.

		MMR	Sig.	Decision
GDPPC	Pearson Correlation Coefficient (r)	-0.372	0.083	Significant
TFR	Pearson Correlation Coefficient (r)	0.548	0.007	Significant
HIVPR	Pearson Correlation Coefficient (r)	0.860	0.000	Significant

Results in Table 5 revealed that the individual relationship of the explanatory variables with maternal mortality ratio. Starting with GDP per capita, Pearson correlation coefficient $r = -0.372$. The negative sign shows reverse relationship between GDP per capita and maternal mortality ratio which means, maternal mortality increases as GDP per capita decreases and vice versa. As the p-value (Sig=0.083) is less than 0.10 it means that the relationship between GDP per capita and Maternal mortality is significant at 10%. The total fertility rate and HIV prevalence rate are significantly, positively related to maternal mortality at 99% as $r = 0.548$ and 0.860 with sig. of 0.007 and 0.000, respectively, which are less than 0.01.

DISCUSSION OF FINDINGS

Starting with GDP per capita, the trend of GDP per capita of Somalia in the study period was not predictable and there were fluctuations from time to time. In 1991 and 1992 there were sharp decline, followed by steady increase of GDP per capita from 1993 to 1998. From 1999 to 2005, the GDP has fallen down again although it was fluctuating. The next three years the GDP per capita has risen as it reached its maximum point in 2008. The following four years from 2009 to 2012 the GDP per capita has once more declined. Glancing to the trend of the total fertility rate of Somalia in the period under study of approximately two decades, there were two equal and opposite trends. In the first decade (from 1990 up to 2000) an increasing trend with number of fluctuations has been exhibited while in the last decade (from 2001 to 2012) in spite of some fluctuations, the trend was declining. Although the trend of total fertility rate was decreasing in the last decade, its level is still high and Somalia remains as one of the highest countries in the world in terms of fertility rate as it is averaging to 6.79 children per women with very small standard deviation of 0.22.

Coming to HIV/AIDs prevalence rate, there was generally rising trend of HIV/AIDs prevalence rate in Somalia in study period of the two decades with more rise and fall from year to year.

There was an increasing trend in maternal mortality ratio of Somalia in the period covered by the study under consideration with number of fluctuations.

The relationship of each independent variable on maternal mortality was calculated using Pearson correlation coefficient and also through regression analysis. Pearson correlation coefficients between GDP per capita, total fertility rate, HIV prevalence rate with maternal mortality were found $r = -0.372$, 0.548 and 0.860 with P-values of 0.083, 0.007 and 0.000, respectively. This showed that the three explanatory variables have significant relationship with maternal mortality ratio at conventional levels of significance. The GDP per capita is reversely related to maternal mortality ratio while total fertility rate and HIV prevalence rate are directly related to maternal mortality ratio. The strong influence of the explanatory variables is also shown by the regression analysis where overall influence of the independent variables is found coefficient of determination of R^2 with 81% which implies that the selected explanatory variables are explaining the dependent variable with higher percentage.

The findings of this study are in agreement with other researchers' results among them Williamson (1999) conducted a study on the effect of women's economic status on their mortality in less developed countries the findings of that research revealed that women's status, as measured by indicators such as level of education relative to men, age at first marriage, and reproductive autonomy, is a strong predictor of maternal mortality. John found that the better mother's economic status the better her survivorship. This is in line with this research in that economic status of the mother affects reversely her mortality.

The underlying research is in line with the work of Nancy *et al.* (2012) as they conducted a study on the health issues of women and children in Pennsylvania USA. The findings that their study showed include that maternal mortality is much higher in developing than in developed countries and that maternal mortality is a function of a number of factors, including the greater risk inherent in pregnancy and delivery owing to lack of adequate medical care, the greater prevalence of infectious diseases, which are cofactors in some deaths; and the higher incidence of pregnancy. Provision of family planning services has been proposed as one way to reduce maternal mortality. The findings of this research revealed that economic status of the mother, greater prevalence of infectious diseases and higher fertility rate are factors affecting the maternal mortality and that is exactly what this study found.

CONCLUSION

It was concluded that GDP per capita experienced instability and there were no significant trend that can be stated as it showed numerous fluctuations in the period under study. Total fertility rate showed two equal and opposite trends as it was increasing in the first decade while it was decreasing in the last decade but in general it was increasing.

HIV/AIDS prevalence rate also showed general increase in the trend in the study period of 23 years. On maternal mortality ratio, the analysis showed an increasing trend of the maternal deaths with number of fluctuations. On the relationship between GDP per capital, total fertility rate and HIV/AIDS prevalence rate as independent variables and maternal mortality ratio, the study found out that there is significant relationship between them. GDP per capita, total fertility rate and HIV/AIDS prevalence rate are significantly influencing the maternal mortality ratio of Somalia. The findings also revealed the validity of demographic transition theory in that as the result of the poverty and higher fertility rate, the maternal mortality ratio is high.

RECOMMENDATIONS

Based on these findings, the following recommendations were made:

- i. The Central Government of Somalia should take steps to elevate the incomes of the population such that its people among them vulnerable groups such as pregnant women could able to access health facilities in order to reduce maternal mortality ratio. One of the ways that the incomes of the people can be increased is micro financing to the women, youth and other poor people in the community.
- ii. There should be national policies towards fertility rate to educate women and to offer them employment opportunities. TFRs tend to be low when women have access to education and paid employment outside the home. Family planning policies should also be introduced which in turn will decrease fertility rate. Since total fertility rate is directly related to maternal mortality ratio, the reduction of total fertility rate will bring decrease in maternal mortality ratio.
- iii. There is a need to minimize HIV/AIDS prevalence rate which in turn contributes the reduction of maternal mortality ratio. Community awareness campaign to be taken to warn people the ways that HIV/AIDS spreads. In this campaign the community can be mobilized in order to avoid the causes of HIV/AIDS and by reducing it will result in minimization of maternal mortality ratio.

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SUGGESTED CITATION

Nafiu, L.A., A.A. Aau'ud, and R.N. Adiukwu. 2016. "Determinants of Maternal Morality in Somalia". *Pacific Journal of Science and Technology*. 17(2):318-328.



[Pacific Journal of Science and Technology](http://www.akamaiuniversity.us/PJST.htm)