

## **The Effect of Public Health Spending on Under-five Mortality Rate in Uganda**

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### **Abstract**

Previous studies indicate that under-five mortality rates have remained stagnant and Uganda failed to meet the Millennium Development Goals target and hence unlikely to achieve Sustainable Development Goals. Although effective health reforms and programs such as the Immunization Integrated Management of Childhood Illness (IMCI), and Home Based Management of Fever (HBMF) and increasing health expenditure were undertaken since 1990s, health outcomes especially under-five mortality rates have remained poor. Uganda's under-five mortality rate has remained high that is 68 per 1000 live birth in relation to MDGs target 56 per 1000 live birth in 2014. The MDGs assessment report by United Nations Development Programme (UNDP) shows that the low level of public health expenditure is a major factor determining poor child health outcomes in Uganda. However empirical evidence on the health expenditure and its effect on under-five mortality rate have remained inconclusive. Simple Ordinary least squares (OLS) method was used to investigate the relationship between public health spending and under-five mortality rate. The results revealed that recurrent health expenditure, capital health expenditure, women literacy rate and percentage of population living in urban areas are strongly associated with under-five mortality rate. The study therefore recommends that the government should increase health spending per capita in relation to the increase in population and increase accessibility to education for the girl child.

**Key words:** Under-five mortality rate, Neonatal mortality rate, Public health expenditure, Sustainable Development Goals and Health status

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## **1 Introduction**

Globally, under-five mortality rate has decreased by 53%, from an estimated rate of 91 deaths per 1000 live births in 1990 to 43 deaths per 1000 live births in 2015. The average annual rate of reduction in under-five mortality has accelerated from 1.8% a year over the period 1990–2000 to 3.9% for 2000–2015 but remains insufficient to reach MDG 4 (WHO, 2016) and about 19 000 fewer children died every day in 2015 than in 1990.

The international community is in the process of agreeing on a new framework “the Sustainable Development Goals (SDGs)” where the target is to reduce under-five mortality to at least as low as 25 per 1000 live births. However, many countries will not meet the proposed SDG target of 25 deaths per 1000 live births by 2030 if their current trends in reducing under-five mortality continue (WHO, 2016).

While the poverty levels in Uganda have been declining over the years from 52% in 1992/93 to 19.7% in 2013, under-five mortality has remained high and stagnant around 90 per 1000 live births in 2012 (MFPED, 2013). Under five mortality rate reduced from 137 per 1,000 live births in 2007 to 90 per 1000 live birth in 2012 way above the Millennium Development Goals (MDG) target of 56 per 1000 live births in 2015 (MFPED, 2013). Effective health reforms have been implemented such as Immunization, Integrated Management of Childhood illness and Home Based Management of Fever with hope of reducing under-five mortality to MDG target.

Younger (2001), identified the vital factors that impact on child survival as, household income, availability of health services and the vaccination of children. Out of pocket payments remained the largest form of payment within Uganda’s health sector, contributing over 60%. This has fostered inequality in accessibility to health services especially by the poor people thereby reducing the chances of child survival (MoH, 2010).

Uganda’s total health expenditure increased from 280.9 billion Uganda shillings in 2008/9 to 930.5 billion Uganda shillings in 2013/14. Out of this government funding 525.25 billion Uganda shillings (88%) was recurrent budget while 300.82 billion Uganda shillings were for capital development. This increase is reflected both in per capita terms as well as percentage of GDP. Private funds from households, Private Not for Profit (PNFPs), local Non-Government Organizations (NGOs) and private firms contributed 50%, 2008/09 and 49%, 2009/10, while public funds contributed only 16%, 2008/9 and 15%, 2009/10. Households however accounted for the largest proportion of funds spent on health. Other funds came from donors, International NGOs and Global Health Initiatives making up 34%, 2008/9 and 36%, 2009/10. Funding from donors and Global Health Initiatives showed a significant increase in 2009/10 while that from international NGOs declined (MoH, 2014).

Expenditures on curative functions remain extremely high for example in FY2008/9 was 108.99 billion Uganda shillings (64%), preventive functions was 639.83 billion Uganda shillings (23%) and others was 362.98 billion Uganda shillings (13%) while in FY 2009/10 declined to 180.235 billion Uganda shillings (56%) for curative, 774.77 billion Uganda shillings (24%) for preventive and 657.83 billion Uganda shillings (20%) for others (MoH, 2010). This deviates from the strategies and targets set within the Health Sector Strategic Investment Plan (Ministry of

Health, 2010). Investing in prevention programmes and services is considered a more cost effective way of health spending as it reduces burden of disease, improves quality of life and productivity of the general population.

Data presented in table 1, indicates that there has been a slight reduction in Under-five mortality rate from 1980 to 2013 that is 206 per 1,000 live births to 90 per live births while public health expenditure has increased from 6.43 percent in 1980 to 12.19 percent in 1990, reduced in to 9.5 percent in 2012

**Table 1: Under-five Mortality, Public expenditure, MDGs and Abuja target**

<b>Year</b>	<b>1980</b>	<b>1990</b>	<b>2005</b>	<b>2014</b>	<b>2015 target</b>
Under-five mortality (per 1,000 live births)	206	177	152	68	56 (MDG)
Public health expenditure (percentage of government expenditure).	6.43	12.19	11.21	10.1	15 (Abuja)

**Source:** MDG Report, 2010; World Bank Indicators, 2013

The under-five mortality reduction is still low. This indicates that Uganda failure meet 2015 MDG target of reducing under-five mortality to 56 per 1,000 live births. Although Uganda's overall public health expenditure has been increasing, it is still below Abuja target of 15 percent. The statistics for Uganda compared to other countries, indicates that, the country was still far away to in meeting the MDG target of 2015, despite the interventions the country put in place more especially increasing per capita public health expenditure over a number of years.

The government of Uganda has continued increasing the proportion of per capita health expenditure every year as mechanism of improving the status of health sector with the hope of increasing accessibility and quality that would bring efficiency and effectiveness in the health sector service delivery. The total expenditure on health as a percentage of GDP was 8.5 percent in 2015 (World Bank, 2015). A number of strategies have been implemented such as immunization Integrated management of childhood illness (IMCI), Home based management of fever (HBMF) HSSIP I(2011-2015), with the intention of achieving MDGS targets such as reducing under-five mortality by two thirds in 2015. Despite the above Government initiatives, the under-five mortality rate has reduced at a slow rate and has remained high compared to MDGs target of reducing it by 2/3 by 2015 (56 deaths per1000 live births). For example, according to the Annual health sector performance report , financial year (2014/2015) about 69 death cases occurred among the child under five years in 2014 (MoH,2015). This raises questions on how public expenditure on health influences under-five mortality. This study therefore set out to investigate the effect of public spending on health expenditure on under-five mortality in Uganda.

## **2 Literature Review**

### **2.1 Child mortality**

**Under-five mortality:** Substantial global progress has been made in reducing child death since 1990. The number of under-five death worldwide has declined from 12.7 million in 1990 to 5.9 million in 2015. While that translates into around 16,000 fewer children dying every day in 2015 than in 1990, it still implies the deaths of about 16,000 children under age five every in 2015. (UNICEF, 2015)

Since 1990 the global under-five rate has dropped from 53 percent from 91 deaths per 1,000 live births in 1990 to 43 percent in 2015. In addition all regions except sub-Saharan Africa and Oceania have reduced the rate by 52 percent or more. The global under-five mortality rate is falling faster than at any other time during the past two decades. The global annual rate of reduction has steadily accelerated since 1990 to 1995 from 1.2 percent to 4.0 percent in 2005 to 2013. Despite these gains, progress remains insufficient to reach MDG 4, particularly in sub Saharan Africa, Central Asia and Southern Asia. (UNICEF, 2015)

Accelerating progress in child survival urgently requires greater attention to ending preventable child deaths in Sub-Sahara Africa and Southern Asia. Under-five deaths are increasing concentrated in Sub-Saharan Africa and Southern Asia, while the share in the rest of the world dropped from 32percent in 1990 to 18 percent in 2013. Though Sub-Saharan Africa has had a decline in under-five mortality rate accelerate, with the average annual rate of reduction increasing from 0.8 percent in 1990 to 1995 from 4.2 percent in 2005 to 2013, sub Saharan Africa still has the highest child mortality rate 92 deaths per 1,000 live births, which is more than 15times the average for developed regions. Only five countries have managed to reduce under-five deaths by a half these include India, Nigeria, Pakistan, Democratic Republic of Congo and China while Uganda has not yet reached despite its intervention. (UNICEF, 2015)

**Neonatal mortality;** the global neonatal mortality declined from 36 deaths per 1,000 live births in 1990 to 19 deaths per 1,000 live births in 2015. Despite decline , in neonatal mortality, the proportion of under-five deaths that occur within the first month of life has increased from 47 percent in 1990 to 58 percent in 2015, this due to fact that the declines in the neonatal mortality rate are slower than those in the mortality rate for older children . The leading causes of death among children under-five include preterm birth complications (17percent), pneumonia (15 percent), intrapartum-related complications (11 percent), and diarrhea (9 percent) and malaria (7percent), what is surprising; nearly half of under-five deaths are attributed to under nutrition. (UDHS, 2016 and UNICEF, 2015)

### **2.2 Factors that determine under-five mortality in Uganda**

**Public health expenditure:** Damian et al (2014) found out that percapita health spending has a significant effect on under-five mortality rate in Nigeria Bhalotra. (2007) found a significant effect of public health expenditure on infant mortality. (Farahari, Subramanian, & Canning, 2010),Found a significant effect on infant mortality and that public health expenditure reduces the probability of death among women, young and elderly in India. The effects of public financing of health expenditures and other factors on health outcomes were examined by Berger and Messer. (2002). They found out that mortality rates depend on the mix of health care

expenditures and the type of health insurance coverage. In particular, increases in the publicly financed share of health expenditures are associated with increases in mortality rates. These authors concluded that, as countries increase the level of their health expenditures, they may want to avoid increasing the proportion of their expenditures that are publicly financed.

Babazono. (1994), provides some evidence of a positive impact of public financing of medical care on overall mortality and morbidity rates. Using pooled cross-country time-series data, a negative relationship between health expenditure and mortality rates was found. In Europe, there is also some evidence pointing to a positive relationship between health care input and health outcomes (Forbes & McGregor, 1894).

Preker, et al. (2002), points out that majority of the 1.3 billion poor around the globe have restricted access to health services due to their inability to pay for health facilities than the rich (Gwatkin, 2000); (Wagstaff, 2000) yet public health spending matters more to the poor than to the rich (Gupta, et al.2003). Furthermore, increased public spending on health improves the availability, accessibility and affordability of health care services which reduces the chances of childhood mortality.

Shetty A, et al. 2014, found out that percapita state spending on health was the most important determinant of infant mortality rate in which country. In addition, Andrew J, et al. (2015) points that an increase in public health expenditure by 1% of state level GDP is associated with a reduction in the infant mortality by about 8 infants deaths per 1000 live birth.

Public spending on health varies significantly across the different countries. according to the (WHO, 2011), the per capita total health expenditure is US\$47, in Afghanistan having highest levels of infant mortality in the world of which government contributes only 22% , on the other hand Norway spends US \$8,019 per person on health of governments share is 79 percent , in the United States of American, the per capita health expenditure is US\$7,164; of the government share is 49 percent while Uganda spends 9.45 percent with the government share being only 20 percent. What is surprising is that the USA spends more on health than in Uganda where the under-five mortality is higher (90 death per 1000 live births) than that of USA (WHO, 2011)

### **Health expenditure (recurrent and capital) and Under-five mortality rate**

Findings of the some studies that have investigated the association between public health expenditure and under-five years' mortality are mixed. Some studies show exceedingly small effect and other show positive effect. In addition to that, the effect of public health expenditure on childhood mortality in developing countries is found to depend heavily on the social – economic situation of the country.(Kim & Moody, 1992), Found that the contribution of health resources to the infant mortality is rather small in comparison to the role of socioeconomic resources.(Musgrove, 1996) Concluded that public health expenditure simply replaces out of pocket health expenditure due to which it does not have any effect on child mortality. Similarly, (Filmer & Pritchett , 1999) found quite a small impact of public spending on health on child and infant mortality in a cross –country study of developing countries during the 1990s. The study by Gupta et al also revealed that although public spending on health improves health indicators in developing and transition countries, the relationship between public spending on health and

infant and children mortality rates are rather weak. After controlling for observed inter-state heterogeneity in India, (Deolalikar, 2004) found a weak relationship between public health expenditure and infant mortality.

On the other hand, found a negative association between public health spending and under-five mortality when he treated public health spending as an exogenous variable. The effect of public health expenditure on under-five mortality became insignificant when public health spending was treated as an endogenous variable. (Wagstaff & Claeson, 2004) in another study based on data from 127 countries, (Bokhari & Gottret, 2007) found that 10 percent increase in per capita public health expenditure led to an average reduction of 3.3 percent in under five mortality rates.

Health is a critical component of the living standards of a society. Health contributes to human capital formation. An improved human capital is better placed to participating in economic activities, improved productivity at individual levels which consequently leads to a better status. This is due to absenteeism from work, reduces disease burden which translates into low economic costs in terms of providing health services (Basta & Scrimshaw, 1979).

Filmer and Pritchett. (1999) found that public spending and health outcome are tenuously related. According to them doubling public spending from 3 to 6 percent of GDP would improve child mortality by 9 to 13 percent. Surveying the literature on the linkage between public expenditure and outcome (Princhelt & Filmer, 1996) also noted that all of the negative findings on the effect of public spending on outcomes could potentially reflect differences in the efficacy of spending which could arise from a variety of reasons including corruption and patronage. Besides, it is also noted that the adverse linkage between public spending and outcomes could be done away with by replacing of public spending by private sector environment. This argument is stressed by in (Filmer, Hammer and Pritchett, 2000) while commenting on the weak links that several studies have found between public spending on health and health status. Most of the studies which find that public spending have low or negligible impact; tend to argue that public provision could lead to a “crowding out” of private sector provision. However these studies have failed to address the efficacy of public spending.-

### **Socio- economic factors;**

**Literacy rate and under-five mortality:** Bbaale, (2012) pointed out that breastfeeding has significant association with a lower relative risks of child mortality and stunting. They stressed that child initiated to breastfeeding after a full day increase the relative risk of mortality by 1.15 and were statistically significant at 5 percent level of significance. In addition, the study, Horta et al. (2007) conducted a study for W.H.O in which the long term effects of breast feeding were documented. The study stressed that breast feeding is a protective against obesity, Diabetes and hypertension. Andrew J et al. (2015) revealed that female literacy rate is a major determinant of infant mortality rate among Indian states.

Bbaale, (2012) revealed that parents education has significant association with favorable child health outcome. Mothers with primary, secondary and posted secondary education reduce the relative risk of child mortality by 0.6, 0.3 and 0.25 respectively compared to counterparts with no education. In addition Ssewanyana et al. (2004) also asserted that mother’s education has

significant impact on infant mortality and reduction is larger for mothers with more education. Mortality rates for infants whose mothers are primary graduates are 20 per thousand lower than those whose mother did not complete primary school. For the infants of mothers who completed secondary school, mortality rates are 35 per thousand lower.

Ssewanyana and Younger. (2005) asserted that mothers' education attainment has increasingly large impact on the under-five mortality. Children whose mothers have attained secondary are 34 per 1,000 lower than those children whose mothers did not complete primary education. In addition effect of women literacy rate on under-five mortality are examined by Filmer and Pritchett. (1999) within health production function using 1960 -1992 data across 20 OECD. The study revealed that under-five mortality depends on the female literacy, found out that roughly 10 percent lower mortality per additional year of female schooling, having four more years of female education than the current average (5years) is associated with 39 percent lower under-five mortality. Mohammed &Phanindra. (1999), found out that female literacy rate have a strong effect on infant mortality rates; a 10 percent increase in literacy causes infant mortality rate to reduce by approximately 7 percent. Bbaale and Buyiza (2012) found out that that mother's education is fundamental in reducing infant and child mortality. They suggested that efforts to reduce child mortality need to target measures that aim to educate women. The government program to extend free education at the secondary level is therefore a commendable effort that needs to be strengthened and be embarrassed by all stakeholders to encourage girls to attain education beyond secondary level .this enable the government of Uganda to achieve MDGs 4 target.

**Urban population and Under-five mortality rate :** Bbaale, (2013) found out that children born in Kampala have few risks of being affected by communicable disease compared to those born in rural areas like karamoja. In addition Bbaale, et al. (2011) stressed that women living in rural areas are 21-25% less likely to be assisted by formally trained person during childbirth and to deliver in health environment compared their counterparts in urban areas. The main problem here relates to availability and accessibility of health care services such as trained medical personnel drugs and hospitals. In addition Andrew J et al. (2015) stressed that in increase in the share of urban population by 10% points would reduce the infant mortality rate by 3.5 infant death per 1000 live birth.

The quality of food a child eats affects his /her health and survival especially before his /her fifth birth day. The ability of a child to resist most bacterial infections and recover from injections is greatly affected by how much and well he /she eats. Additionally a well-nourished child tends to be healthier both during child hood and adult hood and also a well-nourished woman faces fewer risks during pregnancy and her child has better chances of surviving into adult hood, with better physical and mental development (UNICEF, 2007).Furthermore it is estimated that about half of the global child deaths are caused by malnutrition and its related consequences more especially in rural areas are common in Sub Saharan Africa.

Others have found out that the poor health is concentrated among poor households in the poorest states (Bhalotra, 2007). For example, under-five deaths in poor countries constitute 30% of the total death which is less than 1% in rich countries (Cutler & LLeras-muney, 2006). In addition,

more of the total under-five death, 10million children die due to preventable diseases which are rare in the developed world (Jonnes, Steketee, Black, & Morris, 2003). From the above literature, the conceptual framework presented in figure 1 is developed .

**Figure 1: Relationship between Public health expenditure, Social-economic factors and Under-five Mortality rate**

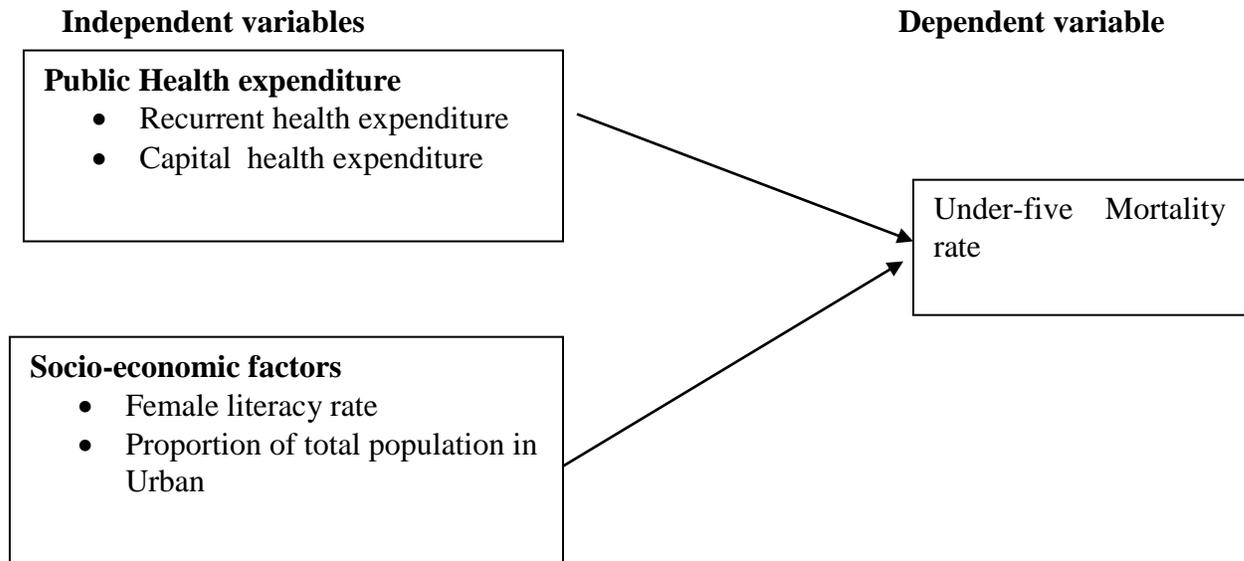


Figure one shows that the under-five mortality is influenced by both public expenditure and social economic factors. Increased health expenditure accompanied with social economic factors leads to purchases of more medical equipment especially laboratory and hospital beds , drugs , employment and training of more medical doctors , nurses, vehicles and construction of more health centers and this in turn increases accessibility and availability of health facilities. The general effect therefore is to improve child survival and hence lowering of under-five mortality.

### **3. Methodology**

#### **3.1 Data sources and coverage**

The data were drawn from various sources. The time series data on under-five mortality for Uganda was obtained from the annual reports of the sample registration system of the World Bank Indicators (2013) starting from 1980 to 2012. Data on Per capita health expenditure (recurrent and capital) for Uganda was obtained from Background to the budgets from 1980 to 2012 and annual reports from the Ministry of health and Female literacy rate and Percentage of population living in urban areas for Uganda were derived from World Bank Indicators (2013) specifically for Uganda.

### 3.2 Model specification

Theoretical model used in this study borrowed from George Compah-Keyeke, Frank Gyimah Sackey and Marcella Aziensum Azinim (2013), specified as follows:

$$Health\ Status = \left(\frac{Hi}{Ni}\right)^\alpha \times \left(\frac{NHi}{Ni}\right)^\beta \times e^{Ai} \quad (1)$$

Where;

- Health status represents Under-five mortality rate,
- $H_i$  = Public expenditure in the health sector of Uganda
- $NH_i$  = All other nonpublic sector health spending
- $N$  = Total Population
- $A$  = Specific factors, female education.

George Compah-Keyeke, Frank Gyimah Sackey and Marcella Aziensum Azinim (2013) postulated that the transformation of equation 3.1 to logarithmic form would help to achieve the following two objectives; First, to capture non linearity of model since most of studies found that the relationship between public spending and health status to be a nonlinear. Secondly, it would also allow for comparisons with earlier findings since the regression results provided elasticity which was found to be constant over time. Therefore, taking natural logarithms of equation 1 leads to;

$$\ln(HS) = \alpha_1 \ln(H_i / N_i) + \beta \ln(NH_i / N) + A_i \quad (2)$$

Where HS is the health status that represent Under-five mortality rate,  $H_i$  the public health expenditure which represent capital and recurrent health expenditure,  $NH$  represent other -non public expenditure and  $N$  the total population.  $A_i$  represents other specific factors such as female education, urban population, etc.

#### Model specification:

Following the above theoretical model, the empirical model of the study takes the following form:

$$\ln(UMR_t) = \alpha_0 + \alpha_1 \ln(RHE_t) + \alpha_2 \ln(CHE_t) + \alpha_3 \ln(FLR_t) + \alpha_4 \ln(UR_t) + \varepsilon_t \quad (3)$$

Where;

$UMR$ = Under-five mortality rates;  $RHE$  = recurrent health expenditure;  $CHE$ = Capital health expenditure;  $FLR$ = Female Literacy rate;  $UR$ = Proportion of total population that lives in urban areas. Natural logarithms of the variables are taken before being used in model to allow easy comparison with earlier findings and for capturing non-linearity of the model.

### **3.3 Variable description and measurement**

The variables used and their measurements are given in table 2. Under-five mortality is important measure of population health as this facilitates comparison of population health at a point of time and also progress over the period of time. Moreover, cost effectiveness of the data collection makes under- five mortality one of precise measure of population health. Sensitive measures of population health like disability adjusted life expectancy(DALE) are strongly correlated with under-five mortality thus implying that the determinants of under-five mortality are strongly related to factors like economic development , standard of living , social well affect the health of the entire population (Reidpath & Allotey, 2003)..

The recurrent and capital health expenditure incurred by the central government of Uganda. This variable affects the child hood mortality through the determinants of health like socio-economic and demographic status. Female literacy rate is the percentage of female enrollment in secondary school. This variable was considered because it is one of the behavioral factors that influence child health very much (Filmer and Pritchett, 1999). The level of urbanization is represented by the percentage of population living in urban areas by virtue of development and availability of both public and private health care services being better in urban areas (Filmer & Pritchett , 1999).

**Table 2: Showing variable, definition, measurement**

<b>Variable</b>	<b>Definition</b>	<b>Measurement</b>
Under-five mortality rate	Number of child who die before their fifth birth day.	Per 1000, live births
Recurrent health expenditure	Percentage of recurrent expenditure incurred by the government on health in a given financial year.	Local currency (Uganda Shilling)
Capital health expenditure	Percentage of capital expenditure incurred by the government on health in a given financial year	Local currency (Uganda shillings)
Female literacy rate	Percentage of literate female	Education attainment
Urban population	Percent of total population that lives in urban areas	Education attainment

### **3.4 Estimation procedure**

Data was processed and analyzed using STATA. Since the data used was time series, preliminary tests were carried out to establish normality, and stationarity of the series. Augmented Dickey-Fully (ADF) and Philip-Perron (PP) tests for stationarity were employed to test for unit root, Engle-Granger 2 step Algorithm while Graphical analysis was employed in order to explore the trend behavior of the study variables. Using the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) tests for stationary, unit root tests were carried out for each variable and the results are shown in tables 3a, b and c

**Table 3a: Unit root test for under-five mortality, recurrent health expenditure, capital health expenditure, urban population and female in enrollment in levels.**

Test	ADF			PP		
	Coefficient	P-Value	Order	Coefficient	P-Value	Order
Variable						
Under-five mortality (Per1000 live births)	-0.099	0.9931	I(2)	0.759	0.969	1(2)
Recurrent health expenditure (Percentage of government expenditure)	-2.674	0.2472	1(1)	-2.79	0.2008	1(1)
Capital health expenditure (Percentage of public health expenditure)	-2.807	0.1944	1(1)	-2.807	0.1944	I(1)
Ln Urban population (millions)	-4.42***	0.002	1(0)	-4.445***	0.0019	1(0)
Proportion of female enrollment in secondary.	-1.645	0.07742	1(1)	-1.955	0.626	1(1)

\*\*\*P<0.01,\*\*P<0.05,\*P>0.05

**Table 3b: Unit root test for under-five mortality, recurrent health expenditure, capital health expenditure at first difference.**

Test	ADF			PP		
	Coefficient	P-Value	Order	Coefficient	P-Value	Order
Variable						
Under-five mortality (Per1000 live births)	-1.488	0.8333	1(2)	-2.171	0.506	1(2)
Recurrent health expenditure (Percentage of government expenditure)	-2.674***	0.0000	1(1)	-6.519***	0.0000	1(1)
Capital health expenditure (Percentage of public health expenditure)	-6.541***	0.0000	1(1)	-6.563***	0.0000	1(1)

\*\*\*P<0.01,\*\*P<0.05,\*P>0.05

**Table 3c: Unit root test for under-five mortality at second difference.**

Test	ADF			PP		
	Coefficient	P-Value	Order	Coefficient	P-Value	Order
Variable						
Under-five mortality (Per1000 live births)	-3.214*	0.0817	1(2)	-3.3*	0.0663	1(2)

\*\*\*P<0.01,\*\*P<0.05,\*P>0.05

The results of the unit root test presented in tables 3a, b and c indicate that urban population was stationary in levels; recurrent health expenditure, capita health expenditure and female literacy rate were stationary at first difference while under five mortality rate was stationary at second difference.

### **Normality test**

**Table 4: Normality test**

Variable	Pr(Skewness)	Pr(Kurtosis)
UMR	0.2310	0.7118
RHE	0.1770	0.2124
CHE	0.1450	0.3156
FLR	0.1400	0.9066
UR	0.9700	0.5470

*Source: Author's Computations*

Since p-values for both kurtosis and skewness in table 4 are higher than 0.1 all the study variable are normally distributed therefore we fail to reject the null hypothesis that the study variables are normally distributed.

### **Unit root tests**

Results of Dickey-fuller and Phillips-Perron tests, showed that Urban population and capital health expenditure variables are integrated of order zero  $I(0)$ , recurrent health expenditure and female secondary attainment variables are integrated of order one  $I(1)$  while Under-five mortality variable is integrated of order two  $I(2)$ .

### **Cointegration test**

In order to ascertain whether the variables were cointegrated, the following test was performed using ADF and PP, Breusch – Pagan test for heteroskedasticity and Ramsey Test as indicated in the paragraph that follows

### **Unit root tests for residuals**

Using Engle-Grange 2 step Algorithm method, results indicated that ADF and PP test statistics are statistically significant at a 5 percent level of significance implying that the residuals are stationary in levels which indicates co-integration. This proves that the regression results are not spurious, indicating that there is a long run relationship between under-five mortality and its determinants. In addition the test for heteroskedasticity using Breusch – Pagan test for heteroskedasticity showed that the error term had a constant variance ( $\chi^2(1) = 0.15$ ,  $\text{prob} > \chi^2 = 0.6994$ ) implying that heteroscedasticity is not a problem.

### **Ramsey test**

The results of Ramsey test presented in table 5 shows the probability of F- statistics of 0.9698, which leads to the acceptance of the null hypothesis of the model at 5% level of significant

**Table 5: Ramsey RESET test using powers of the fitted values of LD2.UMR**

Ho: model has no omitted variables	
F(3, 21)	0.08
Prob > F	0.9698

#### 4. Presentation and discussion of results

**Table 6: Summary statistics**

Variable	Mean	Std. Dev.	Min	Max
Under-five Mortality (per 1000 live births)	50.079	42.770	68.900	211.9
Recurrent health expenditure (Percentage of government expenditure)	5.262	2.227	1.829	9.645
Capital health expenditure (Percentage of government expenditure)	3.357	2.157	0.190	8.339
Female literacy rate ( Percentage of female enrollment in secondary schools)	16.195	8.771	5.474	36.732
Urban Population (Percentage of total population).	2.833	1.399	0.946	5.815

Table 6 indicates that the average recurrent health expenditure during the period of analysis was 5.3 percent with maximum 9.7percentof total health expenditure. The average capital health expenditure 3.4percentwith a maximum of 8.3 percent the average percentage of female enrollment in secondary school was 16.2 percent while the maximum was 36.7 percent of female who enroll in secondary education, the mean of the under-five mortality is 50.079 while the maximum was 211(variable is measured per 1000 live births). Mean of urban population was 2.8 percent of total population with maximum of 5.8 percent total population. The disparity of the child under-five mortality (per 1000 live birth) is 42.770, recurrent health expenditure is 2.227 percent, capital health expenditure is 2.157 percent, urban population is 1.399 percent and female literacy rate is 8.771 percent. Basing on the above results, it indicates that majority of female don't join secondary school as compared to male since the maximum enrollment of female is 36.7 percent. Therefore this calls for further attention from the government to increase the proportion of female enrollment.

**Table 7: Correlation matrix between variables**

Variable	Under-five Mortality	Recurrent health expenditure	Capital health expenditure	Urban Population	Female enrollment in secondary school.
Under-five mortality (per 100 live births)	1.0000				
Recurrent health expenditure (percentage of government expenditure)	-0.3705	1.0000			
Capital health expenditure (percentage of government expenditure)	-0.2284	-0.3704	1.0000		
Female literacy rate (percentage of female enrollment in secondary school)	-0.7637	0.3478	0.1372	1.0000	
Urban population (Percentage of total population )	-0.7535	0.3753	0.2297	0.7126	1.0000

Table 7 indicates that the variables are correlated with under-five mortality meaning that there is some degree of association between the independent variables and under-five mortality. The number of people living in urban areas and percentage of female enrollment in secondary school are strongly negatively correlated with under-five mortality rate while recurrent health expenditure and capital expenditure are moderately negatively correlated with under five mortality rate. The results indicate that almost all the values of the correlation coefficients between explanatory variables and the dependent variable. However some independent variables are correlated leading to the problem of multi-co linearity which affects the coefficients to be estimated using simple OLS. This problem was solved by generating the error correction model and testing for co integration. When the correlation Matrix for the study variables was taken in differences, all the independent variables were correlated with the dependent variable but all the independent variables were not correlated with one another while in differences.

### **Regression results**

Having carried out diagnostic test above, the ordinary least squares regression was fitted to the data at 1<sup>st</sup> difference to establish the effect of Public health spending on under-five mortality rate and the results are indicated in the table 8.

**Table 8: Regression Results**

<b>Under-five mortality</b>	<b>Coefficient</b>
RHE ( %age of government expenditure)	-0.0047 (0.1580)
CHE <sub>-1</sub> (% age of government expenditure)	-0.0118*** (0.0010)
FLR (% age of female enrollment in secondary )	-0.0266*** (0.0000)
UR (%age of urban population )	-0.0422*** (0.0000)
_cons	5.9555 (0.0000)

R-squared = 0.9869  
 Adjusted R-squared = 0.9850  
 Durbin-Watson d-statistic( 5, 32) = 1.254  
 F(4,27) 714.64  
 Prob>F 0.000  
 \*\*\*P<0.01,\*\*P<0.05.\*P>0.05

The results given in table 8 gives details of the nature on the relationship that exists between the under-five mortality and the various explanatory variables. Statistically, the significance of a time series analysis is better if the P-value (that is prob>2 or prob>F) is less than 0.0500. However since Durbin Watson statistics was slightly below the expected value, the residuals were subjected to a unit root test and the residuals were found to be stationary in levels as shown in table 9 which indicates that the results were not spurious.

**Table 9: Unit root test for regression residuals in levels.**

<b>ADF</b>			<b>PP</b>		
Test	P-value	Order	Coefficient	P-value	Order
Coefficient					
	0.0367	I(0)	-3.430	0.0474	I(0)

Recurrent health expenditure, capital health expenditure, percentage of female enrollment in secondary and people living in urban areas are significant.

The fitted regression is;  $UMR=5.9555-0.0047RHE-0.0118CHE-0.02661FLR-0.0422UR$ .

Table 8 indicates that, Adjusted R-squared = 0.9850 implying that about 99 percent of the total variations in under- five mortality is explained by independent variables (Recurrent health expenditure, Capital health expenditure), female literacy rate and Urban Population). Capital health expenditure per capita was significant with a P-value of 0.001 and its coefficient indicates that there exists a negative relationship between the variable and under-five mortality. Capital health expenditure was an important variable on health status in reducing under-five mortality. A

unit increase in capital health expenditure on average will reduce under-five mortality by 0.0118 points holding other factors constant.

The number of people living in urban areas was statistically significant with a P- value of 0.0000 and negative coefficient indicates that there exists a negative relationship between the variable and under-five mortality. Urban population was an important variable in determining under-five mortality especially in reducing under-five mortality. A unit increase in urban population on average reduces under-five mortality by 0.0422 points holding other factors constant.

The percentage female enrollment in secondary was statistically significant with a P- value of 0.000 and negative coefficient indicates that there exists a negative relationship between the variable and under-five mortality. Female enrollment was an important variable in determining under-five mortality especially in reducing under-five mortality. Increasing the enrollment of female education on average will reduce under-five mortality by 0.0266 points holding other factors constant. The negative sign indicate that children of educated mothers are having less chances of being exposed to health risk diseases.

### **Error Correction Model (ECM)**

After carrying out Johansen test of cointegration, the residuals were significant at 5% level of significance and behavior of the residual rotated around zero This indicated that short run model leads to the long run equilibrium mode and this enabled all the dependent variables to be significant and the overall model was good since the P-value for the F-statistics was 0.0039. Estimation of the error correction model was done and the regression estimates are presented in table 10

**Table 10: Error Correction Model (ECM)**

	ECM	ROBUST ECM
DD UMR	Coefficient	Coefficient
RHE-1 (% age of government expenditure)	-0.0012** (0.0380)	-0.0012** (0.0400)
CHE-1 (% age of government expenditure)	-0.0019*** (0.0010)	-0.0019*** (0.0050)
D Female literacy rate(Education attainment)	-0.0018* (0.069)	-0.0018* (0.0720)
Urban population ( % age of total population )	0.0021*** (0.0010)	0.0021*** (0.0020)
ECM-1	-0.0802** (0.0220)	-0.0802** (0.0090)
Constant	-0.0133182 0.039	-0.0133 0.0530
R-Squared	0.4950	0.4950
Adjusted R –squared	0.3950	
Durbin Watson	1.2450	1.0560
Prob>F	0.0039	
Breusch pagan	chi2(1) =0.45(prob >chi2=0.5301	prob >chi2 =0.503

p-value in parentheses \*\*\*p<0.01,  
\*\*p<0.05,\*<0.1

D and DD represent the first level and second level of difference respectively while -1 indicates a lag of a variable. The coefficient of the lagged recurrent health expenditure and capital health expenditure are negative and significant at 5 and 1 percent level of significance respectively, the coefficient of female literacy rate is negative and significant at 10 percent, the coefficient, the coefficient of urban population is positive and significant at 1 percent while coefficient of the lagged residual is negative and significant at 5 percent level of significance.

This gives the rate at which adjustment is done towards the long run equilibrium model. The coefficient of error correction term gives the speed of adjustment of each variable towards its long run equilibrium value, whereas the sign of the coefficient gives the direction of adjustment towards equilibrium. The higher the coefficient of lagged error term, the faster the speed of adjustment towards equilibrium in the long run. From the table 8, the coefficient of the error

correction term is negative and significant at 5, percent level of significance implying that the variables adjust towards long run equilibrium.

The fitted long run regression is as follows.

$$DDUMR_{-1} = -0.0133 - 0.0012REH_{-1} - 0.0019CHE_{-1} - 0.0018DFLR + 0.0021UR - 0.0802Lec + \varepsilon_t$$

Where  $\varepsilon_t$  is the error term which captures other variables that are not captured by the Error Correction Model. Thus, the recurrent health expenditure, capital health expenditure, female literacy rate and urban population are significant variables with p-values of 0.0380, 0.0010, 0.069 and 0.0010. This confirmed that recurrent effect on under-five mortality can be realized in the long run period.

### **Discussion of the findings**

The findings of the study revealed association between under-five mortality and health expenditure per capita (current and capital health expenditure) in Uganda. These results are consistent with Ramesh and Sam (2007), who emphasized that increasing spending on health employment and personnel will definitely increase access to health care and help in improving life expectancy and reducing child mortality. Issa and Ouattara(2005) also found that Health Expenditure Per capita is more effective in reducing Under-five mortality in developing than developed countries. However the results are inconsistent with Filmer and Pritchett (1999), who argued that adding health expenditure on the model adds little explanatory power. This was due to the fact that, changes in child health status are affected by changes in consumption of various health care services some of which may be less effective in improving health services.

In addition to above, the reasons why the increase in public health spending is not accompanied by equal reduction in under-five mortality is because public spending favors the better-off rather than the poor (Wagstaff, 2002). Thus public financed curative health care services in Uganda are more likely to serve the richer segments of the population than the poor. This explains why under-five mortality is lower in urban areas where majority of people are rich as compared to urban slums which are dominated by poor people.

The coefficient on female literacy rate has a negative sign and significant at 10 percent level of significance meaning that a unit increase in female literacy especially in secondary will on average reduce under-five mortality by 0.0018 units holding other factors constant. This is in line with Filmer and Pritchett (1999), Ssewanyana and Younger (2005), Bbaale and Buyiza (2012). That implied that the more educated mothers increase the chances of child survival. The major attribute to this is that educated women normally visit hospitals when pregnant, they take children for immunization and they normally provide right diet to their children hence reducing the chances of being affected by diseases such as malaria and kwashiorkor. This indicates that for an increase of health services to be accompanied by equal reduction in under-five mortality rate, the supply of health services must be accompanied by the demand for services. This demand for health services depends on the knowledge and awareness among the general masses. Therefore this calls for greater focus on promoting health education among mothers.

Urban population significantly affects under-five mortality rate. An increase in urban population reduces under-five mortality rate. When urban population increases by a unit, on average under-five mortality rate reduces by 0.12 units holding other factors constant. This is due to the fact that better health facilities and services like hospitals, vaccination of children and qualified physician to handle children complications, short distance to medical centers with better roads are available in urban areas as compared to rural areas. This enhances accessibility and efficiency in health services which in turn increases chances of child survival. This is consistent with Kaushalendra, Faujdar, & Singh (2013), who explained that there was high chances for child survival in urban areas due to availability of health services, trained health personnel from both private and public health facilities as compared to rural areas where there are no drugs in the hospital, inadequate health facilities and medical personnel which in turn affects child survival negatively. In addition, this finding is consistent with Bbaale et al (2011) who indicated that location and regional differences have a significant effect on child survival in Uganda. They stressed that Women living in rural areas are 21–25% less likely to be assisted by a formally trained person during childbirth and to deliver in a health institution compared to their counterparts in urban areas. This could be attributed to problems related to availability and accessibility of healthcare services in rural areas. The key policy recommendation is that the Government should increase its health expenditure to relevant health services in rural areas.

## **5. Summary, conclusion and policy recommendations**

### **Summary**

This study set out to determine the effect of public health spending on under-five mortality. The main objective was to examine the effect of public health expenditure measured by per capita health expenditure on under-five mortality, and the specific objectives were; to examine the relationship between recurrent health expenditure and under-five mortality and to establish the relationship between Capital health expenditure and under-five mortality. A time series regression analysis was run using data obtained from World Bank indicators covering a period from 1980 to 2012.

Recurrent health expenditure and Capital health expenditure had a strong relationship with under-five mortality rate. Increased public health expenditure and effectiveness in allocation would help to reduce under-five mortality rate in Uganda. Female enrollment in secondary school was significant and increased accessibility to girl child education would reduce under-five mortality. Also urban population was significant. This meant that increasing the number of people living in urban areas would reduce under-five mortality rate.

### **Conclusion**

The findings clearly suggest that just increasing public spending alone is not going to improve health status of children in Uganda but must be accompanied by other factors like female education. There is urgent need to ensure efficiency and effectiveness in the public spending on health. It could be concluded that despite the relationship between under-five mortality and many other possible determinants, the most important factor relevant to under-five mortality in Uganda is urban population and female literacy rate. This implies that that reduction in under-five mortality is associated with increasing female enrollment in secondary schools and urbanization.

### **Policy recommendations**

The key policy implication that can be drawn from this study is that government of Uganda should increase proportion of funds allocated to the health sector. This will enable health sector to widen its expenditure on both recurrent and capital expenditure there by enabling them to stock the hospitals with drugs and other medical equipment , train and recruit more doctors to cater for children. In addition the government of Uganda should increase female enrollment in secondary. This can be done through massive sensitization, giving scholarship and gender mainstreaming in higher education institutions. Finally the government of Uganda should extend more health services in rural areas. This would ensure even distribution of resources which would in turn help to reduce under-five rate.

### **Suggested area for further study**

This study mainly focused on the public health expenditure and under-five mortality rate, considering female enrollment in secondary school and urban population. Therefore there is a need for further study to explore the effect of private health expenditure on under-five mortality rate.

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