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**The Effects of Health Care Expenditure on Health Outcomes in West Africa:
Analysis of Selected 14 Countries from 2000 to 2018**

Kilanko Oluwaseun

Eastern Illinois University

2019

Thesis Committee

Dr. Mukti Upadhyay (Advisor)

Dr. Ali Moshtagh

Dr. Linda Ghent

Abstract

This study has examined the impact of health expenditure on health outcomes in the selected West African countries. The health outcomes used in this study are infant mortality, under-five mortality, and maternal mortality rates. A panel data set for 14 countries for the period 2000–2018 was used. Aside from examining the role of total health expenditure on the health outcomes, we examine whether public and private healthcare expenditure could have dissimilar health outcomes. This research used panel data estimation method. Panel data has some advantages over the cross sectional analysis and time series analysis in the sense that it controls for the effect of omitted variables, takes into consideration the international differences and provides more accurate inference of model parameters via more degrees of freedom and more sample variability. A one percentage point increase in health expenditure will reduce infant mortality by 2.4 percent, under-five mortality by 3.9 percent and maternal mortality by 4.9 percent. These are economically significant effects too and indicate decent contribution of health resources toward building human capital in these economics. Human capital expansion presumably affects economic growth positively in the developing countries of West Africa, making it worthwhile to increase health expenditure in the region.

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CHAPTER ONE

INTRODUCTION

Over the years, economic theory has identified human capital as an important impulse to economic growth in all facets of life. Before the introduction of human capital theory, growth theory only considered physical capital as the most important input into the output produced. But after the introduction of human capital theory in the 1960s, health and education of the labor force were recognized as essential inputs in production. For human capital to spur growth, healthy time is required for both market and non-market activities. Health care financing becomes vital in producing healthy time or sustaining human capital. To achieve development, a fair amount is expected to be spent on the health care sector of the economy. Health care financing that will be discussed in this work will be the total expenditure as well as the components, government and private expenditure. Effects of health care financing can be measured in terms of the health outcomes such as infant mortality, under-five mortality, maternal mortality and life expectancy. Population health is affected by many factors such as social and economic conditions.

A country is said to have effective health system if the health status and outcomes of the citizen is better than that of a similar country with similar health care resources. Rates of infant, under-five, and maternal mortality are important health outcomes on which lies the focus of this research. Infant mortality rate measures how many infants (less than one year of age) die per 1000 live births in a given year. Infant mortality consists of neonatal and post-neonatal mortality rate. The neonatal mortality rate indicates deaths that occur in the first four weeks of life and this is usually caused by problems during pregnancy such as congenital abnormalities, low birth weight and also problems during delivery such

as birth injuries and asphyxia and after delivery such as measles and other infections. Post-neonatal mortality rate is related to maternal and obstetric factors such as poverty, inadequate health care, infectious diseases and injuries (UNICEF, 2011).

Under five mortality rate is the chance that a child will die between birth and exactly five years of age per 1000 live births. The major causes of this death is diarrhea, malaria, tetanus, pneumonia and other infections. Most of these illnesses are caused by poverty, civil conflict and malnutrition and these are common in Western Africa, which is part of the sub-Saharan Africa.

Maternal mortality rate is the expectation that a female will die because of childbirth. This is measured as the number of female deaths per 100000 live births from any cause related to pregnancy and its management. Death from pregnancy is not less than half a million per year and these deaths occur mostly in developing nations (WHO, 2004) and this is more a result of a lack of access to emergency care, inadequate health care and family planning procedure. According to UNICEF (2009) the causes of maternal mortality can be direct or indirect. Direct causes can be obstetric complications such as postpartum hemorrhage, eclampsia and complications of abortion. Iodine deficiency during pregnancy, anemia, malaria and even HIV/AIDS are the causes of indirect death in mothers. The underlying causes includes inadequate maternal care, lack of knowledge and information, malnutrition and dirty environment.

Infant, under-five, and maternal mortality rate is a very big issue especially in developing countries and this has attracted the attention of various stakeholders and researchers. This is because there is a belief that unhealthy infants and children grow up to become sickly adults who form the labor force of the economy and a weak labor will definitely create a vicious cycle of low productivity, weak economic growth and development and this will in turn worsen population health status. The burden of mortality and morbidity among the poor is widely regarded as one of the public health concerns in the

world today and has become a major issue in the international community and this was reflected in the millennium development goals and now in the sustainable development goals of the 2030 Agenda for sustainable development.

Mostly, UNICEF and World Bank have incorporated child mortality reduction into their future programs. According to UNICEF, about 29,000 children under the age of five die every day, which means an average of 21 per minute, mainly from preventable causes. These deaths occur mostly in developing countries like Nigeria. Some of these deaths are from preventable causes such as malaria, tetanus, or measles. The importance of health economics cannot be over-emphasized and this is because health in childhood is one of the key predictors of productivity in later life.

Health outcomes in developed countries have been improving along with health expenditure. According to (OECD, 2012) the infant mortality rate has dropped more than tenfold and the life expectancy have increased over fifty years by about ten years. Over the same period, the health expenditure share of the gross domestic product rose from 3 percent to about 10 percent.

1.1 Statement of the problem

UNICEF (2011) shows 11 million infants under the age of one die each year and 90% of such death occurs in developing countries including many in West Africa, the focus of this study. Although under-5 mortality has been declining, yet at the end of the last decade these deaths were still as high as seven million. (UNICEF 2012). Infant and under-five mortality is often caused by diseases such as malaria, pneumonia as well as other infections. These diseases are mostly influenced by poverty, malnutrition and war. A majority of maternal mortality rate, the number of female deaths per 100000 live births, occurs in the developing economies as well, caused primarily by inadequate health care and family planning (WHO, 2004).

Most studies on health care expenditure and health outcomes have been on developed economies. For developing countries, research on this topic based on sound data has been few and far between. Paucity of data on developing countries has been one of the main reasons. This study focuses on health expenditure by both public and private sectors and relates it to mortality outcomes in selected 14 West African countries. Infants and children that are unhealthy grow into sickly adults and this in turn creates a vicious cycle of low productivity, weak economic development and poor standards of living. On the maternal side, women who die during childbirth leave a trail of unhappy life and poverty for the rest of the families.

How strong is the relationship of total and component health expenditures with health outcomes in West African countries? Is private spending more effective in reducing mortality than public spending on health? By addressing these questions, this research can generate some useful policy implications for developing countries in general and the sample West African countries in particular.

Development of a relevant model for analyzing the health sector outcomes is critical. This research critically reviews the literature to formulate an appropriate model which will explore our key questions by including a set of control variables to make our estimates as unbiased and consistent as possible.

1.2 Objective of the study

The objective of the study is to analyze the impact of health care expenditure on health outcomes in selected West Africa countries using panel regression analysis. We will also disaggregate the expenditure into public and private and see how these expenditures affect the health outcomes using annual data from 2000 to 2018.

1.3 Hypothesis of the Study

The general hypothesis of the study is that health expenditure has significant impact on the health outcomes. For testing purpose, the following null and alternate hypotheses are stated

Hypothesis 1:

H_0 : Total expenditure is positively related to the reduction of infant, under-five, and maternal mortality rates

H_1 : Total expenditure has impact in reducing infant, under-five, and maternal mortality rates

Hypothesis 2:

H_0 : Government expenditure has much more of an impact on mortality reduction than the impact of expenditure by the private sector.

H_1 : Government expenditure has a significantly less of an impact on mortality reduction than an equal expenditure by the private sector.

1.4 Organization of Study

This study spans five chapters. After this introductory chapter, Chapter two presents literature review which is followed by Chapter three for a conceptual framework based on theories and empirical reviews of previous studies relevant to this study. Data presentation and econometric analysis, estimation and interpretation of results will be presented in Chapter four. The last chapter summarizes the findings in brief and offers conclusions and policy recommendations

CHAPTER TWO

LITERATURE REVIEW

2.1 Empirical Studies

The rich are more likely to have access to good health care without support from the government. The poor are significantly less healthy. Spending on health care is therefore important for health outcomes of the poor who cannot easily afford access to health care unless heavily subsidized. Hence poor households are more likely to benefit from a government provided health care than from out-of-pocket private facilities (Gwatkin, 2000). It is the public health care financing in developing countries that can bridge the gap between the health status of the poor and the rich.

There have been many studies on the topic of health care financing and health outcomes that tend to reveal how health financing minimizes the poor-rich differences in health outcomes. The empirical evidence on this topic is mixed, some study supports the fact that health expenditure reduces mortality rate and increases life expectancy, while others reveal a positive relationship of expenditure with mortalities. Some studies find mixed results.

Gani (2008) discusses the relationship between per capita public health expenditure and three measures of health outcomes. The study uses cross-country data from seven Pacific Island countries between 1990 and 2002. The fixed-effects estimation procedure was adopted for the study to control for the country-specific factors. Gani (2008) finds government health care finance affects infant mortality rate more than under-five mortality. The outcome is consistent with the government budgetary allocation to health care in the Pacific Island countries, which are largely targeted for

primary health care services such as immunization, control of diarrhea, nutritional training for mothers and some antenatal care.

Dhrifi (2018) investigated the effects of health expenditure on child mortality rates using a simultaneous-equation model for 93 developed and developing countries with data spanning from 1995 to 2013. He analyzes the relationship for developed and developing economies by comparing low, lower middle, upper-middle and high-income countries. The study employed the three-stage least squares (3SLS) technique to be able to solve the endogeneity problems by introducing instrumental variables. Results show that the explanatory variables differ according to the sample considered. Government health spending has a positive and very significant effect in reducing mortality rates for upper-middle and high-income countries but for low and lower-middle income countries, government health expenditure is not statistically significant. Higher health expenditure was found in the developed economies and low health spending in less developed economies. The insignificant spending in the less developed countries according to this study may indicate resources not being allocated effectively towards health care spending. The study also shows that in less developed countries, public expenditure on health has a greater effect on mortality rates than private health expenditure, while in developed countries private expenditure has a positive impact on child health status.

Rahman et al. (2018) investigate the relationship between different types of health care expenditure (total, public and private) and the three main health care outcomes (life expectancy at birth, crude death rate and infant mortality rate) in the region of South Asian Association for Regional Cooperation (SAARC) and the Association for South East Asian Nations (ASEAN). Using the World Bank data set for 15 countries over the period of 1995 to 2014, a panel data analysis was conducted. Based on the findings, the total health expenditure has a significant effect in reducing infant mortality rate in the region. The separate effects of the private and public health care expenditure were examined

and as expected, they were both negative and significant which implies that both types of health care expenditure are necessary for improving the overall health in these countries. Private health care expenditure significantly reduced the crude death rate in the region, while public health spending showed the opposite result. This may be due to the improper utilization of public sector funds. The study did not find any significant effect of healthcare on life expectancy.

Cre'mieux et al.'s (1999) study examines the relationship between health care spending and health outcomes in Canada. Canadians' social, environment and consumption conditions were considered as part of the control variables. Despite very small differences in per capita health care spending and health outcomes across provinces, a strong relationship exists. It was deduced from the model that lower the health care spending in Canada, the lower the life expectancies and higher infant mortality rates. A 10% reduction in health care expenditure is associated with infant mortality rates going higher by 0.5% among males and 0.4% among females, and life expectancies lower by 6 months for men and 3 months for women. Even though differences in health care expenditure levels across Canadian provinces are not that much, health care expenditure remain the main determinant of health outcomes. Furthermore, supply side variables, such as health care spending or the number of available physicians, are also highly significant determinants of health outcomes even after controlling for socio-economic factors.

Novignon et al. (2012) study Sub-Saharan Africa to understand the impact of health care expenditure on health status. Health status is measured by life expectancy at birth, crude death rate and infant mortality rate. The results show that health care expenditure was associated with increase in life expectancy and reduction in infant mortality rates. Even though both private and public sources of health care expenditure were significantly associated with improved health outcomes, public health care expenditure had relatively larger impact. The study suggests a greater need for regional

governments to increase allocation of resources to health care service delivery. Effective public-private partnerships in developing the health sector could improve health status of the population in general.

Raeesi et al (2018) provided econometric evidence of a link between health expenditures and three health outcomes (infant mortality, under 5 mortality and life expectancy) within four different health care systems. Panel data were collected and grouped for 25 countries according to the health care system over a period of 15 years (2000-2015). The countries included in the study based on their different health care systems. The study classified the health systems into 4 different categories such as National Health Insurance System, Traditional Sickness Insurance, National Health Services, mixed systems. Multivariate regression model was used to investigate the effects of studied variables on health. The results showed that among various explanatory variables, health expenditure (public and private) had important effect on health outcomes. Based on the classification of countries with different health care systems, increase in the health expenditure also has a significant impact on improving health outcomes. The study concluded that, based on the different impacts of private and public health expenditure on health outcomes in each health care system, public sector should be more responsible in countries with National Health Service. In countries with mixed system, however, the private sector should be more responsible for the health care of the country.

Using panel data, Anyanwu and Erhijakpor (2009) find support for the argument that total and government expenditure on health matter for health outcomes. The study examined the relationship between total as well as government health expenditure on health outcomes (infant mortality and U5MR) using data from 47 African countries between the period of 1990 to 2004. Based on the results, the public health spending as well as the total expenditure on health are crucial to health outcomes

because health expenditure have a statistically significant effect on infant mortality and under-five mortality.

Nixon and Usman (2006) examine the relationship between health care expenditure and health outcomes in countries of the EU over the period 1980-1995, using life expectancy (female and male) and infant mortality as the dependent variables. Econometric analyses were conducted on a panel data set for the former 15 members of the European Union over the period. The results from the study reveal that increasing health expenditure are notably associated with large improvements in infant mortality but only marginally associated to life expectancy. It was noted that females have gained marginally more than males. This study went ahead to see the relationship in health expenditure and health outcomes between developed and developing countries and came out with the fact that there is a positive marginal effect of health expenditure on the examined health outcomes for developed countries, but more so for infant mortality than life expectancy. This was consistent with diminishing returns in the area of health care in developed nations. On the contrary, small health care spending in developing countries and even intermediate nations, have certainly bigger impact.

Syeda et al. (2013) investigate the linkage between health care expenditures (HCE), economic growth and health outcomes (i.e., life expectancy (LE), infant mortality and the share of elderly people) on South Asian Association for Regional Cooperation (SAARC) countries over the period of 1995–2010. Panel co-integration technique is used for analysis of short and long run relationship between the health care expenditures and health outcomes. The results show that there is a long-run relationship between health expenditures, economic growth and health outcomes in SAARC region. Life expectancy and share of elderly people in population have a negative relationship related to health care expenditures. This implies that health care expenditures are not necessity but rather luxury goods in SAARC countries. On the other hand, there exists no significant relationship between infant mortality

and health expenditures. According to Syeda et al. (2013), SAARC countries import 80% of all medical devices and equipment, 30% public hospitals cater to 80% of the population, public hospital buildings are poorly maintained, and are equipped with poorly functioning and outdated equipment. World's largest populated countries, more pollution, poor life style and so on lead the SAARC nations on declined pathway and unachieved goals are still dreamt by nation. This means that health care expenditures donnot translate to reduction in infant mortality. In the same vein, health care expenditures have not helped to improve the growth of these nations in the SAARC region. The study then suggested that there is a need for sufficient rationalizing of the budget allocation practices in health sector. Provision of incentives to work in remote locations should be a priority and such reforms and strategies should be planned and implemented so as to be able to achieve the desired result of improving the health status of the SAARC countries, and particularly Nepalese people through more equitable and efficient resource allocation. In the era of globalization and modern technological world, this region needs to meet and compete for international health standards by improving poor health system infrastructure to maintenance level, poverty conversion to equality, and malnutrition to balance diet.

Tae and Shannon (2013) also empirically examined the relationship between public health expenditure and national health outcomes but they did so for developed countries. Data was collected from 17 OECD countries between 1973 and 2000. Two health outcome indicators were used for the study, namely: infant mortality rate and life expectancy at birth. To analyze cross-country panel data, a mixed-effect model was used. Based on the results, there exists statistically significant association between government health expenditure and public health outcomes. Particularly, the findings showed that a negative relationship exists between government health expenditure and infant mortality rate, and a positive relationship between government health expenditure and life expectancy at birth. This

result implies that a higher level of public health expenditure significantly decreases infant mortality and increases life expectancy, controlling for other socio-economic conditions in the given countries. The results also reveal that public health expenditure is a very strong predictor for health outcomes. This study suggested that there should be increased government spending on medical goods and services in order to provide better overall good health for individuals.

Bhalotra (2007)'s research is on India for 28 years, 1970-1998. The study examined the relationship between state health expenditure and infant mortality. His main contribution was to exploit sub-national panel data on health care expenditure to identify how it affected infant mortality. Based on the result, the author finds that the state health expenditure saves no lives but upon allowing lagged effects, controlling for trended unobservable and restricting the sample to rural households, a significant effect of health expenditure on infant mortality emerged. This study concluded that there are striking differences in the impact of state health expenditure by social group.

Novignon and Lawanson (2017) sought to understand the relationship between the child health outcomes and health spending. The study employed panel data from 45 sub-Saharan African countries over the period 1995 -2011. Aside from the fact that the paper studied the relationship between the two main variables, the study went ahead and investigated the lagged effect of health care spending. This study also carried out a disaggregated analysis of the health spending into private and public spending in relation to the child health outcomes, which are infant mortality, under-five and neonatal mortality. The results of the study indicate that health expenditure had significant and positive influence on child health outcomes in Sub-Saharan African nations with elasticities of -0.11 for infant mortality, -0.15 under-five mortality and -0.08 neonatal mortality. From the analysis, there also exists a positive and significant lagged effect of health expenditure on child health. On the disaggregated level, public health expenditure was found to be more significant than private expenditure.

Farag et al. (2013) studied relationships for 1995, 2000, 2005, and 2006 in a panel data setting to examine the relationship between country health expenditure, selected health outcomes which are infant mortality and under-five mortality and government effectiveness. Government effectiveness was included in the analysis to investigate if good governance improves the effectiveness of government health spending. This paper collected data from 133 low and middle-income countries for ensuring a large sample size. A fixed effects model was employed to control for time-invariant country-specific unobservable determinants of health outcomes. The results from the study indicated that income matters, but that health care spending is also an important determinant of health outcomes. The paper observed clearly that there exist beneficial effects of macro-level health spending on health outcomes if the right policies and institutions accompany it.

Eric et al. (2017) investigates the relationship between healthcare expenditures and health outcomes (i.e. infant mortality, under-5 mortality and life expectancy) from 1995 to 2014 in Ghana. Ghana's healthcare expenditure has been on the increase for the past two decades. Increasing healthcare expenditures is expected to enhance the acquisition of better hospital resources that will improve healthcare. From the results, infant and under-5 mortalities declined by 50 and 25%, respectively, as of 2014, while life expectancy increased from 60.7 to 64.8 years. Out-of-pocket payments on health care decline but are higher than the World Health Organization's recommended financial threshold. While government's expenditure on healthcare have yielded positive results, the improvement in the health outcomes is not attributable to the increasing health expenditure alone. This paper explains the policies on maternal health, national health insurance and healthcare reforms that have influenced health outcomes. The study also highlights the challenges of healthcare system in Ghana of which the major ones are inadequate financial investments in health, and limited health workforce and facilities. This work recommended that there is the need to establish new health

institutions and expand existing ones, government should provide incentives to health workers, the concept of predictive, preventive and personalized medicine (PPPM) for treating NCDs should be introduced, and lastly, alternative insurance schemes should be designed for vulnerable groups. Finally, there must be willingness of the government to curb misappropriation of funds, to achieve better health outcomes.

Akinci et al (2014) examine the impact of health care expenditures on health outcomes on 19 countries in the Middle East and North Africa (MENA) region. Panel data collected between the periods 1990-2010 was used to estimate impact of the independent variable on the dependent variable. The health expenditure was disaggregated into both public and private spending and the health outcomes into three categories namely infant, under-five and maternal mortality rates. According to the results, the average infant mortality rate declined from 42.2 deaths per 1000 live births in 1990-1995 to 24.7 in 2006-2010. Child mortality rate in the region has been reduced from 54.4 deaths per 1000 live births in 1990-1995 to 30.2 deaths per 1000 live birth, while in this period the average maternal mortality rate declined from 134.6 deaths per 100000 births to 71.1. Concisely, after controlling for confounding factors, both government and private spending on health care significantly improve infant, under-five, and maternal mortality in the MENA region.

Rad et al. (2013) compare the effect of public and private expenditure on health status in Eastern Mediterranean Countries. The health status indicator that is used in this study is infant mortality rate. The health expenditure was divided into public and private in order to ascertain the relationship that exists between the types of expenditure and health status. The data used for this study was between 1995 and 2010. Public health expenditures contain social security spending, taxing to private and public sectors, and foreign resources like loans and subventions. On the other hand, private health expenditures contain out of pocket expenditures and private insurances. The model was

estimated using the random effects and the results showed that public health expenditure had a strong negative relationship with infant mortality rate. However, surprisingly a positive relationship was found between the private health expenditures and infant mortality rate (IMR). The relationship for public health expenditures was significant, but for private health expenditures, it was not. Each of these has different effects on the health status. The study findings showed that the public health expenditures in the EMR countries impacts health outcome positively, while the private health expenditures did not have any significant relationship with health status, so often increasing the public health expenditures leads to reduce IMR. However, this relationship was not significant because of contradictory effects for poor and wealthy peoples.

Yaqub et al (2012) examines how governance in Nigeria affects the effectiveness of public health expenditure. They investigate the impact of public health spending on infant and under-5 mortalities as well as life expectancy. Data on public health expenditure and governance variable captured by the corruption perception index were regressed on infant mortality, under-five mortality and life expectancy, using the ordinary least squares and the two-stage least squares. According to this paper, public policy is expected to promote good health in the economy, so that broad based economic growth can be achieved and the more reason why many countries devote huge budgetary allocation to health, but in most developing countries especially, this huge health expenditure failed to translate into better health status. The result obtained from the study show that public health expenditure has a negative effect on infant mortality and under-5 mortalities when the governance indicators are included. This means that to achieve the Millennium development goal of lowering infant mortality by two-thirds by 2015, reducing under-5 mortality rate and raising life expectancy in Nigeria were projected to be unattainable if the level of corruption was not reduced considerably. As the level of corruption goes down and value of the corruption perception index rises, health status

improves drastically, and there is a decline in infant and under-5 mortalities and life expectancy rises. This implies that for public expenditure on health to lead to improvement in health status, the issue of corruption must be addressed.

The health outcomes in this work are all centered on mortality rate (infant, under-five and maternal) in West Africa. Compared with developed countries, life expectancy is lower and mortality rates are higher in developing countries. Many deaths result from infectious diseases such as malaria, but also from measles, tuberculosis, polio, and diphtheria. Although its incidence has been falling, women also die due to complications arising from HIV/AIDS. Most of these diseases are not self-manifestation in nature but are the result of the other risk factors such as risk of unsafe sex, unsafe drinking water, malnutrition and even exposure to indoor smoke.

West Africa has struggled to raise the low quality of its health care delivery in both public and private sectors. Among a host of reasons for such an outcome is a lack of adequate medical personnel, especially in the rural areas (Chaundhury, Hammer, Kremer, Muralidharan, and Rogers, 2006). Medical personnel in this region often leave their nations in search of greener pasture. Most of the countries that are unable to provide public health care to their citizenry are often not able to regulate private sector's quack practices, which often contribute to higher child and maternal mortality as well. The literature reviewed above does not conclusively show a clear relationship between healthcare expenditures and health outcomes.

CHAPTER THREE

METHODOLOGY AND DATA

This study will employ dataset from World Development Indicator Databank. This provides the necessary data required for this study. However, this study will make do with the selected countries in West Africa based on availability of data. In examining the relationship; and controlling for variables such as poverty (captured by consumption expenditure), health care expenditure which under the total analysis will be health expenditure as a percentage of gross domestic product and under the disaggregated analysis into public health expenditure per capita and private health expenditure per capita, malaria, urbanization and foreign aid against the dependent variables, which are infant mortality, under five mortality and maternal mortality rate.

3.1 THE MODEL AND DATA

The econometric approach that will be used in this study will be panel data regression in equations for infant, under-five and maternal mortality rates. The specification is related to existing literature and it allows for ways through which health expenditure can affect the chosen health outcomes in the selected 14 West African countries.

Thus, dependent variables used in the model are

Infant mortality (death between birth and age 1 per 1000 live births)

Under-five mortality (probability of death by age 5 per 1000 live births)

Maternal mortality (per 100000 live births)

Independent and control variables used are:

Health expenditure as a percentage of gross domestic product

Per capita public health expenditure for disaggregated analysis

Per capita private health expenditure for disaggregated analysis

Poverty proxy by per capita household consumption

Gross domestic product

Malaria (incidence of malaria)

Urbanization (as a percentage of the total population)

Foreign Aid (net official development aid) per capita

3.2 Model specification

$$Y_{it} = f(H_{it}, W_{it})$$

Where Y_{it} is the health outcomes (infant mortality, or under 5 mortality or maternal mortality rate),

H_{it} is total health expenditure and

W_{it} is a vector of social-economic control variables.

In a reduced form, the Specification above can be rewritten as

$$Y_{it} = \alpha + \beta_1 \ln(\text{ConsGdp}_{it}) + \beta_2 \ln(\text{heg}_{it}) + \beta_3 \ln(\text{gdp}_{it}) + \beta_4 \ln(\text{mal}_{it}) + \beta_5 \ln(\text{urbanpop}_{it}) + \beta_6 \ln(\text{odacap}_{it}).$$

Where Y_{it} Health outcomes (infant mortality or maternal mortality rate)

ConsGdp_{it} = per capital household consumption expenditure is used to proxy poverty level

Heg_{it} = health expenditure as a percentage of gross domestic product and per capital for the disaggregated analysis

GDP_{it} = GDP per capita in US dollars

$Urbanpop_{it}$ = urban population as a measure of urbanization

Mal_{it} = incidence of malaria

$Odacap_{it}$ = foreign Aids

The a priori expectation of the study based on literature reviewed is that most of the coefficients ($\beta_1, \beta_2, \beta_3, \beta_5, \beta_6$) should be negative while β_4 (the effect of malaria) should be positive.

Health expenditure, both total and disaggregated (public and private), is an inflow of fund into health and this is expected to have a negative effect on infant mortality, under 5 mortality, and maternal mortality rates. This means that an increase in the health expenditure is expected to broaden the access to health care and services, which helps to decrease these mortality rates. Increasing health expenditure should improve the health status of the population and foster economic growth and development.

Demographic factors, such as urban population, can help in understanding any difference in health situation across sectors. Based on previous studies, mortality rate is higher among rural, low-income households than among the urban households. This is because of, among other reasons, the access to better health facilities in the metropolitan areas or cities. Private cost of health such as transportation may also be lower for urban households because of proximity. So based on facts, it is expected that urbanization will have a negative relationship with the health outcomes in this study.

The per capita income is a proxy for socio economic status in general. Gupta et al. (1999) concluded in their study that as per capita income rises, population health status improves and this implies that increase in income have a high tendency to reduce infant and maternal mortality rates. The impact of income on health works through many indirect channels because higher income also leads to better nutrition, and the ability to pay for health care and services, better education and better sanitation.

Incidence of malaria is one of the major sicknesses that are peculiar to African nations. This sickness is capable of killing if not treated and monitored properly. This is expected to increase the rate of mortality both in infants and in women.

3.3 Estimation techniques

Literature shows different estimation techniques and methods that have been used to analyze the relationship between healthcare expenditure and health outcomes. Examples are cross-sectional analysis, autoregressive distributed lag model, and panel data technique. This research will be using panel data estimation method. Panel data has some advantages over the cross sectional analysis and time series analysis in the sense that it controls for the effect of omitted variables, takes into consideration the international differences and provides more accurate inference of model parameters via more degrees of freedom and more sample variability.

CHAPTER FOUR

DATA ANALYSIS AND INTREPRETATIONS

4.1 Descriptive Statistics

This section presents descriptive statistics of the various variables used in the model. The data covers a sample of 14 West African countries ranging from 2000 to 2018. The table 1 below presents some relevant statistics. The average infant mortality rate (deaths per 1000 live births) for these countries is about 70.1 with a standard deviation of about 24.5. Over the period, Cape Verde recorded the lowest infant mortality rate of 15 in 2017, with Sierra Leone recording the highest value of 142 in 2000. Under five mortality rates averaged 113 with a standard deviation of 454 over the period. The lowest value is 17.4, recorded by Cape Verde in 2017, while the highest value of 233.1 was recorded by Sierra Leone in 2000. Maternal mortality rate also averaged 680.9 with a standard deviation of 423 Cape Verde again records the lowest Value of 42 in 2015 while the highest value of 2650 again recorded by Sierra Leone in 2000. Household consumption expenditure per capita also averaged 741.5 with a standard deviation of 475.1. Sierra Leone again recorded the lowest value of 208.1 in 2000 and the highest value of 2450.1 was recorded again by Cape Verde. Health expenditure as a percentage of GDP averaged about 5.47% over the period with a standard deviation of 2.5. The lowest value of 2.143% recorded by Nigeria in 2002. The highest value of 20.415 % is recorded by Sierra Leone in 2015. Health expenditure is further decomposed into public and private health expenditure. The data used is in per capita. Government health expenditure relatively lower average value of 14.15, compared to 24.071 for private expenditure. Malaria prevalence averaged 294.3 per 1000 of the population at risk with a standard deviation of 155.6. The highest value of 607.1 was recorded by Burkina Faso in 2000 and the lowest value of 0.01 was for Cape Verde in 2012. Sierra Leone's performance was generally the worst by most measures of health care mainly because of the politically unstable environment.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
imr	252	70.125	24..539	15	142
u5m	252	112.959	44.823	17.4	233.1
mmr	224	680.959	427.8714	42	2650
ConsGdp	218	741.461	475.082	208.206	2450.089
HlthExGr	238	5.4703	2.524	2.143	20.415
Gdpcap	252	929.416	762.633	139.315	3670.429
Malaria	126	294.284	155.548	0.01	607.11
Uubanpop	252	40.007	11.005	16.186	65.261
GovHEXCap	238	14.146	21.322	1.175	108.946
PvtHEXCap	238	24.071	15.084	3.471	79.832
Odacap	252	78.982	94.079	1.337	650.857

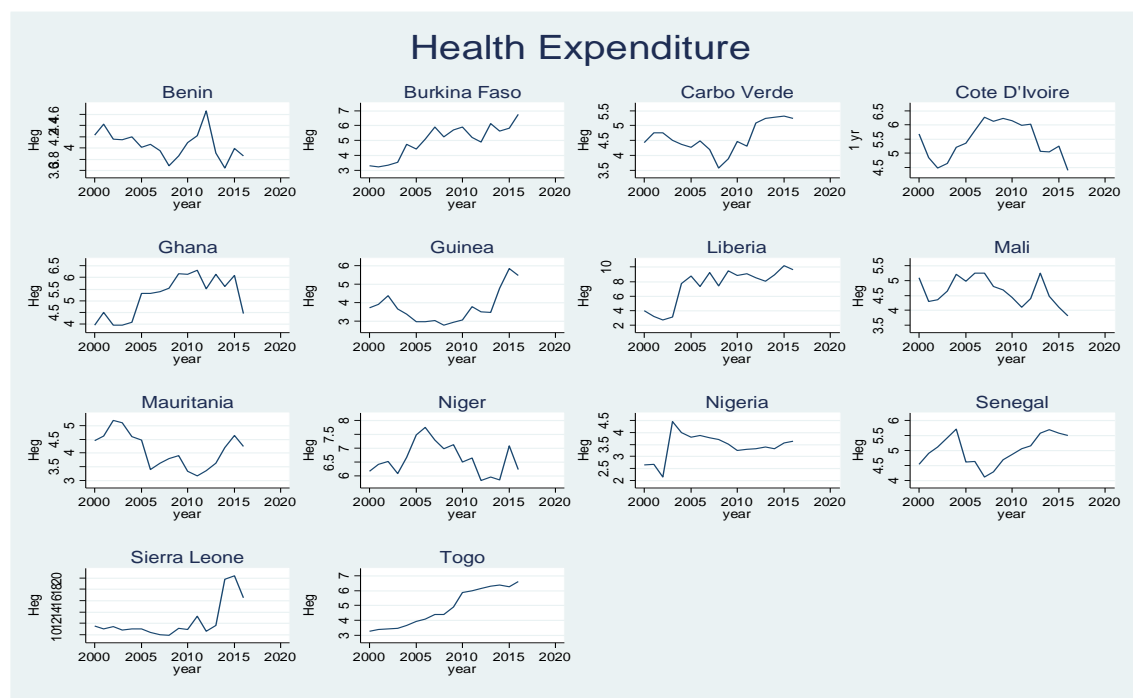
Net development assistance received per capita also averaged \$78.98 with a standard deviation of 94.08. This shows a larger dispersion in ODA to sub Saharan Africa. Cape Verde records the highest ODA per capita of \$650.857 in 2010. The lowest value of \$1.337 is recorded by Nigeria in 2001.

4.2 Trends in Health Expenditure

The graph in Figure 1 shows the trends in health expenditure growth for all the countries in the sample. All countries show fluctuating growth in health expenditure over the period. Countries such as Burkina Faso, Liberia, Guinea and Togo have experienced generally upward trends. Benin Cote D'Ivoire, Mali, Ghana and others have experienced a general decline in health expenditure after 2002.

These trends show an unstable health expenditure pattern. This instability could have implications on health outcomes in the region. This may also have a spillover on the growth and development of the nations.

Figure 1: Health Expenditure Growth in West Africa



4.3 Trends in Health Outcomes

The graphs Figure 2 to Figure 4 below show the trends in the various health outcomes used in this study. Infant mortality rate and under five mortality rates have experienced similarly downward trends in all the countries over the period. The graphs for the two mortality rates look similar because of the high correlation between these two variables. The improvements in health conditions reflect the recent surge in health interventions in the region. Compared to global estimates, however, West Africa still falls short, with most countries still having maternal mortality, under five mortality and infant mortality rates higher than world threshold levels.

Figure 2: Trend of Infant Mortality in West Africa

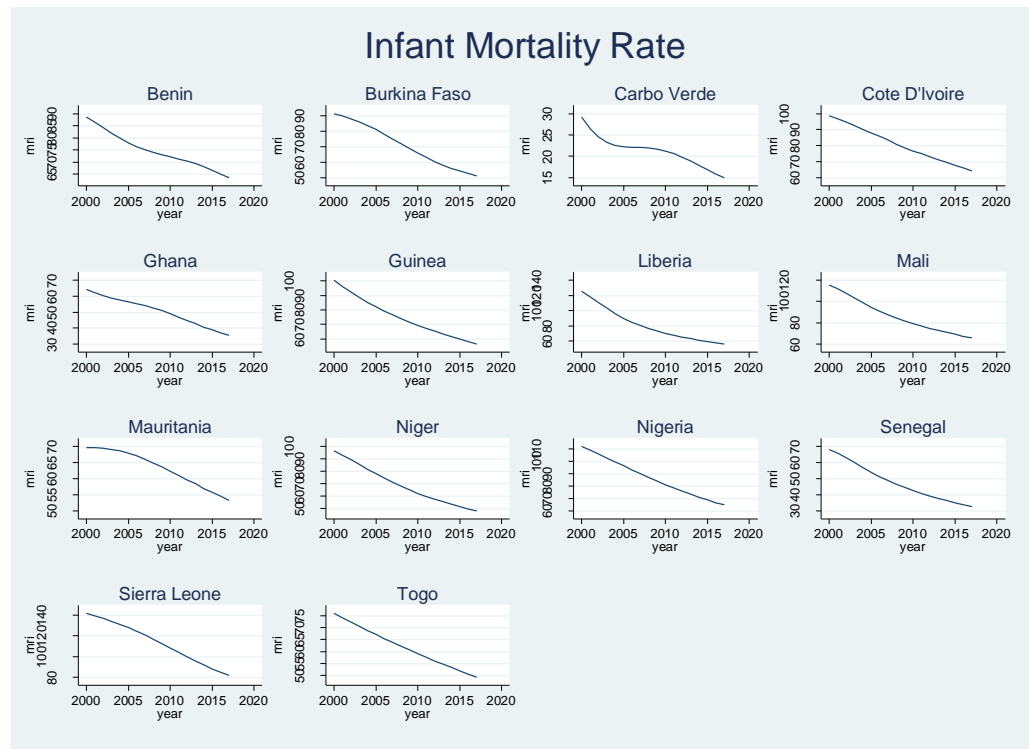


Figure 3: Trend of Under - five Mortality Rate in West Africa

Under Five Mortality Rate

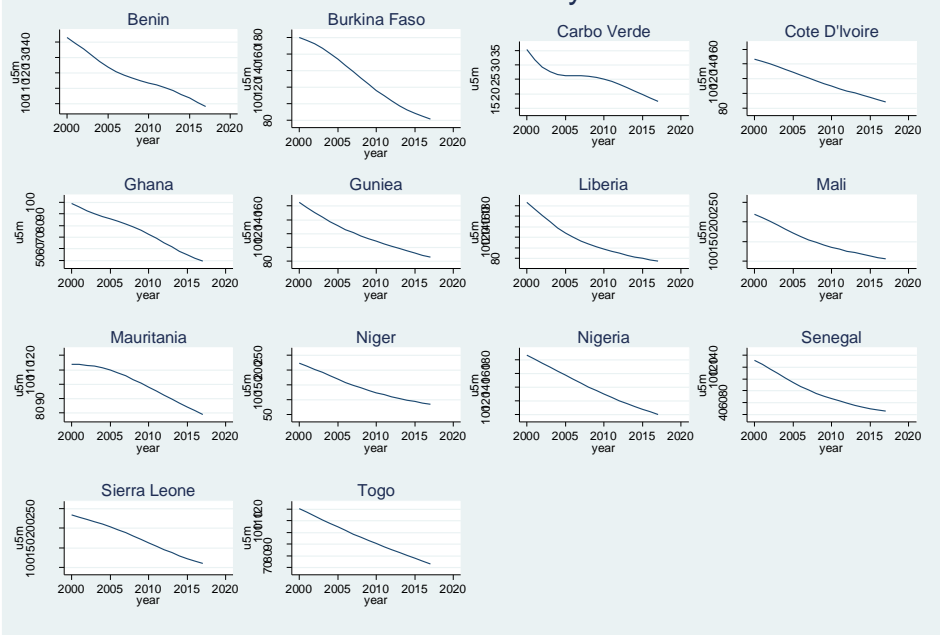
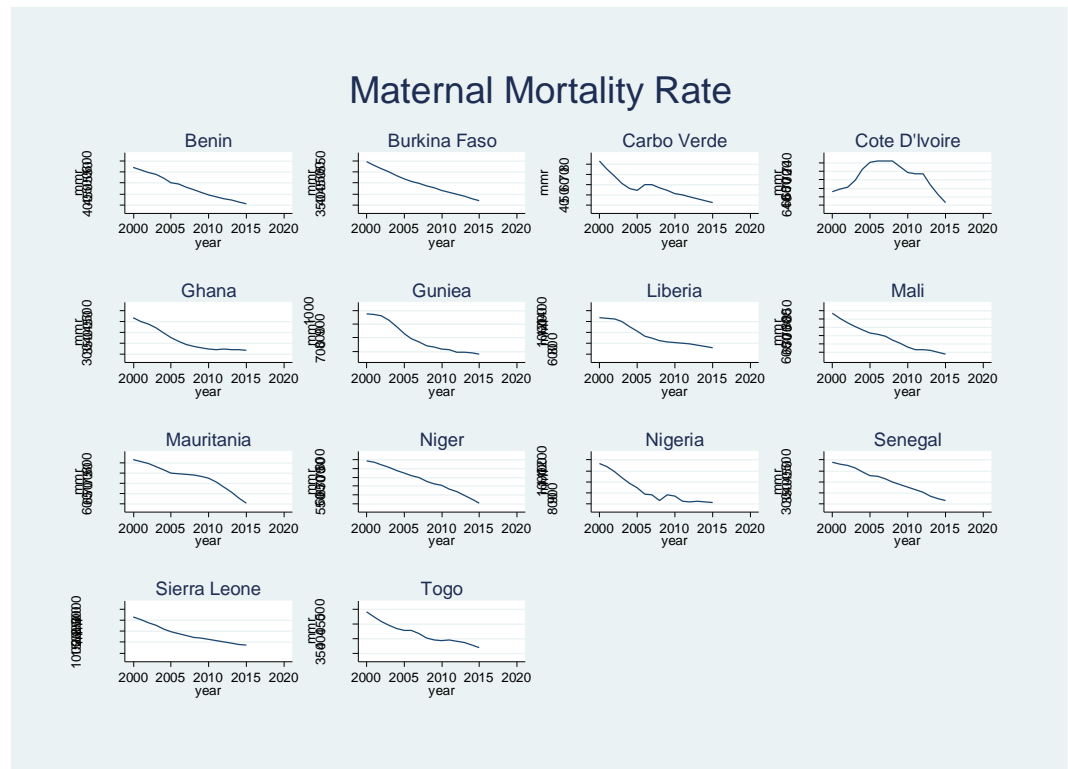


Figure 4: Trend of Maternal Mortality Rate in West Africa



4.4 Regression Results

The short time series of data we have for each country and a relatively small group of countries that comprise West Africa make a panel data model ideal for estimating the relationship of health outcomes with health expenditures. We estimate fixed and random effects models to determine which model is appropriate for our data. Three health outcome variables (the mortality rates) are used in the estimations. Each regression relates a health outcome with three measures of health expenditure growth: total, public, and private. The Hausman test can tell us which of the models is most appropriate and suitable. That model is then run with robust standard errors to control for the possibility of heteroscedasticity and autocorrelation.

The results of all regressions and relevant Hausman tests are provided in the appendix. The final regressions with the robust standard errors are presented and interpreted below.

4.4.1 Results with Total Health Expenditure on the health outcomes

Tables 2, 3, and 4 report the results of three regressions each – for the three mortality rates (under-5, infant, and maternal). Each regression was initially run in both fixed effects (FE) and random effects (RE) specifications and the Hausman test was conducted to determine the best specification. RE produces unbiased estimates and produce small standard errors if the omitted country-specific characteristics are uncorrelated with the explanatory variables. FE, on the other hand, directly controls for the unobserved omitted characteristics which are correlated with the variables included in the model. This makes FE consistent whereas RE is more efficient if it turns out to be consistent as well. The Hausman test actually rejects the consistency of the RE models in our data and leads to the desirability of FE in all cases. These results are displayed on Table 10 in the appendix. The fixed effects results with robust standard errors are presented and interpreted below in Tables 2 through 4.

Table 2: Effects of Total Health Expenditure on Mortality Rates

VARIABLES	(1) u5m	(2) Imr	(3) Mmr
ConsGdp	0.0788 (0.315)	-0.149 (0.159)	0.326 (2.546)

HlthExGDP	-4.379** (2.165)	-1.673** (0.608)	-33.05*** (5.609)
Gdpcap	-0.0167* (0.00953)	-0.00188 (0.00339)	-0.0430 (0.0455)
Malaria	0.0396 (0.0384)	0.0245 (0.0204)	-0.257 (0.201)
Urbanpop	-2.508** (1.233)	-2.939*** (0.707)	-21.95*** (7.079)
Aidcap	-0.0411 (0.0497)	-0.0357* (0.0196)	-0.385 (0.244)
Constant	234.3*** (53.74)	204.8*** (27.14)	1,861*** (234.7)
Observations	111	111	97
R-squared	0.596	0.717	0.438
Number of countries	14	14	14

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results show a negative effect of health expenditure as a percentage of GDP (HlthExGDP) on health outcomes. Column (1) of Table 2 shows that for a one-percentage point increase in health expenditure as a percentage of GDP, under-five mortality decreases by 4.4 points, *ceteris paribus*¹. This is significant at the 5% level. In addition, infant mortality rate falls by 1.7 points, in response to a percentage point increase in health expenditure growth. Maternal mortality drops by 33 points (or a fall of 0.33 in maternal death per 1000 live births) for a one percentage point increase in health expenditure. This is highly significant at the 1% level. Around the mean values of mortality, a one percentage point increase in total health expenditure reduces under-5 mortality by 3.9 percent, infant mortality by 2.4 percent, and maternal mortality by 4.9 percent. Thus, irrespective of the health outcome adopted, increased health expenditure significantly improves health outcomes.

Household consumption expenditure (ConsGdp) which proxies for poverty is found to have a positive relation with under-five mortality and maternal mortality, and a negative relation with infant mortality. The coefficients are, however, statistically insignificant in all models. Another variable, GDP per capita, is negatively related with health outcomes as expected. However, only the effect on under five mortality is statistically significant, at 10%. Other variables held constant, a \$100 increase in GDP per capita results in a 1.7 fewer under-5 deaths per 1000 live births, indicating a small economic significance of GDP per capita, once health expenditure and other variables have been controlled for.

West Africa is a relatively malaria-prone zone but with a large difference of malaria prevalence across countries (between 0 and 607 per 1000 of the population at risk) for Cape Verde and Burkina Faso respectively). Would a higher incidence of malaria lead to more deaths? The variable's coefficient is not, however, statistically significant. Next, with respect to urbanization, the expectation was that

¹ In other words 44 fewer children would die per 10,000 live births. (Mortality rate is deaths per 1000 live births.)

greater urbanization with better health facilities in cities and towns would help lower all types of mortality. Our data support this hypothesis as the coefficients are highly significant. Urbanization, which is simply urban population as a percentage of total population, reduces mortality at varying rates. Around the respective means, a one percentage point increase in urbanization lowers under-5 mortality by 2.2 percent, infant mortality by 4.2 percent, and maternal mortality by 3.2 percent. These are fairly sizeable effects.

Development assistance, or foreign aid received, per capita (Aidcap) also has a negative effect on health outcomes as expected. However, only the coefficient for infant mortality rate is significant. A \$100 increase in ODA per capita leads to 3.6 fewer deaths of infants, or a 5 percent reduction at the mean value.

The overall fitness of the models, depicted by the within R-squared, shows that about 59.6% of the variation in under five mortality is explained by the independent variables specified in the model. This value is about 71.7% for infant mortality and 43.8% for maternal mortality respectively.

4.4.2 Results with Decomposed Health Expenditure per Capita

The correlation between public and private health expenditures is 0.37, this means that the two variables are not high correlated and there is no issue of collinearity. This section presents results for the models that decompose health expenditure into expenditures incurred by government and the private sector. Similarly, separate regressions are run for under five mortality, infant mortality and maternal mortality rate. These results with their corresponding Hausman tests are presented as regression 4, 5 and 6 respectively. The Hausman tests lead to the fixed effects results in all cases. Hence the fixed effects with robust standard errors results are presented and interpreted below:

Table 3

Results with Decomposition of Health Expenditure into Public and Private

	(1)	(2)	(3)
VARIABLES	U5M	IMR	MMR
ConsGdp	0.214 (0.459)	-0.0607 (0.219)	2.156 (4.849)
GovHGdp	0.278 (0.317)	0.204 (0.141)	2.158 (1.519)
PvtHGdp	-1.331* (0.662)	-0.593** (0.265)	-12.34 (10.03)
Gdpcap	0.0251* (0.0131)	0.0100 (0.00597)	0.215 (0.201)
Malaria	0.0417 (0.0476)	0.0332 (0.0192)	-0.119 (0.131)
Urbanpop	-6.468*** (1.659)	-3.106*** (0.671)	-23.81*** (4.991)
Odacap	-0.0966** (0.0419)	-0.0427* (0.0216)	-0.456 (0.272)
Constant	354.4*** (72.94)	194.0*** (31.37)	1,611*** (289.5)
Observations	111	111	97
R-squared	0.667	0.741	0.509
Number of countries	14	14	14

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A striking result in Table 3 is that government health expenditures (GovHGdp) do not provide significant effects on any of the three mortality outcomes whereas private expenditures affect infant

and U-5 mortality significantly. Even the sign of the government expenditure's coefficient is unexpectedly positive. On the other hand, the a priori expectation of a negative relationship with mortality comes out true for private expenditure (PvtHGdp). Looking at the mean value of private health expenditure across countries (\$24.1, higher than public health expenditure) a dollar increase in domestic private health expenditure results in a 1.331 reduction in under five-mortality rate and a 0.593 reduction in infant mortality rate. It can be inferred that private health expenditure has a much more significant effect on health outcomes than government health expenditure. This result is somewhat surprising and calls for reallocation of health resources between public and private sectors.

Urbanization remains highly significant in economic as well as statistical sense. The coefficients are comparatively larger as well than those in the previous specifications. Other variables held constant, a one-percentage point increase in urban population results, per 1000 live births, in 6.5 fewer deaths of children under five, 3.1 fewer infant deaths, and 2.4 fewer maternal deaths. All of these effects are significant at 1% level. Foreign aid received per capita has a negative effect on health outcomes as expected. A \$10 increase in aid results in a one fewer death of children under five, and a 0.4 reduction in infant mortality. The coefficient for maternal mortality is statistically insignificant.

Other variables look similar in their effects to those in the specification for total health expenditure. Surprisingly, however, GDP per capita now has a positive relationship with under-five mortality, albeit at 10% level. As expected, malaria prevalence displays a positive relationship with infant and under-5 mortality though the effect is not significant.

The overall fit of the three mortality regressions with component health expenditures is better than for models with total expenditure as judged by the within R-squared.

CHAPTER FIVE

CONCLUSION AND POLICY IMPLICATIONS

This study has examined the impact of health expenditure on health outcomes in the selected West African countries. The health outcomes used in this study are infant mortality, under-five mortality, and maternal mortality rates. A panel data set for 14 countries for the period 2000–2018 was used. Aside from examining the role of total health expenditure on the health outcomes, we examine whether public and private healthcare expenditure could have dissimilar health outcomes. The control variables used for this work are poverty (proxy by household consumption expenditure), gross domestic product, urbanization, the incidence of malaria, and foreign aid.

The general hypothesis for this study was that an increase in health expenditure would reduce mortality rates of infants, children under five, and mothers. Our panel data indicate that health expenditure is, as expected, negatively related to health outcomes. A one percentage point increase in health expenditure will reduce infant mortality by 2.4 percent, under-five mortality by 3.9 percent and maternal mortality by 4.9 percent. These are economically significant effects too and indicate decent contribution of health resources toward building human capital in these economics. Human capital expansion presumably affects economic growth positively in the developing countries of West Africa, making it worthwhile to increase health expenditure in the region.

GDP's effect conforms to the a priori expectation for under five mortality although it is not significant for infant or maternal mortality rate. This implies that GDP's effect differs across different

outcomes. This result again emphasizes the need to be wary of interpreting higher GDP growth rates in Sub-Saharan Africa as an indication of general improvement in living conditions.

The expected positive correlation of the incidence of malaria with all types of mortality, however, turned out statistically insignificant. Urbanization, on the other hand, provides a noticeably powerful impact on health outcomes. Urbanization enables access to good roads, faster emergency responses, and greater concentration of professionals and health centers. The facilities generally lead to improved health service delivery. A clear policy implication is that an improvement in urban infrastructure leads to better health outcomes. A greater focus on urban health infrastructure should not, however, be made at the cost of rural development, as this will only exacerbate the already wide health inequalities existing in the region.

It is not surprising that foreign aid conforms to the a priori expectation in terms of its contribution to a reduction of infant and under-5 mortality. This is because much of the time foreign aid is directed towards developing or strengthening preventive health care system including immunization against polio, measles, tetanus, tuberculosis and hepatitis B, among others.

Based on the disaggregated analysis, our findings reveal that public and private health expenditure have different effects on the health outcomes. Government health expenditure was found to be positively related to all the health outcomes but it does not exert a significant impact. On the other hand, private health expenditure reduces mortality of all types studied, and also provides a significant impact on infant and under five mortalities though not a significant impact on maternal mortality. This may be because of how public health funds are used in these countries. Public health system in many developing countries is characterized by misallocation, overspending due to corruption and delays due to lack of good governance. Private health expenditure is more significant in improving health outcomes than public expenditure. This is in line with the findings of Novignon et al. (2017)

that the effect of public health spending is less than the effect of private health spending. Because of public goods aspect of large infrastructure, public health expenditure is expected to be more significant in developing regions such as Sub-Saharan Africa. Our results, however, call for a reassessment of public-private emphasis on health expenditures in the region.

Based on the findings of this study, there should be an increase in the funds allocated to healthcare in West Africa in order to ensure adequate facilities and funds for improved health care delivery. This means that money spent on health will improve the health condition of the people thereby causing the nation to have a healthy labor force and this can transform to economic growth and development

Steps should be taken to reduce the various bottlenecks that hinder the proper disbursement of funds for health purposes. The administrative and political issues such as corruption should be checked to ensure quick and efficient allocation.

Public-private partnership may go a long way to help the region to improve the health status of the population at large. Steps should also be taken make private health more affordable. This could be done through effective health insurance programs that subsidize private health care which could greatly improve healthcare accessibility.

This study faced a major issue with data availability which limited the rigor of the analysis. It is possible to cover more countries and data to further examine the findings of this paper. More health outcome variables can also be used. A consistent measure of inequality such as the Gini coefficient can be used to see whether inequality of income can explain a part of health outcome. It is possible that endogeneity in health expenditure could be a concern since the size of health resources may depend on economic growth. These issues could be explored and addressed possibly by using methods such

as the two-stage least squares. Also, depending on data availability, time series econometric techniques can be used on country specific basis. This will allow for an individual assessment of the situation for each country and for assessing any dynamic relationships that may exist.

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Appendices

Table 4: Regression 1

	Fixed	Random
	effects	Effects
VARIABLES	u5m	u5m
ConsGdp	-0.00600 (0.229)	0.0247 (0.0182)
heg	-3.495** (1.454)	-4.023*** (1.105)
gdpcap	-0.00263 (0.00754)	-0.0247*** (0.00841)
mal	0.0229 (0.0358)	0.0727** (0.0322)
urbanpop	-6.223*** (0.969)	-2.221*** (0.648)
odacap	-0.0832**	-0.0212

	(0.0378)	(0.0315)
Constant	382.4***	202.6***
	(42.35)	(29.08)
Observations	111	107
R-squared	0.638	
Number of country	14	14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Regression 2

	Fixed	Random
	Effects	Effects
VARIABLES	mri	mri
ConsGdp	-0.149	0.00814
	(0.0977)	(0.00968)
heg	-1.673***	-2.181***
	(0.620)	(0.574)
gdpcap	-0.00188	-0.0119***
	(0.00322)	(0.00433)
mal	0.0245	0.0408**

	(0.0153)	(0.0170)
urbanpop	-2.939***	-1.077***
	(0.414)	(0.352)
odacap	-0.0357**	-0.0147
	(0.0162)	(0.0163)
Constant	204.8***	116.7***
	(18.07)	(15.79)
Observations	111	107
R-squared	0.717	
Number of country	14	14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Regression 3

	Fixed	Random
	Effects	Effects
VARIABLES	mmr	mmr

hcecap	-0.252	-0.110
	(0.197)	(0.180)
heg	-30.64***	-19.56*
	(10.02)	(10.52)
gdpcap	0.0120	-0.104
	(0.0863)	(0.0816)
mal	-0.0307	0.0996
	(0.316)	(0.322)
urbanpop	-21.26***	-5.030
	(7.772)	(6.780)
odacap	-0.477	-0.428
	(0.309)	(0.319)
Constant	1,926***	1,162***
	(322.0)	(299.2)
Observations	93	93
R-squared	0.464	
Number of country	14	14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Regression 4

	Fixed	Random
	Effects	Effects
VARIABLES	u5m	u5m
hcecap	-0.00419 (0.0178)	0.0245 (0.0196)
dgep	0.219 (0.307)	-0.235 (0.305)
dpep	-1.005*** (0.216)	-0.801*** (0.292)
gdpcap	0.0220*** (0.00796)	-0.00595 (0.0112)
mal	0.0980*** (0.0261)	0.0897*** (0.0332)
urbanpop	-6.325*** (0.631)	-1.606** (0.645)
odacap	-0.0856*** (0.0245)	-0.0376 (0.0352)
Constant	345.3*** (27.01)	156.8*** (28.81)

Observations	107	107
R-squared	0.809	
Number of country	14	14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: Regression 5

	Fixed	Random
	Effects	Effects
VARIABLES	mri	mri
hcecap	-0.00208 (0.00881)	0.00853 (0.0108)
dgep	0.177 (0.151)	-0.196 (0.168)
dpep	-0.579*** (0.107)	-0.342** (0.162)
gdpcap	0.0116*** (0.00393)	-0.00506 (0.00620)

mal	0.0528***	0.0536***
	(0.0129)	(0.0182)
urbanpop	-3.019***	-0.264
	(0.311)	(0.351)
odacap	-0.0429***	-0.0189
	(0.0121)	(0.0195)
Constant	179.9***	72.16***
	(13.32)	(15.68)
Observations	107	107
R-squared	0.813	
Number of country	14	14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9 : Regression 6

	Fixed	Random
	Effects	Effects
VARIABLES	mmr	Mmr

Hcecap	-0.156	-0.0995
	(0.207)	(0.176)
Dgep	0.606	-2.646
	(4.056)	(2.964)
Dpep	-10.52***	-7.738***
	(2.460)	(2.512)
Gdpcap	0.232**	0.0881
	(0.0922)	(0.0969)
Mal	0.225	0.217
	(0.294)	(0.312)
Urbanpop	-22.70***	-5.773
	(7.781)	(6.950)
Odacap	-0.471	-0.476
	(0.299)	(0.299)
Constant	1,709***	1,099***
	(310.7)	(298.3)
Observations	93	93
R-squared	0.523	
Number of country	14	14

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

10:
Test

Hausman Tests			
Regression	Hausman Test coefficient	P- Value	Decision
1	41.99	0.000	Fixed Effects
2	17.97	0.003	Fixed Effects
3	31.10	0.000	Fixed Effects
4	579.42	0.000	Fixed Effects
5	2049.91	0.000	Fixed Effects
6	15.47	0.030	Fixed Effects

Table:
Hausman
results

