INCOME AND HEALTH OUTCOMES IN THE ANGLOPHONE WEST AFRICAN COUNTRIES: A DYNAMIC HETEROGENEOUS APPROACH

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ABSTRACT
The health status of a population is a very vital economic indicator because unhealthiness can have a significant impact on households' productivity. The health status in the African Countries is well below that of the rest of the world. This study investigated the effect of income on health outcomes in the Anglophone West African Countries from 2000-2019. Data were obtained from the World Bank's World Development Indicators, and Global Health Expenditure Data bases. The model of the study is based on Grossman Model (1972). This study employed Dynamic Heterogenous Panel Regression (Panel ARDL) because of the variability of the countries in Anglophone West Africa. Results revealed that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure have significant effect on maternal mortality, under-five mortality, neo-natal mortality and infant mortality in the Anglophone West African Countries in the long run. The study therefore, recommends that health sector should be adequately funded, out-of-pocket health expenditure should be discouraged, bridge the gap of income inequality and fiscal policies to improve health sector be should be employed in the sub-region.

Keywords: Dynamic heterogenous panel regression, Health outcomes, Income, Mortality rate, Per capita GDP
JEL Codes: P46, I14, C23

1. INTRODUCTION
Health is defined as a condition of complete physical, mental, and social well-being, not only the absence of disease. A better healthcare system is a basic human need. As a result, health is seen as a fundamental human right, and achieving optimal health is one of the most important worldwide goals. Because unhealthiness can have a major impact on households, a population's health status is a very important economic indicator. In Africa, the relevance of health outcomes and income cannot be overstated, with most nations facing poor health outcomes and significant levels of income disparity, further impoverishing households.
Income is a significant phenomenon because it is extremely critical for any country's growth and development. It has an impact on societal cohesion, defines the level of poverty for any given

average per capita income and the poverty-reduction consequences of growth, and even has an impact on people's health (Stewart 2003). Poor health can have a substantial impact on an individual's income and earning capacity. People may be motivated to improve their condition by working, innovating, or learning new skills as a result of inequalities. On the other hand, it could be a roadblock to growth and poverty reduction.

In most industrialized and emerging countries, income disparity has risen. More than two-thirds of the world's population (71%) lives in countries with rising inequality. (Odusanya & Akinlo, 2020; Matthew & Brodersen, 2018). Rising income disparity is regarded as one of our generation's most pressing issues (Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015). Despite advances made in terms of development, income and wealth in some countries are becoming increasingly concentrated at the top. Okwu et al. (2021), states that immense reduction in income inequality and poverty, people centred fiscal policies, increased productivity and national output, has been one of the main objectives of governments of most countries all over the world.

Healthcare systems in Africa are neglected and underfunded, according to Oleribe, Momoh, Uzochukwu, Mbofana, Adebiyi, Barbera, Williams, and Taylor-Robinson (2019). This results in serious issues across the six World Health Organization (WHO) pillars of healthcare delivery. In Anglophone West African countries, disease prevalence, maternal mortality, neonatal mortality, under-five mortality, and infant mortality have all become severe burdens. An effective and efficient healthcare system can significantly aid a country's economy, long-term viability, and sustainability.

Health expenditure has significantly increased in Africa while domestic government healthcare financing has been stalled and insignificant (Bhakta, Martiniuk, Gupta, Howard, Essuman, Braimah, Ndanu, Ntim-Amponsah, James, Ajayi, Ogun, Oladokun, Renner, McGill, & The World Bank, 2016). Over the last two decades, total health expenditure in middle-income and low-income countries has proliferated. But this increase has been driven mainly by out-of-pocket spending by households and development assistance, about half of which was earmarked spending for HIV/AIDS. Universal Health Coverage aims to provide health care services to the population on a consistent basis, according to their needs, without putting people in financial jeopardy (World Bank, 2019). The achievement of equitable distribution of income, alleviation of poverty, and better health outcomes in Africa countries will continue to be major development objectives.

Africa has a high rate of disease prevalence (WHO, 2016). The health status in the African countries is well below that of the rest of the world, despite the recommendation of 15% health expenditure of a nation's GDP. Nigeria's health outcome indices have remained unacceptably poor. The maternal mortality rate is 814 deaths per 100,000 women. Infants and children under the age of five years have mortality rates of 70 and 104 per 1000 live births, respectively. Health disparities exist between states and geographic zones, as well as the rural/urban gap, education, and socio-economic position (WHO, 2018). Malaria is considered as one of the leading tropical diseases affecting poor rural households in Nigeria (Urama, Manasseh, & Ukwueze, 2018). Pregnant women are also at risk as a result of malaria which could cause morbidity and mortality.

According to Global Burden of Disease (GBD, 2018), the top 10 causes of death in Liberia are malaria, diarrheal diseases, neo-natal disorders, lower respiratory infections, ischemic heart disease, HIV/AIDS, stroke, tuberculosis, sexually transmitted diseases, and cirrhosis. As of 2017, the population of Liberia was 4,731,906 million, per capita income was $710, life expectancy at birth was 64 for females and 62 years for males, while the infant mortality rate was 50/1,000 live

births (WHO, 2018). In general, OOPE as a percentage of total health expenditure in Nigeria was (76.60%), Sierra Leone (44.78%), Ghana, (37.69%), and (29.34%) in Gambia in the year 2018 (WHO, 2020; (GHED), 2020). Onyeoma (2020), identified high population growth rate a challenge to economic growth in Nigeria. The study of (Ogunbadejo & Zubair, 2021) confirmed that increase in government allocation to health and agriculture sectors in Nigeria would lead optimal performance of the economy.

Ghana has been cited as one of the African countries with perhaps one of the most significant health inefficiencies (Kaseje 2006; McKay 2015). This poor population health status is mirrored by crises in health financing and human resources for health (Mills et al., 2012). Health system in Sierra Leone is in a censorious condition despite all the investments that have been made to healthcare system, as evidenced by poor core health indicator rankings (World Vision 2012). The Government of Sierra Leone is a signatory to the Abuja Declaration, which encourages a state to commit 15 percent of its annual budget to health. Despite these commitments, the U.N.'s Human Development Index ranks Sierra Leone 181 out of 187 countries (UNDP, 2015). Life expectancy rates of both men and women remain among the lowest in the world, at 49 years for men and 51 for women (WHO, 2015).

Previous studies examined health outcome or health indices in relation to crime, consumer debt, income inequality (Payne, Brown-Iannuzzi, & Hannay, 2017; Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015). However, divergent results have emanated from literature. Some studies found the country's average income level to be positively correlated with individual health outcomes, while others found out that country income inequalities are negatively associated with health conditions (Pasqualini, Lanari, Minelli, Pieroni, & Salmasi, 2017; Truesdale & Jencks, 2016). Previous studies identified that geographical or residential locations could negatively or positively impact health outcomes (Chetty, Stepner, Abraham, Lin, Scuderi, Turner, Bergeron, & Cutler, 2016; Barber, Fullman, Sorensen, Bollyky, McKee, Nolte, Abajobir, Abate, Abbafati, Abbas, Abd-Allah, Abdulle, Abdurahman, Abera, Abraham, Abreha, Adane, Adelekan, Adetifa, & Murray, 2017; Ward & Viner, 2017). Studies such as (Matthew & Brodersen, 2018, Yao, Wan, & Meng, 2019; Hoffmann, Hu, De Gelder, Menvielle, Bopp, & Mackenbach, 2016; Adua, Frimpong, Li, & Wang, 2017) on relationships between income inequality and population health remain inconclusive.

In the light of the above, previous researches in this area remains inconclusive and available literature suggests that there is paucity of literature on income and health outcomes in the Anglophone West African Countries. This is a major motivation for this study so as to contribute to empirical literature by investigating the effect of income on health outcomes. Income is measured by per capita GDP while health outcomes is measured by maternal mortality and under-five mortality, infant mortality and neo-natal mortality. Specific objectives are: examine the effect of per capita gross domestic product on maternal mortality in the Anglophone West African Countries; establish the effect of per capita gross domestic product on under-five mortality in the Anglophone West African Countries; investigate the impact of per capita gross domestic product on neo-natal mortality in the Anglophone West African Countries, and examine the impact of per capita gross domestic product on infant mortality in the Anglophone West African Countries. Hypotheses are also in line with the specific objectives.

2. LITERATURE REVIEW

This section discusses various conceptual, theoretical and empirical literature related to income and health outcomes.

2.1 Conceptual Literature

The World Health Organization (WHO, 1948) defines health as a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity. In addition, the Ottawa Declaration (WHO, 1948) states that an individual or group must be able to identify and realize aspirations, satisfy needs, and change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities (National Center for Health Statistics) (NCHS, 2012). Health outcomes are an interrelated set of attributes that describe the consequences of disease for an individual.
Maternal mortality is defined as any loss of a woman's life due to a pregnancy complication or death within 42 days of childbirth, regardless of the period or location of the pregnancy, and resulting from issues that are linked or escalated by the pregnancy management but not from an accident or incidental factors.

Under-five mortality which is referred to as child mortality is also an important rate that focuses only on children under one year of age. The child mortality rate (or under-five mortality rate – U5MR) is the probability expressed as a rate per 1 000 live births, of a child born in a specified year dying before reaching the age of five when subject to current age-specific mortality rates. Child mortality is the mortality of children under the age of five.

Income is defined as household disposable income in a particular year. It consists of earnings, self-employment, and capital income, and public cash transfers; income taxes and social security contributions paid by households are deducted. The income of the household is attributed to each of its members, with an adjustment to reflect differences in needs for households of different sizes.

Gross Domestic Product (GDP) per capita is a core indicator of economic performance and is commonly used as a broad measure of average living standards or economic well-being. Average GDP per capita, for example, does not reveal how GDP is allocated among citizens. For example, the average GDP per capita may rise, but if income inequalities rise as well, more people may suffer (OECD, 2013).

Out-of-pocket payments (OOPs) are defined as direct payments made by individuals to health care providers at the time-of-service use. The Gini index, often known as the Gini coefficient, is a measure of income distribution devised by Italian economist Corrado Gini in 1912. It is frequently used to measure income distribution or, less usually, wealth distribution among a population as a measure of economic inequality. The coefficient is a number that ranges from 0 (or 0%) to 1 (or 100%), with 0 denoting perfect equality and 1 denoting complete inequality.

Current Health Expenditure (CHE) is a measure of how much money each country spends on health compared to the size of its GDP. It excludes investment, exports, and intermediate consumption and only covers expenditures relating to the final consumption of health care goods

and services. The CHE represents the importance of the health sector in the economy and the monetary priority given to health (CIA, 2021).

2.2 Theoretical Literature

The main theories on health production and demand for health are the Grossman theory, Rosenzweig and Schultz's child health production function theories and Cebu's child health production function. The demand for health theory was developed Grossman (1972) and it determined how people spend their resources in order to achieve health. The concept, which goes beyond typical demand analysis, has had a huge impact on health economics. It makes use of the concept of the individual as a health producer (rather than just a consumer) by erasing the false distinction between consumption and production. It also presents the concept of investing in human capital (health and education) in order to improve outcomes in both the market (job) and non-market (family) sectors.

Rosenzweig and Schultz's Child Health Production Function Theories were propounded by Rosenzweig and Schultz (1982). They were interested in the outcome of pregnancies and dedicated a significant portion of their work to theoretical and methodological issues that they believe have hampered the utility of much earlier research. They stress the need of predicting the demand function for health production inputs (parental behavior) as well as the production function that links behavior to health outcomes together. Their model, which incorporates a health production function into a utility-maximizing framework.

Cebu's Child Health Production Function was developed by Cebu (1991.). The theory developed child health production based on the Rosenzweig & Schultz (1982) models, in which child health production in utero is incorporated in the mother's utility maximization behavior. The Cebu (1991) model concentrated on underlying social, proximate behavioral, and biological factors that influence infant morbidity, growth, and death. The model also demonstrates how maternal education leads to behavioral changes in children, as well as how these changes lead to changes in the prevalence of diarrhea in children.

2.3 Empirical Literature

Yang, Chen, Shoff & Matthews (2012), study on the effects of inequality across the mortality distribution in the U.S. counties employed a rarely used method in mortality research, quantile regression (QR), to investigate whether income inequality is a determinant of mortality and to also determine the varying relationship between inequality and mortality throughout the mortality distribution. They found that the association between inequality and mortality was not constant throughout the mortality distribution and the impact of inequality on mortality steadily increased until the 80th percentile.

Aron, Dubay, Simon, & Zimmerman (2015), looked into the relationship between income and wealth and health and longevity. They found that substantial health disparities that many minorities face are largely due to income. Adults with family incomes at or above 400 percent of the federal poverty level, or FPL (in 2014, the FPL was $23,850 for a family of four), are nearly five times as likely to report being in fair or poor health, and they are nearly three times as likely to have activity limitations due to chronic illness.

Orji & Okechukwu (2015), adopted a multilevel approach to examine the impact of income and income distribution on population health in Nigeria. The results show that absolute income has a significant impact on population health in Nigeria and that population health measured by infant mortality rate, would improve by about 0.15 percent when absolute income increases by 1 percent, at a 95 percent confidence interval. Results further show that relative income has no significant impact on population health. Also, the Gini coefficient and the Pietra inequality indices mimic each other for both absolute and relative incomes. The Gini coefficient expresses a near-maximum inequality for population health due to absolute income and near-perfect equality of population health due to relative income.

Hoffmann, Hu, De Gelder, Menvielle, Bopp, & Mackenbach (2016), examined the impact of increasing income inequalities on educational inequalities on mortality in six European countries between 1990-2000. Fixed-effects panel regression models were employed. Results revealed that across all countries, absolute income differences between low- and highly-educated people increased by $75.3 (men) and $ 64.3 (women) per year, respectively. The study further revealed that an association exists between income inequality and mortality inequality for deaths from external causes, and cardiovascular diseases, but statistically insignificant.

Cevik & Tazar (2016), examined the relationship between public spending on health care and health outcomes using cross-country comparison. They run cross-sectional regressions to estimate the strength of association between child and infant mortality rate and public health expenditures in the worldwide sample. They found government health spending as a share of GDP to be negatively associated with a lower level of under-5 mortality by elasticities of from -0.17 to -0.22. The elasticity is -0.20 for infant mortality.

In a similar study in the USA, (Vilda, Wallace, Dyer, Harville & Theal, 2019), examined the association between state-level income inequality and pregnancy-related mortality among non-Hispanic (NH) black and NH white populations between 2011 and 2015 using Poisson regression. They found that across all states in America, increasing contemporaneous income inequality was associated with a 15% and 5-year lagged inequality with a 14% increase in pregnancy-related mortality among black women after controlling for states' racial compositions and socio-economic conditions. Income inequality was also associated with larger absolute and relative racial inequities in pregnancy-related mortality.

Bein, Unlucan, Olowu, & Kalifa (2017), examined the association between healthcare expenditures and health outcomes for eight East African countries: Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda using panel data regression technique. Result reveals that strong, a positive association exists between total healthcare expenditures and total life expectancy.

Ward & Viner (2017) examined how income inequality and national wealth affected child and adolescent mortality in low and middle-income nations. In 2012, cross-sectional regression analyses of the relationship between income inequality (national Gini coefficient) and national wealth (GDP averaged over the previous decade), as well as all-cause and grouped cause national mortality rates among infants, 1–4, 5–9, 10–14, 15–19, and 20–24-year-olds in low and middle-income countries (LMICs). GDP was factored into Gini models.

Aregbeshola & Khan (2017) examined out-of-pocket payments, catastrophic health expenditure, and poverty among households in Nigeria. The study found that a total of 16.4% of households incurred catastrophic health payments at 10% threshold of total consumption expenditure while 13.7% of households incurred catastrophic health payments at 40% threshold of non-food expenditure. Using the $1.25 a day poverty line, the poverty headcount was 97.9% gross of health

payments. OOP health payments led to a 0.8% rise in poverty headcount and this means that about 1.3 million Nigerians are being pushed below the poverty line. Better-off households were more likely to incur catastrophic health payments than poor households. Descriptive statistics were used in the analysis.

From 1990 to 2014, Ray & Linden (2018) used a simultaneous three-equation model to determine the association between GDP per capita (GDPPC), infant mortality rate, and health expenditures for 194 countries. In the sample with three income level nation groups, GMM-2SLS estimate findings show that there are simultaneous decreasing infant mortality rate and growing GDPPC level impacts. When the effects of GDPPC and the number of doctors per capita are added together, health expenditures have a greater than one elasticity. In non-poor nations, an increase in income inequality as assessed by the GINI coefficient raises the infant mortality rate.

Lenhart (2019) used an increase of the Earned Income Tax Credit (EITC) in the UK to investigate the relationship between income and health. Increased food spending (10.5–20.3 percent rise) and higher private health insurance take-up rates (1.97 percent increase) were found to be mechanisms for better health outcomes in the study. While the size of these impacts shows that food expenditures and health insurance can explain how more money can lead to better health, it appears that income has several impacts on health. For the analysis, a semi-parametric estimator called DD estimate was used.

The study by Ubi and Ndem (2019) models the effects of poverty on health outcomes in Nigeria. The researchers utilized a vector autoregressive econometric technique to see if health outcomes (life expectancy and infant mortality rate) in Nigeria related to poverty. The study's empirical evidence reveals that poverty shock has no meaningful impact on health outcome variables. Variations in health outcomes, in particular, are caused by the health result shock rather than poverty shocks. As a result, it is suggested that improving the population's health is a prerequisite for poverty reduction in Nigeria.

The study carried out by Anjande, Aheme & Ijirshar (2020), using Dynamic panel ARDL in their study on the asymmetric impact of government spending behavior on national income and unemployment in Africa, the found that increase in government spending has a strong and positive influence on the national income growth and negative influence on unemployment among African countries. Result further reveals that reduction in government spending has significant negative influence on growth of national income while it is positive on unemployment. Ogunbadejo, Kanwanye & Zubair (2021), in their study on effect of crude birth rate in Nigeria recommended that government should increase allocation to health and agriculture sectors in the country for optimal performance of the economy.

3. METHODOLOGY

This study adopts an *ex-post* facto research design and the theoretical framework employed is the Grossman theory of demand for health (1972) to examine the effects of income on health outcomes in the Anglophone West African Countries. The target population of this study is the five countries in the Anglophone West African region. The Anglophone West African Countries include Nigeria, Ghana, the Gambia, Liberia, and Sierra Leone. The data to be used in this study covered the period 2000-2019. Data were sourced from World Bank's World Development Indicators (WDI, 2021), Standardized World Income Inequality Data (SWIID, 2021), and Global Health Expenditure Data (GHED, 2020) bases. Panel ARDL through Pool Mean Group Estimator and Dynamic Fixed Effect (DFE) were employed in the model.

Model Specification

The Grossman model was extended to include: per capita GDP, out-of-pocket payment, GINI coefficient, and CHE. Therefore, the models that were used for analysis in this study are as follow:

Aggregated Model:

$$\sum_{j,i,t=1}^{4,5,20} HO_{i,t} = \beta_0 + \beta_k \sum_{k,i,t=1}^{1,5,20} ID_{i,t} + \beta_r \sum_{k,i,t=1}^{3,5,20} CV_{i,t} + \varepsilon_{i,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots 3.1$$

Where:

HO is health outcomes and it is measured with: neo-natal mortality rate, maternal mortality rate, infant mortality rate, and under-five mortality rate; *ID* is Income is proxy by: per capita GDP; *CV* = Control variables are: Current health expenditure (CHE), out of pocket payment (OOPE) and GINI coefficient. $\beta_0$is the intercept; β_k(k = 1) is vector coefficients of income variable in the model. β_r(r = 1, 2,3) = Vector coefficients of control variables in the model. ***ε is*** error term; ***j*** denotes composite of health outcome indicators; ***i*** denotes each country in the cross section; ***t*** is the regular point in time at which the data; ***k*** is coefficient of the income variable.

The disaggregated model is specified below:

Model 1: Maternal Mortality

$MMR = \beta_0 + \beta_1 GDPPC_{i,t} + \beta_2 GINI_{i,t} + \beta_3 OOPE_{i,t} + \beta_4 CHE_{i,t} + \text{ECM}_{t-1} + \varepsilon_{i.t}$ 3.2

Where:

MMR is Maternal Mortality Rate; $GDPPC_{i,t}$ is Gross Domestic Product Per Capita; $GINI_{i,t}$ is GINI Coefficient Index; $OOPE_{i,t}$ is Out of Pocket Health Expenditure; $CHE_{i,t}$ is Current Health Expenditure

Model 2: Under-5 Mortality

$U5MR = \varphi_0 + \varphi_1 GDPPC_{i,t} + \varphi_2 GINI_{i,t} + \varphi_3 OOPE_{i,t} + \varphi_4 CHE_{i,t} + \text{ECM}_{t-1} + \mu_{i,t}$ 3.3

U5MR = Under Five Mortality Rate

Model 3: Neo- natal Mortality

$NMR = \alpha_0 + \alpha_1 GDPPC_{i,t} + \alpha_2 GINI_{i,t} + \alpha_3 OOPE_{i,t} + \alpha_4 CHE_{i,t} + \text{ECM}_{t-1} + \delta_{i,t}$ 3.4

NMR = Neo-natal Mortality Rate

Model 4: Infant Mortality

$IMR = \theta_0 + \theta_1 GDPPC_{i,t} + \theta_2 GINI_{i,t} + \theta_3 OOPE_{i,t} + \theta_4 CHE_{i,t} + \text{ECM}_{t-1} + \mu_{i,t}$ 3.7

IMR = Infant Mortality Rate

4.0 RESULTS AND DISCUSSION OF FINDINGS

Partial Correlation Coefficients

The partial correlation coefficient between pairwise consideration of the variables is presented in Table 1.

Table 1: Correlation Matrix of Income and Health Outcomes

Variables	LMMR	LNMR	LU5MR	LIMR	LGDPPC
LGDPPC	- 0.378	-0.445	-0.431	-0.488	1.000
LOOPE	0.153	0.423	0.581	0.661	-0.085
LGINI	0.058	0.159	0.011	-0.144	0.479
LCHE	0.427	0.213	0.377	0.453	-0.611

Source: Researcher`s computation (2021)

All the variables are expressed in log forms. All the values were calculated from the 100 country-year observations for the five Anglophone West African Countries.

Out-of-pocket expenditure and current health expenditure have positive association with infant mortality rate with correlation value of 0.661 and 0.453, respectively. This implies that out-of-pocket expenditure and current health expenditure and infant mortality rate change in the same direction. Conversely, GDP per capita and Gini coefficient have negative association with the infant mortality rate, with correlation values of – 0.488 and -0.233, respectively, thus GDP per capita and Gini coefficient move in the opposite direction as infant mortality rate.

Furthermore, out-of-pocket expenditure, GINI coefficient, and current health expenditure have positive association with maternal mortality rate of the five Anglophone African countries with correlation value of 0.153, 0.014, and 0.427, respectively. This implies that increases in out-of-pocket expenditure, GINI coefficient, and current health expenditure will lead to increase in maternal mortality rate. Conversely, GDP per capita has negative association with the maternal mortality rate with correlation values of – 0.378, thus increases in GDP per capita will lead to fall in maternal mortality rate.

In addition, out-of-pocket expenditure, GINI coefficient, and current health expenditure have positive association with neo-natal mortality rate of the five Anglophone African Countries with correlation values of 0.423, 0.159, and 0.213, respectively. This implies that increases in out-of-pocket expenditure, GINI coefficient, and current health expenditure will lead to increase in neo-natal mortality rate. Conversely, GDP per capita has negative association with the neo-natal mortality rate with correlation values of – 0.445, thus increases in GDP per capita will lead to fall in neo-natal mortality rate.

Lastly, out-of-pocket expenditure, Gini coefficient and current health expenditure have positive association with under 5 mortality rates of the five Anglophone African countries with correlation value of 0.581, 0.011 and 0.377, respectively. This implies that increases in out-of-pocket expenditure and current health expenditure will lead to increase in under-5 mortality rates. Conversely, GDP per capita has negative association with the under-5 mortality rates with correlation value of - 0.431. Thus, increases in GDP per capita will lead to fall in under-5 mortality rates.

4.2 Cointegration Test

The result of the unit root is presented in Table 2 The variables used to examine the effect of income on health outcomes in the five Anglophone West African Countries were subjected to unit root testing because the dynamic heterogeneous panel estimators require the stationarity of the series. In particular, two panel unit root tests were conducted and they are the Cross-Section

Augmented Dickey- Fuller Panel Unit Root Test (CADF) and Cross- section Augmented Panel Unit Root Test (CIPS).

Table 2 Panel Unit Test for Income and Health Outcomes

Variables	**CIPS**		**CADF**	
	I(0)	**I(1)**	**I(0)**	**I(1)**
LMMR	-1.337	-2.851***	-1.712	-3.410***
LNMR	-1.794	-4.167***	-1.266	-4.229***
LIMR	-1.270	-3.467***	-1.389	-3.977***
LU5MR	-1.516	-3.692***	-1.059	-3.571***
LGDPPC	-1.706	-3.503***	-1.696	-2.764***
LOOPE	-1.788	-4.419***	-1.467	-2.642***
LGINI	-2.071	-3.560***	-2.019	-2.493**
LCHE	-2.435**	-5.461***	-1.613	-3.359***

Source: Researcher`s computation (2021)

Note: All the variables are expressed in log forms. In addition, ***, **, and * indicates 1%, 5% and 10% respectively. The critical values for CIPS and CADF panel unit root tests are -2.21, -2.34 and -2.60 for 10, 5 and 1percent respectively.

The unit roots reported in Table 2 shows that majority of the series were stationary in their first differences I(1) asides from the current health expenditure which is stationary at levels. Arising from the panel unit root test where there is mixed order of integration, this further alludes that the Panel ARDL methodology is appropriate.

4.3 Panel ARDL Results

The results of the Panel ARDL conducted are presented in as follows:

Table 3: Panel ARDL Results Table: Health Outcomes and Income of the Anglophone West African Countries

Long-Run Estimates	**MMR**	**U5MR**	**NMR**	**IMR**
LGDPPC	0.766	-0.445***	0.175	-0.424***
	(1.396)	(-3.265, 0.00)	(1.468)	(-2.620, 0.00)
LOOPE	2.125**	-0.102	0.378***	-0.480*
	(2.170, 0.03)	(-0.430)	(3.026, 0.00)	(-1.705)
LGINI	4.625***	2.540**	-6.630**	3.512
	(4.105,0.00)	(2.610, 0.01)	(-2.290, 0.02)	(1.273)
LCHE	-0.261***	0.146	-0.114*	-0.332
	(-3.017, 0.00)	(0.603)	(-1.869)	(-1.391)
Adjusted R^2	0.619	0.539	0.629	0.694
F-statistic	54.85 (0.00)	39.65 (0.00)	58.30 (0.00)	79.06 (0.00)
Hausman test				
MG vs. PMG		12.71 (0.000)	-	-
PMG vs. DFE	6.78(0.1248)		2.22 (0.696)	1.69 (0.734)

Source: Researcher`s computation (2021)

Notes: Table 3 reports the dynamic heterogeneous panel regression results. All the variables are expressed in log forms. * Significant at 10%, ** Significant at 5%, *** Significant at 1%. The values in parenthesis represent the t-statistic and p-values

4.4 Interpretation of Results

Dynamic heterogeneous panel estimator propounded by (Pesaran and Shin, 1999) is the baseline estimator technique. However, the result of Pool Mean Group (PMG) and Dynamic Fixed Effect (DFE) were presented in Table 3. The Hausman tests were run with the null hypothesis of no systematic differences between the coefficient of PMG and DFE. It checked a more efficient model against the a less efficient but consistent model in order to ensure that the efficient model gives consistent results. The Hausman test statistic and the corresponding p-values of the coefficients are outlined in all the tables where long run homogeneity restriction is tested against the alternative hypothesis. Dynamic Fixed Effect was used for interpretation of the result of estimation for objectives one, three and four while Mean Group was used for objective two based on the Hausman results.

The estimated long-run coefficients (elasticities) for the models were given in the Tables 3. In the long run, there is evidence that GDP per capita, out-of-pocket expenditure, and Gini coefficient have positive relationship with maternal mortality rate. This implies that increases in GDP per capita, out-of-pocket expenditure, and Gini coefficient will lead to increase in the maternal mortality rate of the Anglophone West African countries. GDP per capita, out-of-pocket expenditure sign are not in conformity with *a prior* expectation, while the positive relationship Gini coefficient conforms to the *a priori.* Concerning the magnitude of the parameter estimates, there is evidence that a 1 percent increase in GDP per capita, out-of-pocket expenditure and Gini coefficient will lead to 0.766, 2.125 and 4.625 percent increase in maternal mortality, while a 1 percent increase in current health expenditure will lead to 0.261 percent decrease in maternal mortality which conforms with the *a priori.* The positive relationship between GDP per capita, Gini coefficient and maternal mortality may be due to increased insecurity, corruption, pollution and other factors outside the scope of this study.

In the long run, there is evidence that Gini coefficient and current health expenditure have positive relationship with under 5 mortality rates. This implies that increases in Gini coefficient and current health expenditure will lead to increase in the under 5 mortality rates of the Anglophone West African countries. The result positive relationship between CHE and U5MR is at variance with the *a priori* expectation, while that of GINI coefficient is consist. In addition, there is evidence that GDP per capita and out-of-pocket expenditure has a negative relationship with under 5 mortality rates. This implies that increases in GDP per capita and out-of-pocket expenditure will lead to decrease in the under 5 mortality rates of selected Anglophone West African Countries. The effect is both contemporaneous and persistent.

Concerning the magnitude of the parameter estimates, there is evidence that a 1 percent increase in Gini coefficient and current health expenditure will lead to 2.540 and 0.146 percent increase in under 5 mortality rates, respectively while a 1 percent increase in GDP per capita and out-of-pocket expenditure will lead to 0.445 and 0.102 percent decrease in under 5 mortality rates, respectively.

The estimated long-run coefficients (elasticities) for the model are given in the Tables 4.4. In the long run, there is evidence that GDP per capita and out-of-pocket expenditure have positive relationship with neo-natal mortality rate. This implies that increases in GDP per capita and out-of-pocket expenditure will lead to increase in the neo-natal mortality rate of the Anglophone West African countries. This relationship is not consistent with *a priori* expectation. In addition, there

is evidence that Gini coefficient and current health expenditure have a negative relationship with neo-natal mortality rate. This implies that increases in Gini coefficient and current health expenditure will lead to decrease in the neo-natal mortality rate of the Anglophone West African countries. The negative relationship between Gini coefficient and neo-natal mortality rate is not consistent with the *a priori* while that of CHE is.

Furthermore, from the magnitude of the parameter estimates, there is evidence that a 1 percent increase in GDP per capita and out-of-pocket expenditure will lead to 0.175 and 0.378 percent increase in neo-natal mortality rate, respectively while a 1 percent increase in Gini coefficient and current health expenditure will lead to 6.630 and 0.114 percent decrease in neo-natal mortality rate, respectively.

Table 3 also show the estimated long-run coefficients (elasticities) for the fourth model. In the long run, there is evidence that GINI coefficient has positive relationship with infant mortality rate. This implies that increases in GINI coefficient will lead to increase in the infant mortality rate of the Anglophone West African countries. In addition, there is evidence that GDP per capita, out-of-pocket expenditure, and current health expenditure have a negative relationship with infant mortality rate. This implies that increases in GDP per capita, out-of-pocket expenditure, and current health expenditure will lead to decrease in the infant mortality rate of the Anglophone West African countries.

Based the magnitude of the parameter estimates, there is evidence that a 1 percent increase in GINI coefficient will lead to 3.512 percent increase in infant mortality rate, while a 1 percent increase in GDP per capita, out-of-pocket expenditure, and current health expenditure will lead to 0.424, 0.480, and 0.332 percent decrease in infant mortality rate, respectively.

There is evidence of a long-run significant relationship of out-of-pocket expenditure, Gini coefficient and current health expenditure with maternal mortality rate of the Anglophone West African Countries (LOOPE= 0.2125, t-test= 2.170, $\rho<0.05$; LGINI= 4.625, t-test= 4.105, $\rho<0.05$, and LCHE = -0.261, t-test= -3.017, $\rho<0.05$). This implies that out-of-pocket expenditure, Gini coefficient and current health expenditure are significant factors influencing changes in the maternal mortality rate of the Anglophone West African Countries. Conversely, there is evidence that GDP per capita do not have a long-run significant relationship with the maternal mortality rate of the selected Anglophone West African Countries (LGDPPC = 0.766, t-test = 1.396, $\rho>0.05$). Thus, GDP per capita is not a significant factor influencing changes in the maternal mortality rate of the Anglophone West African Countries.

The Adjusted R-square is 0.594; this implies that GDP per capita, out-of-pocket expenditure, Gini coefficient and current health expenditure explains about 59 per cent changes in maternal mortality rate, while the remaining 41 per cent were other factors affecting changes in maternal mortality but were not captured in the model.

To test the hypothesis for objective one, the F-statistics of 49.12 was used and it is statistically significant at 5 per cent level, thus on the overall, the null hypotheses that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do not significant influence maternal mortality in the Anglophone West African countries were rejected, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence maternal mortality in the Anglophone West African countries.

4.5 Discussion of Findings

The first hypothesis of the study examines the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on maternal mortality rate in the Anglophone West African Countries for the period of 2000-2019. The result of the study reveals that in the long-run, GDP per capita, out-of-pocket expenditure, and Gini coefficient have positive relationship with maternal mortality rate while current recurrent expenditure has a negative relationship with maternal mortality. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out- of- Pocket health expenditure, income inequality, and current health expenditure do not significantly influence maternal mortality rates in the Anglophone West African Countries, and accept the alternative that per capita gross domestic product, Out- of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence maternal mortality rates in the Anglophone West African Countries.
Some empirical studies corroborate this result. For instance, Hu, van Lenthe & Mackenbash (2015) investigated income inequality, life expectancy, and cause-specific mortality in 43 European countries in the period 1987–2008. There were significant associations between income inequality and many mortality indicators were found in pooled cross-sectional regressions, indicating higher mortality in countries with larger income inequalities. Once the country fixed effects were added, all associations between income inequality and mortality indicators became insignificant, except for mortality from external causes and homicide among men, and cancers among women.

The second hypothesis of the study examined the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on under-5 mortality rates in the Anglophone West African Countries for the period of 2000-2019. The result shows that in the short-run GDP per capita has a positive relation with under 5 mortality rates while Out- of- Pocket health expenditure, income inequality, and current health expenditure have negative relationship with under 5 mortality rates. The result of the study reveals that there is evidence that Gini coefficient and current health expenditure have positive relationship with under-5 mortality rates while GDP per capita and out-of-pocket expenditure have negative relationship with under-5 mortality rates in the long run. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out- of- Pocket health expenditure, income inequality, and current health expenditure do not significant influence under-5 mortality rates in the Anglophone West African countries, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence under-5 mortality rates in the Anglophone West African Countries.

This evidence conforms with the result reported by Cevik & Tazar (2016) that examined the relationship between public spending on health care and health outcomes using cross-country comparison. They found government health spending as a share of GDP is negatively associated with a lower level of under-5 mortality rate. They also found significant and negative coefficients on several socio-political determinants such as the law and order, education level, population as well as income level as the main determinant. Compared to previous studies, they found the income level to be slightly less significant and the public health spending to be slightly more significant empirically. Bein, Unlucan, Olowu, & Kalifa (2017) examined the association between healthcare expenditures and health outcomes for eight East African countries. They found that healthcare had a stronger effect on improving life expectancy in females than in males. However, a negative relationship exists between healthcare expenditures and the number of neonatal, infant, and under-five deaths in the selected East African countries.(Okwu et al., 2021)

Also, Novignon and Lawanson (2017), examined the relationship between health expenditure and child health outcomes in 45 Sub-Saharan Africa between 1995 and 2011. The study shows a positive and significant relationship between health expenditure and child health outcomes with elasticities of -0.11 for infant mortality, -0.15 (under-five mortality), and -0.08 (neonatal mortality), health care spending was generally significant in influencing neonatal mortality. Total health spending showed a negative and significant (at 1 percent level) impact on neonatal mortality.

The third hypothesis of the study examines the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on neo-natal mortality rate in the Anglophone West African Countries for the period of 2000-2019. The result shows that in the short-run GINI coefficient and current health expenditure has a positive relation with neo-natal mortality rate while GDP per capita and out-of-Pocket health expenditure have negative relationship with neo-natal mortality rate. The result of the study reveals that there is evidence that GDP per capita and out-of-pocket expenditure have positive relationship with neo-natal mortality rate while there is evidence that Gini coefficient and current health expenditure have a negative relationship with neo-natal mortality rate in the long run. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do not significantly influence neo-natal mortality rates in the Anglophone West African Countries, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence neo-natal mortality rates in the Anglophone West African Countries.

The result is in consonant with evidence reported by Novignon and Lawanson (2017) that examined the relationship between health expenditure and child health outcomes in 45 Sub-Saharan Africa between 1995 and 2011. The study shows a positive and significant relationship between health expenditure and child health outcomes with elasticities of -0.11 for infant mortality, -0.15 (under-five mortality), and -0.08 (neonatal mortality), health care spending was generally significant in influencing neonatal mortality. Total health spending showed a negative and significant (at 1 percent level) impact on neonatal mortality.

A similar study by Kiross, Chojenta, Barker & Loxton (2020), on the effects of health expenditure on infant mortality in 46 countries sub-Saharan Africa between 2000 and 2015, revealed that the public and external health care spending showed a significant negative association with infant and neonatal mortality. However, private health expenditure was not significantly associated with either infant or neonatal mortality. The random-effects model was selected over the fixed effects model based on the Hausman test to assess the effect of health care expenditure on infant and neonatal mortality.

The fourth hypothesis of the study examines the effect of per capita gross domestic product, Out-of-Pocket health expenditure, Income inequality (GINI) on infant mortality rate in the Anglophone West African Countries for the period of 2000-2019. The result shows that in the short-run GDP per capita, out-of-pocket expenditure, GINI coefficient, and current health expenditure has a positive relationship with infant mortality rate. The result of the study reveals that there is evidence that GINI coefficient has positive relationship with infant mortality rate while there is evidence that GDP per capita, out-of-pocket expenditure, and current health expenditure have a negative relationship with infant mortality rate in the long run. In addition, the F-statistics rejects the null hypothesis that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do not significant influence infant mortality rates in the

Anglophone West African countries, and accept the alternative that per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence infant mortality rates in the Anglophone West African Countries.

Previous studies that support this evidence includes Ray & Linden (2018) which used a simultaneous three-equation model to determine the association between GDP per capita (GDPPC), infant mortality rate, and health expenditures for 194 countries. In the sample with three income level nation groups, GMM-2SLS estimate findings show that there are simultaneous decreasing infant mortality rate and growing GDPPC level impacts. When the effects of GDPPC and the number of doctors per capita are added together, health expenditures have a greater than one elasticity. In non-poor nations, an increase in income inequality as assessed by the GINI coefficient raises the infant mortality rate.

Also, Bein, Unlucan, Olowu, & Kalifa (2017), examined the association between healthcare expenditures and health outcomes for eight East African countries: Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. Panel data regression technique was employed in analyzing both cross-sectional and time-series information. Result reveals that strong, a positive association exists between total healthcare expenditures and total life expectancy. A positive relationship also exists between healthcare expenditures and female and male life expectancy. In addition, they found that healthcare had a stronger effect on improving life expectancy in females than in males. However, a negative relationship exists between healthcare expenditures and the number of neonatal, infant, and under-five deaths in the selected East African Countries.

5. CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

The study investigated the effect of income on health outcomes in the Anglophone West African Countries. Results of the dynamic heterogeneous panel regression show that Per capita gross domestic product, Out-of-Pocket health expenditure, income inequality, and current health expenditure do significantly influence maternal mortality, under-five mortality, neo-natal mortality and infant mortality in the Anglophone West African Countries. This confirmed that there is long-run equilibrium relationship between income and maternal mortality, under-five mortality, neo-natal mortality and infant mortality of the Anglophone West African countries.

This study, therefore concludes that per capita gross domestic income, out-of-pocket health expenditure, current health expenditure and income inequality have significant influence on maternal mortality, under- five mortality, neo-natal mortality and infant mortality in the Anglophone West African Countries.

5.2 Recommendations

1. Giving that out-of-pocket health expenditure, and government current health expenditure have significantly high impact on maternal mortality, health sector should be well funded and this can be achieved through increased allocation to the health sector. Salaries of health care worker should be adequately and promptly paid and policy makers in this sector should ensure better work environment is provided. Out-of- pocket health expenditure will drive people further into poverty and therefore should be discouraged or government cushions the effects on households.
2. governments of the Anglophone West African Countries to improve the income of their citizen and also bridge the gap of income inequality in the affected sub-region. Poor income

and large income differences have significantly damaging effects on health. Narrowing the gap of income inequality will require implementation of more inclusive income distribution strategies by the government. This will enable the health outcomes to improve because parents will be able to give food with high nutritional values to their children.

3. There is evidence of a long-run significant relationship of out-of-pocket expenditure and Gini coefficient with neo-natal mortality rate. Therefore, mothers' health should be given adequate attention because of the negative effect of poor health of mothers on neo-natal. This may reduce the number of fetuses deaths or malformation.
4. GDP per capita has a positive and significant relationship with infant mortality in the long run. As a result of the presence of long-run relationship between income and infant mortality, government and other policy makers in the health sector should put fiscal policy in place not only for the present period but also put future plans in place to improve the health sectors of the Anglophone West African Countries.

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