Environmental Quality and Health Effects In Nigeria: Implications for Sustainable Economic Development

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Abstract

It is wide knowledge that quality of environment has great impact on people's quality of health status. This study therefore empirically examines the relationship between environmental quality (proxied by carbon dioxide, CO_2) and health effect; and its implications for achieving sustainable economic development in Nigeria. The period in focus is 1980 to 2016 and the techniques of estimation employed to address the objective of the study are Dynamic Ordinary Least Square (DOLS) and Granger causality. The major findings are summarized as follow: CO_2 emissions and mortality rate are negatively but insignificantly related. However, total electric power consumption and mortality rate have a positive relationship which is significant at 5% level. This suggests an insufficiency in electricity consumption required to enhance people's quality of life and to promote good health. Fossil fuel combustion and mortality rate have a significant positive relationship. This suggests that combustion of fossil fuel is hazardous to human welfare. Finally, government health expenditure and mortality rate are significantly and positively related implying inadequacy of public health expenditure to promote good health.

Also, an existence of a unidirectional causality which runs from CO_2 emission to electric power consumption is observed. CO_2 emission granger causes government health expenditure. Life expectancy granger causes electric power consumption and fossil fuel consumption granger causes mortality rate. There is a unidirectional causal relationship flowing from life expectancy and mortality rate to government health expenditure. In the same vein, life expectancy granger causes mortality rate. Therefore, it is recommended that government formulates appropriate policies that will reduce mortality rate through a reduction in combustion of fossil fuel and CO_2 emissions, increase government health expenditure and ensure adequate electric power consumption. Also, policies and programs that will guarantee enhanced average life expectancy on a sustainable basis to ensure sustainable economic development should be encouraged in Nigeria.

Keywords – *Environmental Quality, Health Effects, Sustainable, Economic Development, Nigeria*

I. INTRODUCTION

A strong positive correlation between sufficient energy use and the development of an economy has been established in the literature (Afolayan et al, 2019; Alaali et al, 2015; Alege et al, 2016; Lu, 2017; Matthew et al, 2018). Equally, poor health outcomes in terms of low life expectancy and a subsequent high mortality have been attributed to low quality environment/environmental degradation attendant upon the use of dirty energy source in fossil fuel as well as intensive manufacturing and construction activities (Balan, 2016; Matthew et al, 2018; Matthew et al, 2019; Mesagan & Ekundayo, 2015). While growth in the economy is imperative, ensuring its achievement in a sustainable manner is of a necessity. United Nations Development Programme (UNDP) in January, 2016 came up with global goals (popularly called SDGs). Strategically placed at the third position of the SDGs is expectation on the part of every country to attain good health and well-being of its citizens by 2030. However, due to the activities of humans involving a high use of energy, threats to the environment have been on the increase causing poor health which can lead to reduced life expectancy and high rates of mortality. Alege et al (2017) noted that one of the highest producers and consumers of fossil

fuel (adjudged to be a major source of CO_2 emissions contributing to climate change) globally is Nigeria.

Emission of carbon dioxide which is a major gaseous component of fossil fuel combustion is identified to be a contributory factor to climate change as it multiplies and accumulates in the atmosphere (Sharma, 2017) thereby, deteriorating the quality of the environment which has serious implications for human health and the country's drive towards sustainable development. This follows from the fact that apart from negatively impacting human health and individuals' welfare, Balan (2016) posits that the effect of environmental degradation on the society is enormous by way of a substantial public health care financing. The challenge of poor health in a country will attract a greater proportion of the nation's budget allocation to redress the situation with high opportunity cost. While articulating the adverse effects of gaseous emissions on humans, Matthew et al (2018) identified children as the most susceptible age group due to their peculiar nature. Equally, Aman (2019) notes the severe health impact of dependence of rural India women on local biomass for the fulfillment of their energy needs due to non-availability of clean sources of energy and fuels.

Available statistics reveal an average of 47.76% of CO_2 emissions from transport alone in Nigeria between 2000 and 2014 (IEA, 2015). During the same period, estimates from UN inter-agency group for child mortality estimation show that under-5 mortality rate in Nigeria averaged 147.4% of 1000 live births (World Bank, 2017). Reports from WHO (2004) corroborate this stance when it was affirmed that every hour, 100 children die in developing countries as a result of exposure to indoor smoke from solid fuels. Equally, it also revealed the death of nearly 1800 people in developing cities everyday as a result of exposure to urban air pollution (WHO, 2004). Increased respiratory tract illness, asthma attacks and malfunctioning of the lungs are a few of the ailments that have been attributed to emitted gaseous substances such as Ozone, SO_2 and NO_2 (Matthew et al, 2018). Difficulties in breathing, death due to cardiac arrest and also lung cancer have equally been associated with the repercussions of air pollution (Oguntoke & Adeyemi, 2017). Gaseous emissions are noted to hinder economic activities especially, in the agricultural sector. Behera et al (2017); Jiang and Li (2017) posited that increased gaseous emission threatens an economy due to its ability to bring about a massive agricultural output decline. This has implications for food security and employment generation which are major in sustainable development goals.

Good health condition is germane for the growth and development of any nation since it is practically and virtually not possible to engage in any economic activity without good health (Matthew et al, 2015). Due to the popular sayings that "health is wealth" and that "a healthy nation is the one wealthy", the aforementioned effects of environmental degradation and air pollutants especially, on health of children has implications for the management of environmental sustainability and adoption of measures aimed at controlling climate change. This is with a view to averting any imminent shock and ensuring the achievement of sustainable economic development in the long-term perspective. Resulting from the above, the study seeks to investigate the effect of environmental quality (proxied by carbon dioxide emissions) on aggregate health outcome (employing child mortality rate as a proxy variable). It also probes the causal relationships among the variables of interest in the specified model in Nigeria as the country matches towards 2030 in a bid to realize sustainable economic development that the generations yet unborn can be proud of.

The remaining parts of the paper as a follow up to this introductory section include: section two which presents a brief overview of the related literature; section three deals with the theoretical framework and the methodology adopted for the study. The focus in the fourth section is presentation of results of the econometric analysis and discussion, while section five (the last section) concludes the study and provides policy recommendations for ensuring environmental quality and mitigating the effect of gaseous pollutants for positive health outcomes and sustainable economic development.

II. BRIEF OVERVIEW OF RELATED LITERATURE

In this section, attempts are made to review previous empirical studies that are related to the study. The review is done specifically on the environment-health relationship with focus on the link between socio-economic variables and health on one side, as

well as environmental quality and health outcomes on the other. Consequently, Yazdi et al (2014) through the employment of auto-regressive distributed lag (ARDL) technique investigated the role of environmental quality and income on health expenditures between 1967 and 2010 in Iran. A long run co-integration was found to exist among the variables in the specified model. Furthermore, it was revealed that income and the pollutants (that is, sulphur oxide and carbon monoxide) have a correlation with health expenditures both in the short run and long run. This indicates that mitigating the effects of the pollutants requires adequate public health investments. Equally, Assadzadeh et al (2014) examined the determination of per capita health expenditures in OPEC countries between 2000 and 2010 based on environmental quality and life expectancy at birth. The outcome shows a direct relationship between CO_2 emissions and health expenditures, while a negative correlation is found to exist between life expectancy at birth and health expenditures in the short run.

Matthew et al (2018) used ARDL approach and established a negative correlation between greenhouse gas (GHG) emissions and health outcomes in Nigeria. Specifically, the evidence reveals that a 1% increase in GHG emissions reduces life expectancy at birth by 0.042% in Nigeria. In the same vein, Declercq et al (2011) asserts that reducing industrial pollution which remains the major cause of air pollution in the main cities in Europe will raise life expectancy at birth to a period of approximately two years. On the same page, Al-Mulali et al, (2012); Behera et al (2017); Odusanya et al, (2014) also observed that an increase in CO_2 rate is dangerous to the health status. For instance, Odusanya et al (2014) investigated how per capita CO_2 emissions affect real per capita health expenditure in Nigeria for the period 1960 to 2011. The conclusion from the study shows that as CO_2 emission rises, health expenditures significantly increase both in the long run and short run. Equally, Aye et al (2017); Phimphanthavong (2013) submitted that the decline in environmental quality due to increasing clamour for high growth rate in countries may impair population's health in the current period and may be sustainable in the long term perspective.

Using cross-sectional data from 49 counties of Canada, the study of Jerrett et al (2003) on the link between environmental quality and health care spending concludes that higher per capita health expenditures are associated with counties with higher pollution while, counties that have more environmental budget significantly pay lower health expenditures. This suggests that nations that are proactive and attach more priorities to quality environment through adequate environmental budget allocation may likely not suffer from serious health issues that require high health financing thus, implying a high positive correlation between environmental degradation and population's health outcomes. Equally, Narayan and Narayan (2008) evaluated per capita health expenditures-environmental quality nexus in eight OECD countries between 1980 and 1999 both in the short run and long run. Using panel co-integration approach, the outcome reveals a long run relationship among all the selected variables. It was further revealed that carbon monoxide and sulphur oxide emissions are positively related to health expenditures.

Analysis of the causal relationship between environmental degradation and mortality rates in India between 1971 and 2010 remains the concern of Sinha (2014). The outcome shows a bidirectional causal relationship between infant mortality rate and growth in CO_2 emission as well as between growth in gross capital formation and child mortality rate. The study of Balan (2016) for the period 1995 to 2013 in 25 EU countries however shows that the energy consumption source of CO_2 matters in the determination of the relationship between environmental quality and health outcomes. Balan (2016) employs panel least squares technique and reveals that while a bidirectional relationship exists between health outcome (life expectancy) and CO_2 emissions sourced from natural gas and petroleum in 25 EU countries, there is no significant causality relationship from coal-sourced CO_2 emissions to life expectancy at birth. He adduced this outcome to significant and large decreases in the consumption of coal in 28 EU countries since the beginning of 1990s. The substitutability of fossil fuels with renewable energy sources such as hydropower, solar energy, wind power and biofuels is being witnessed in these countries (Balan, 2016; Eurostat, 2015). This implies that adopting a measure aimed at reducing the exploration and use of an energy source which is a major contributor to environmental degradation has the potential to stem and nip in the bud health issues in a country.

It is evident in the reviewed studies that declines in environmental quality has implications for deteriorating the population's health status thereby, placing a huge demand on health expenditures. Most reviewed studies either adopted life expectancy at birth or health expenditures as proxy variable for health. It is worthy of note that studies that employed mortality rates while examining environmental quality-health relationship especially in Nigeria are scarce. This study seeks to contribute to the literature by adopting under-5 mortality rate as an outcome of all measures put in place to enhance population's health while investigating environmental quality-health effects link in Nigeria for the period 1980 to 2016. This way, the study will be distinguished from the ones conducted in the past.

III. METHODOLOGY

A. Theoretical Framework

Evidently, increased energy use causes enhanced economic growth and development. However, the rising by-products of energy leading to externalities in the form of environmental deterioration are known to have adverse effects on individuals' health and the society at large. Balan (2016) noted that the amount of atmospheric CO_2 has risen by about 35% in the industrial era. This increase has been associated with human activities in combustion of fossil fuel, bush burning and removal of forests amongst others (Balan, 2016) which has implications for climate change (IPCC, 2007) and consequent global warming. This suggests that putting in place adequate measures to reduce exploration and the use of energy source that is a major contributor to environmental degradation has the potential to stem down and nip in the bud health issues in any country.

The theoretical framework for the study following Keeler et al (1971); Selden and Song (1995); Stokey (1998), is premised on optimal growth models which build on Ramsey (1928) model, as extended by Koopmans (1965) and Cass (1965). According to Drabo (2011), these are dynamic optimization models which solve the utility maximization problem of the infinitely-lived consumer/agent using the techniques of optimal control theory. Some of the optimal growth models considered the effects of pollution on growth path while others focused on natural resources depletion (Drabo, 2011). This implies that achievement of optimal pollution control and hence, improved environmental quality rests with some abatement or curtailment of growth by lowering the consumption of energy (e.g. fossil fuel) which is considered to be a major cause of environmental degradation through the accumulation of gaseous pollutants in the atmosphere. Pearce and Watford (1993) argued that optimal pollution control requires a lower level of growth than would be achieved in the absence of pollution (Drabo, 2011).

B. Model Specification and Sources of Data

The major objective of this study is to investigate the relationship between environmental quality (proxied by CO_2 emissions) and health effects (proxied by mortality rate) in Nigeria between the period of 1980 to 2016. Hence the model for the study, likened to Matthew et al (2018) and Matthew et al (2019) is represented by equations (1) and (2) in its implicit and explicit forms as follow:

$$MoT = f(CO_2, GHE, ELCON, FFC, LE)$$

$$MoT_t = \beta_0 + \beta_1 CO_{2t} + \beta_2 GHE_t + \beta_3 ELCON_t + \beta_4 FFC_t + \beta_5 LE_t \quad (2)$$

The variables are described as follow and sources of data used for the analysis are provided:

MoT: Under-5-mortality rate (per 1,000 live births) measures health effect. Data were sourced from World Bank (2017) as estimated by UN Inter-agency Group for Child Mortality Estimation (that is, UNICEF, WHO, World Bank, UN DESA Population Division).

CO_2: Carbon dioxide emissions (in kiloton) due to solid, liquid and gas fuel consumption, bush burning, construction and manufacturing of cement, primary/fossil fuel consumption, and so on. It is expected that increased CO_2 emissions will lead to increased health challenges which may lead to increasing rate of mortality among the citizens. Source of data for the variable is the database of U.S. Carbon Dioxide Information Analysis Center.

GHE: Government health expenditure represents the proportion of total government expenditure spent

on health (expressed in per cent). Increased healthcare expenditure would logically, be linked to some kind of health benefit. Therefore, it is expected that as CO_2 emissions rise the probability of increasing mortality rate is equally high. Data were sourced from CBN Annual Report and Statement of Account, various issues.

$ELCON$: Total electric power consumption measured as total net consumption (that is, gross consumption minus consumption of the generating units). It is determined in kilo-watt (kWh) per capita. Data were obtained from the database of International Energy Agency (IEA).

FFC: Fossil fuel energy consumption (percentage of total energy consumption) refers to the burning of fossil fuel including coal, oil, petroleum and natural gas products. High fossil fuel combustion is assumed to be the main contributor to gaseous pollutants concentration in the air. Collection of data was from International Energy Agency, IEA database.

LE: LE at birth is the number of years new-born children will live assuming the mortality risks prevailing for the cross section of the population at the time of their birth were to remain the same throughout their life. According to Chen and Ching (2000), its derivation is from obtaining the average age of all individuals who die in a certain year. The collection of data was from the database of the World Bank's World Development Indicators (WDI). It is expected that as average life expectancy increases, the rate of mortality would fall.

C. Estimation Method

The analyses in this study are in phases. First, the order of integration of the time series were established through the conduct of the unit root/stationarity test using augmented dickey fuller (ADF) and Phillip Perron's (PP) tests. This was in a bid to avoid nonsensical/spurious regression. Second, Johansen and Juselius (1990) multivariate co-integration test was utilized to confirm the long run relationships of the variables and hence, establish the model's sustainability in the long run. Third, we adopted dynamic OLS (DOLS) technique to obtain the parameter estimates. The technique of DOLS is efficient (unlike the conventional OLS) in obtaining the parameter estimates in the face of endogeneity of the explanatory variables because it adds the leads and lags to the analysis. In other words, DOLS takes care of the biases due to small sample size and endogeneity of explanatory variables by taking the leads and lags of the first-differenced regressors. Finally, pair wise granger causality test was utilized to investigate causality relationships between pairs of variables in the specified model.

IV. RESULTS AND DISCUSSION

Table I presents the descriptive statistics of the adopted time series from 1980 to 2016. Descriptive statistics reveal the characteristics of the employed variables in the study:

Table I: Descriptive Statistics of Annual Data Series (1980-2016)

Descriptive Statistics	CO_2	ELCON	GHE	LE	MoT	FFC
Mean	70400.94	100.0514	2.990571	47.67334	182.5229	19.63000
Median	69893.00	90.83000	2.400000	46.32000	202.1000	19.71000
Maximum	106068.0	156.7300	7.300000	52.62000	214.5000	22.84000
Minimum	35200.00	50.87000	1.100000	45.55000	111.6000	15.89000
Std. Deviation	24140.69	26.99083	1.714216	2.242528	34.94500	1.636799
Skewness	-0.066814	0.522430	0.835393	1.118065	-0.785697	0.088005

Kurtosis	1.545724	2.317752	2.628861	2.708206	2.086872	2.437245
Jarque-Bera	3.110296	2.270911	4.271848	7.416233	4.816994	0.507022
Probability	0.211158	0.321276	0.118135	0.024524	0.089950	0.776071
Sum	2464033	3501.800	104.6700	1668.567	6388.300	687.0500
Sum. Sq. Deviation	1.98E+10	24769.17	99.91019	170.9837	41519.20	91.08980
Observation	35	35	35	35	35	35

Source; Authors` computations (2019)

As shown, Table I provides useful information about the sample series such as the mean, median, minimum and maximum values; and the distribution of the sample measured by the skewness, kurtosis and Jaque-Bera statistics. The mean and median values of fossil fuel consumption, life expectancy, government health expenditure are almost identical. However, the mean and median values of CO_2 emission, total electric power consumption and mortality rate are little bit far from each other. This implies that the data set is fairly distributed. In the same vein, the value of Kurtosis of all the dataset is not far from 3 and positive values of the majority of the variables show that the distribution of the data is fairly symmetrical. Therefore, these data could be used for econometric analysis since assumption of normal distribution of the data set has been established following the Jaque-Bera result with the probabilities.

Regression analysis started by investigating the stationarity of the time series adopted in the study. In order to validate the existence or otherwise of stationarity of time series data of the variables, it is expedient that the data were subjected to a unit root test. For robustness, this was achieved by employing the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Table II presents the outcome as shown:

Table II: Results of Unit Root Test

Variables	ADF Test			PP Test		
	Level	First Difference	Remarks	Level	First Difference	Remarks
C02	-2.945842**	-2.948404**	I (1)	-2.945842**	-2.948404**	I (1)
ELCON	-2.951125**	-2.954021**	I (1)	-2.951125**	-2.954021**	I (1)
GHE	-2.945842**	-2.951125**	I (1)	-2.945842**	-2.948404*	I (1)
LE	-2.957110**	-2.957110**	I(1)	-2.945842**	-2.948404**	I(1)
MoT	-2.951125	-2.951125	I(1)	2.945842	-2.948404	I(1)
FFC	-2.951125	-2.954021	I(1)	-2.951125	-2.954021	I(1)

Source; Authors` computations (2019) ** 5% level

The findings from the various tests as reported in Table II indicate that all the series were stationary after first differencing. This established that the variables under consideration for this analysis possess

unit root hence, we could not reject the null hypothesis of no unit root at levels for all the series. Thus, they were integrated at order 1 (that is, I(1)).

Having established that the variables are all integrated at order 1 (i.e. I(1)), the study proceeded to examine whether there exists a co-integration among the variables. Due to the fact that the variables have unit root they might show deviation in the short run, yet they could have a long run equilibrium relationship. In order to examine the existence or otherwise of the long run convergence of the variables, the study utilized Johansen and Juselius (1990) multivariate co-integration test and the outcomes presented in Table III.

Table III: Johansen Co-integration Tests (Trace Statistics) and (Maximum Eigenvalue)

Null Hypothesis	Eigen value	Trace Statistics	P-value	Maximum Eigenvalue	P-value
r=0	0.897471	174.7354	0.0000	75.16105	0.0000
r≤1	0.720686	99.57439	0.0000	42.08884	0.0042
r≤2	0.539828	57.48555	0.0048	25.61312	0.0875
r≤3	0.452368	31.87243	0.0284	19.87100	0.0743
r≤4	0.260325	12.00143	0.1569	9.950951	0.2152
r≤5	0.060245	2.050482	0.1522	2.050482	0.1522

Source; Authors` Computations

The results of the tests shown in Table 3 indicate the existence of at most five co-integrating vectors in the systems from the Eigen value and the maximum Eigen statistics. Hence, the variables of interest in this paper have a long run equilibrium relationship with one another, though they might likely show some adjustment to short run disequilibrium. With the confirmation of the existence of co-integration which establishes the model's sustainability in the long run, the study proceeds to obtain the parameter estimates using the technique of dynamic OLS (DOLS). Table IV provides the findings as follow:

Table IV: Dependent Variable: MORTALITY_RATE__UNDER_5_

Method: DOLS

Variable	Coefficient	t-statistics	P-value
CO_2	-3.66E-05	1.361238	0.2007
ELCON	0.116332**	2.241522	0.0466
LE	-14.38269*	17.72011	0.0000

FFC	1.155130*	3.556583	0.0045
GHE	1.527462***	1.886408	0.0859
R-Squared	0.999369		
Adjusted R-Squared	0.998221		

Source; Authors` Computations ***Significant at 10%, **Significant at 5%, *Significant at 1%,

From Table IV, observations made and their explanations are as follow: CO_2 emissions have a negative and statistically insignificant effect on mortality rate in Nigeria. This implies that the emission of CO_2 in aggregate does not significantly contribute to high rate of under-5 mortality in Nigeria; the reason for this might be connected with less industrial activities in the country. This suggests that under-5 mortality may have been due to the functioning of the health system which is at the sub-optimal level. Public expenditure earmarked to the health sector is grossly inadequate thereby, leaving most health related issues to out-of-pocket financing. Total electric power consumption however, is positively and significantly related to under-5 mortality rate at 5% level of significance. A unit change in total electricity consumption as observed from the findings brings about approximately 0.17% increase in mortality rate in Nigeria. This implies that total electric power consumption significantly heighten mortality in the country. This might be the result of the comatose state of the power sector and epileptic supply of electricity in the country. Following from Afolayan (2019), inadequate supply of electric power can lower the performance of the health sector through an inefficient use of high-powered hospital machines and equipment for curing and managing life-threatening ailments and diseases thus, reducing quality manpower needed for positively impacting economic development in a sustainable manner.

Life expectancy has a negative and significant relationship with mortality rate in Nigeria as expected and observed from the literature. This implies that as life expectancy rises by 1 year, probability of under-5 mortality (per 1000 live births) will reduce by 14.38% in the country. Furthermore, fossil fuel consumption has a positive and significant relationship with under-5 mortality rate and this is significant at 5% level. A unit change in fossil fuel consumption brings about a significant increase of approximately 1.16% in mortality rate. This implies that the consumption of fossil fuel is hazardous to human welfare in the country. Finally, government health expenditure has a positive and significant relationship with mortality rate at 10%. A unit change in government expenditure brings about 1.5% increments in mortality rate in the country. The reason why this study does not conform to the a priori expectation might be as a result of the inadequate funding of the Nigerian health sector on one hand and on the other, the embezzlement of public funds by public office holders in the various sectors of the economy, in which the health sector is not insulated. In specific terms, government cannot be said to be performing well in the health sector with regards to its expenditure. Government health expenditure has never reached 10% of its total expenditure in spite of the nation's population of close to 200 million people and its annual growth rate of approximately 2.8%. This has incapacitated the health system in tackling many health challenges as they evolve and also, cater for the generality of near 200 million people. However, the explanatory variables which are CO_2 emissions, electric power consumption, life expectancy, fossil fuel consumption and government health expenditure jointly explained about 99% of the systematic variations in the dependent variable (under-5 mortality rate) in the model, leaving 1% unexplained as a result of random chance. This signifies that the model utilized for this analysis is a good one.

The outcomes of the causal relationships between pairs of variables employed in the model using pair wise granger causality test are presented in Table V as follow:

Table V: Causal Relationships between Variables of Interest (Pairwise Granger Causality Test)

Sample: 1980 2016

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ELCON does not Granger Cause CO_2	33	0.10331	0.9022
CO_2 does not Granger Cause ELCON		5.81886	0.0077
GHE does not Granger Cause CO_2	35	1.13697	0.3342
CO_2 does not Granger Cause GHE		5.25688	0.0110
LE does not Granger Cause CO_2	35	2.80647	0.0763
CO_2 does not Granger Cause LE		0.72989	0.4903
MoT does not Granger Cause CO_2	35	4.08110	0.0271
CO_2 does not Granger Cause MoT		5.41066	0.0099
LE does not Granger Cause ELCON	33	6.13561	0.0062
ELCON does not Granger Cause LE		2.19390	0.1303
MoT does not Granger Cause ELCON	33	6.20663	0.0059
ELCON does not Granger Cause MoT		7.15303	0.0031
MoT does not Granger Cause FFC	33	0.74670	0.4831
FFC does not Granger Cause MoT		3.30442	0.0515
LE does not Granger Cause GHE	35	10.5014	0.0003
GHE does not Granger Cause LE		2.05408	0.1459
MoT does not Granger Cause GHE	35	12.0203	0.0001
GHE does not Granger Cause MoT		1.86272	0.1728

MoT does not Granger Cause LE	35	17.3889	1.E-05
LE does not Granger Cause MoT		9.25208	0.0007

Source; Authors` Computations

This section examined the direction of causality between pairs of variables of interest in the study regarding the relationship between environmental quality and health effects in Nigeria within the context of Pair wise Granger Causality Test. The results presented in table 5 show that there is an existence of a unidirectional causality which runs from CO_2 emission to electricity consumption in Nigeria. People's awareness of the danger inherent in accumulating CO_2 in the atmosphere through the combustion of fossil fuel and other non-renewable energy may induce them to opt for electric power usage, which is a cleaner and renewable source of energy. A unidirectional causality flows from life expectancy to CO_2 and also, to government health expenditure. CO_2 emission equally granger causes government health expenditure. High life expectancy will induce people to continue to engage in more economic activities which may enhance the accumulation of CO_2 in the air. Mitigating its effects for improved health and quality human capital therefore, requires more public expenditures in the health sector for achieving sustainable economic development.

A bi directional causal relationship is established between mortality rate and electricity consumption in the country. Life expectancy granger causes electricity consumption in the country. However, there is the presence of unidirectional causality from life expectancy to mortality rate. Fossil fuel consumption granger causes mortality rate. There is a unidirectional causal relationship flowing from life expectancy to government health expenditure. Mortality rate granger causes government heath expenditure and life expectancy granger causes mortality rate. The results also exerted a bidirectional causal relationship between health effect (i.e. under-5 mortality rate) and CO_2 emissions in agreement with the findings of Sinha (2014). Sinha (2014) observed a feedback relationship between growth in CO_2 emissions and infant mortality rate in India between 1971 and 2010.

V. CONCLUSION AND POLICY RECOMMENDATIONS

This study examined the relationship between environmental quality (proxied by CO_2 emissions) and health effects in Nigeria over the period of 1980 to 2016. Consequently, the major findings in this study are summarized as follow. Environmental degradation caused by CO_2 emissions and has a negative and insignificant effect on health outcomes in Nigeria. Similarly, total electric power consumption and mortality rate have positive relationship which is significant at 5% level. This implies that electric power consumption is not sufficient to contribute to welfare improvement in the country. Most activities that can result to enhanced standard of living rely mainly on electricity usage which in itself is comatose and not in adequate supply in Nigeria. Life expectancy is negatively and significantly related to mortality rate. Fossil fuel consumption and mortality rate have a significant positive relationship. This implies that the consumption of fossil fuel is hazardous to human health and welfare in the country. Finally, government health expenditure and mortality rate have a significant positive relationship. Also, there is an existence of a unidirectional causality which runs from CO_2 emission to electric power consumption; CO_2 emission granger causes mortality rate as well as government health expenditure. The more deteriorated the environment is through increased CO_2 emissions, the more negatively impacted is the people's health and the greater the public expenditure that is required for medical care.

There is a bi directional causal relationship between mortality rate and electric power consumption in the country. Life expectancy granger causes electric power consumption in the country. However, there is the presence of unidirectional causality from life expectancy to mortality rate. Fossil fuel consumption granger causes mortality rate. There is a unidirectional causal relationship flowing from life expectancy to government health expenditure. In the same vein, mortality rate granger causes government heath

expenditure. This suggests that adequate government expenditure to the health sector is essential for achieving effective health outcomes through increased life expectancy and reduced mortality. Due to the crucial findings that originated from this study, it could be recommended that the policy makers in Nigeria should embark on appropriate environmental policy measures that will reduce consumption of fossil fuel as well as mitigate the negative effect of CO_2 accumulation in the air and thereby enhance health outcomes, an increase in government health expenditure to make health care accessible and affordable to the most down-trodden citizen when the need arises for it, as well as increased electric power consumption in the country. Also, the policies and programs that will guarantee an increase in life expectancy on a sustainable basis should not be undermined by the policy makers.

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