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DEMOGRAPHIC AND ENVIRONMENTAL FACTORS ON WOMEN'S HEALTH OUTCOME IN NIGERIA

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ABSTRACT: *Despite the improvement in health status and health expenditure in Nigeria, health outcomes measured by the life expectancy rate remains low. This paper investigates the relationship existing between environmental factors and female life expectancy in Nigeria. Using annual time series data for the period 1990–2019 from the World Bank databases, evidence of poor environmental factors of sanitation, carbon dioxide emission and low access to electricity was found over the period. Johansen cointegration regression analysis results affirmed the presence of a long-run relationship among the variables while the result of the vector error correction model indicates that in the short run, environmental factors of access to electricity and carbon dioxide emission, from the use of petroleum-derived fuels as an energy cooking source, have a negative relationship with life expectancy. Demographic factors also exhibit a negative relationship with life expectancy; the lag of fertility rate has a negative effect on female life expectancy. We conclude that women's health outcomes are associated with their demographic and environmental factors which have a significant impact on their life expectancy. There is a need for the government to make plans on improving demographic factors towards improving female life expectancy in Nigeria.*

KEYWORDS: Mortality Rate, Fertility Rate, Life Expectancy, CO2 Emission, Women.

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INTRODUCTION

The health outcome is a good measure of economic development and structure of a nation (Sen, 1993). Life expectancy is a measure of health representing the average number of years a newborn is expected to live if mortality pattern at the time of birth remains the same in future (World Bank, 2017). It has steadily increased in most parts of the world (Kabir, 2008) through decline in mortality associated with improvement in health, socio-economic development, changing institutional structure, improved medications and increased awareness (Cutler & Meera, 2013). Peoples' higher life span and healthier lifestyle have been attributed to significant advancement in medicine and the reduction of communicable diseases which have outpaced the last three decades (WHO, 2013); however, it has not slowed down adult mortality in poor countries (WHO, 2016).

The level of variability of life expectancy has important implications for individuals and aggregate human behaviour across countries as life expectancy reflects the health of a country's people and the quality of healthcare they receive when they are ill. Lower life expectancy is associated with developing countries especially in sub-Saharan Africa while higher life span is recorded in developed countries. The improvement of human's health is an important factor for sustainable development (Bayati, Akbarian & Kavosi, 2013). The CIA World Factbook (2015) indicated that across the world in 2015, Monaco ranked 1st as the country with the highest female life expectancy of 89.52 years while Chad was the lowest, ranking 224th with 49.81 years; Nigeria with the highest population in Africa ranked 213th with 53.02 years. African countries lagged behind with 61.6 years which is below the 74.1years of the world. Female life expectancy in Africa is relatively linked with issues of high mortality and morbidity which has a direct relationship with demographic factors of fertility rate and population dynamics.

In Nigeria, despite improvements in components of demographic factors over the years, data from the World Bank revealed that fertility remains high at 5.5 childbirth per woman in 2017, infant mortality stands at 64.6 live birth per 1,000 childbirth while the pandemic of HIV/AIDS has also added severe strain on the health status of people with 53.9% of the women within age 15 years and above living with the syndrome. Akanni and Uche Isiugo-Abanihe (2014) identified that most of Nigeria's developmental problems are linked with issues of rapid population which is determined by demography factors of fertility among women. They stated that despite slight improvement in child survival in Nigeria over past years, issues of high fertility have not reduced, with many women having more children than they desired due to their inability to choose the time and space of reproduction.

The low life expectancy in Africa has often been related to mismanagement of environmental resources, pollution and anthropogenic climate change (Patz et al., 2005). Various studies on health revealed that the quality of an environment is important as it affects morbidity and health status of the people as issues of air pollution, sea/water pollution, depletion of land and its mineral resources, soils deterioration and climatic change are all capable of reducing longevity by raising mortality (Evans & Smith, 2005). Consequently, The World Health Organization (WHO) 2015 identified that the burning of wood, emission, pollution of fossil fuels and the release of climate pollutants cause significant changes in longevity.

A clear knowledge of potential trajectory factors in health is crucial to guiding long-term investments and developmental policy implementation. Hussain (2002) asserted that factors of

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income, educational level, healthcare spending, urbanization, access to safe drinking water, and nutritional outcomes have been found to be significant determinants of life expectancy in developing countries. These factors are shaped by the distribution of income, resources and pattern of life which are influenced by policy choice. UNECA (2011) asserted that climate change is expected to alter temperature, air movement, and precipitation in various ways and to varying degrees across Africa with consequences for human health. With the strong connection between population health, economic and environmental health, the impact of climate change and demographic factors may impede the development of the African continent through its effect on the life expectancy of the people.

Statistics of the World Bank revealed that female life expectancy of 53.7 for Nigeria in 2015 is relatively lower than most countries in Africa especially that of West African regions; Ghana recorded 63.4 years, Benin had 62.1, Togo 60.7, Mali 58.1, Niger 60.7, and Senegal stood at 68.6. Although other countries had moderate improvement regarding female life expectancy in 2019, only slight improvement was recorded in Nigeria with a rise to 55 years; thus, it becomes imperative to understand factors affecting female life expectancy in Nigeria with focus on demographic and environmental factors which generally affect women in their day to day activities and living.

This paper considers the effects of demographic and environmental factors on female life expectancy in Nigeria with focus on ascertaining the short and long run relationship existing between the variables. Following this section is section two with a brief review of literature on the conceptual, theoretical and empirical literature. Section three covers the research method, section four presents the discussion of findings and section five discusses the conclusion of the study.

LITERATURE REVIEW

Life Expectancy in Nigeria

Life expectancy is longer for women than men across the world and in Nigeria, this fact remains valid with women's life span being slightly higher than men's. The World Health Organization (2019) report indicates that the difference is partly due to an inherent biological advantage for the female and also part of behavioural differences between men and women. In 2017, the World Bank recorded that life expectancy for Nigerian females stood at 53.75 years while that of men was 53.01 years. Although females live longer than men, their health is poor due to challenges faced during their reproductive years. Female reproductive issues of fertility rate and maternal mortality have been considered important in determining the years of existence of a woman. Women's longevity advantages over men become apparent in old age due to the capability of women in home management and the result of lower lifetime risk behaviours such as drinking of alcohol and smoking.

Although statistics on female life expectancy as reported by World Health Organization (2019) revealed that improvement has been recorded over the years from 47.1 years in 1990 to 49 years in 2005 and estimated as 55.16 years in 2018, yet, Nigeria ranks among the lowest countries in terms of life expectancy in Africa and at the regional west Africa level. Nigeria's health sector is challenged with multifaceted problems involving poor finance, inadequate technology, shortage of medical practitioners, inadequate infrastructures, inadequate funding,

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weak public health research, poor record keeping, and lack of training among others, which have an adverse effect on the life expectancy of the people.

Living a healthy and long life has attracted attention from many scholars in both developed and developing countries over the decades. The transformation taking place in the digital and information revolution through advancement in technology was observed by authors like Deloitte (2014) to contribute to life expectancy in developed countries. Developing countries associated with the use of biomass energy have been found with low life expectancy as rising use of biomass across households has an effect on longevity. Rural households are particularly dependent on traditional biomass, but many urban households cook with it as well, mainly in the form of charcoal. Usage of biomass at homes has consequences on the health of people especially under-five children who are often prone to diseases in early life. Across households in sub-Saharan Africa, poor women with children pay heavy prices spending much of their time at home breathing in smoke from coal and wood cook stoves as a result of conventional cooking methods. Unexpected changes in energy prices, including prices for gasoline and heating fuel (natural gas and electricity), often increase the use of conventional cooking methods and affect food access at the household level (Charlotte & Timothy, 2017).

Comparative analysis of Nigeria's female life expectancy with others revealed Nigeria has lower life expectancy behind that of the global world, sub-Saharan Africa, lower-middle income and the lower income groups (Table 2.1).

Table 2.1. Female Life Expectancy Rates Across the World (1990–2019)

Years	World	Sub-Saharan Africa	Lower-Middle Income Countries	Lower-Income Countries	Nigeria
1990	67.75	51.95	60.70	52.24	47.19
1995	68.71	51.86	62.47	53.24	47.01
2000	69.87	52.09	64.11	55.01	47.19
2005	71.16	54.35	65.88	58.01	49.03
2010	72.84	58.27	68.02	61.47	51.66
2015	74.27	61.66	69.86	64.12	53.97
2019	75.05	63.41	70.89	65.63	55.62

Source: WDI, 2020

Empirical Literature

Various empirical literatures considered life expectancy as a key determinant of health outcomes. Most literature focus attention on total life expectancy. Females and males face health challenges differently, consequently the need for understanding factors that can affect female health outcomes. Popoola's (2018) paper on the macroeconomic implications of low life expectancy in sub-Saharan Africa, using a panel technique approach focused on eight countries in SSA in the period 2000–2015, found that using panel regression method that improved water supply, good sanitation, access to toilet facilities, clean environment and improved standard of living has a positive statistically significant relationship with higher life expectancy. Lee and Kim's (2017) papers on factors affecting life expectancy in South Korea considered educational attainment, electric power consumption, infant mortality, and internet

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services as main factors determining life expectancy in the country. Multiple regression analysis tests revealed that life expectancy is positively related to electric power consumption and educational attainment while infant mortality showcased a negative relationship with life expectancy. The effect of electric power consumption was found to be weak with infant mortality having a high negative effect on life expectancy thus signifying that healthcare at early life matters for life expectancy in South Korea.

On life expectancy in Nigeria, Sede and Ohemeng (2015) considered the socioeconomic determinants of life expectancy in Nigeria with data spanning from 1980–2011. The study considered the role of socio-economic variables of the unemployment rate, secondary school enrolment, per capita income, government expenditure on health, and the Naira foreign exchange rate. Results using VAR and VECM framework revealed that the conventional socio-economic variables of per capita income, government expenditure on health and education measured by school enrolment which literature considered to be highly effective in determining life expectancy in developing countries are not significant for Nigeria. The study called for the Nigerian government to give attention to health expenditure, issues of unemployment and focus more on factors that can appreciate the Nigerian Naira. Also, Ilker, Ogunjesa, Meliz and Savas (2019) on the effects of socio-economic factors on life expectancy at birth in Nigeria found that government health expenditure and private health expenditure of the GDP do not have significant relationship on life expectancy in the country while access to safe water and basic sanitation system exerts a significant effect on life expectancy.

Bilas, Franc and Bosnjak (2014) on the determinant factors of life expectancy in the European Union Countries considered the effect of gross domestic product (GDP) growth rate, population growth rate, level of education attained, school enrolment rate, GDP per capita on life expectancy on 28 European Union countries in the period of 2001 to 2011 by applying panel data analysis approach. Their findings affirmed that both GDP per capita and educational level led to variations in life expectancy at birth in the countries with a positive relationship. Further endogeneity tests confirmed that 60% of cases of life expectancy are determined by economic and social factors.

Amjad and Khalil (2014) investigated the impact of socio-economic factors on life expectancy for the Sultanate of Oman using time series data from 1970–2012 using ARDL approach and found that food production and school enrollment have a positively significant effect on life expectancy while population growth negatively affects life expectancy. Result also indicated that carbon dioxide emission exerted a positive insignificant effect on life expectancy in the long run while in the short run, a negative and significant effect was seen on life expectancy by CO2 emission. The study concluded by suggesting that there is a need for the government of Oman to consider socio-economic factors for ensuring longevity in the region.

Kabir (2008) also examined the socio-economic determinants of life expectancy for 91 countries using multiple regression and probit frameworks. Based on a cross-country variation, countries were disaggregated into low, medium and high life expectancy and the result of probit regression revealed that most of the explanatory variables turned out to be statistically insignificant thus implying that socio-economic variables of education, health expenditure, access to water, and urbanization cannot always be seen as the main determinants of life expectancy in developing countries. The paper suggested that adult illiteracy and undernourishment should be reduced to improve life expectancies.

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METHODOLOGY

Data

Annual time series data on Nigeria were selected for the period of 1990–2019 from the World Bank database and the World Development Indicators. Johansen cointegration and vector error correction regression analyses were applied in order to observe the relationship each variable has with life expectancy in the short and long run. Test for serial correlation was done with the LM test and the Heteroskedasticity Test was carried out with the Breusch-Pagan-Godfrey test.

Model Specification and Data Description

This paper considers the environmental factor of household emission associated with the use of cooking energy and the role of fertility and child mortality on women's health outcomes in Nigeria.

$$LE_t = f(IM_t, FE_t, AE_t, AS_t, CO2_t, LIQCO_t, + INF_t,)$$

Explicitly,

$$LE_t = \beta_0 + \beta_1 CM_t + \beta_2 FE_t + \beta_3 AE_t + \beta_4 AS_t + \beta_5 CO2_t + \beta_6 LIQCO_t + \beta_7 INF_t + e_t .. (1)$$

Female Life Expectancy (LE_t) is the average age a female birth cohort will reach if it experienced the mortality conditions of the society at the time of its birth throughout its life.

Under-Five Mortality (CM_t) is the number of infants dying before reaching age one per 1,000 live births in a given year and in this paper, this stands for mortality rate.

Fertility Rate (FE_t) is the number of children that would be born to a woman if she were to live to the end of her childbearing years in a country.

Access to Electricity (AE_t) is the percentage of the population with electric power consumption.

Access to Sanitation (AS_t) refers to the percentage of the population having access to an improved sanitation system which includes flush/pour flush to piped sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, composting toilets or pit latrines with slabs.

Carbon Dioxide Emissions ($LIQCO2_t$) Carbon dioxide emissions from liquid fuel consumption refer mainly to emissions from the use of petroleum-derived fuels as an energy source.

Inflation (INF_t), referred to as the inflation as measured by the consumer price index, reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

e_t is the error term with t for the period from 1990–2019.

β_0 is constant term; $\beta_1 - \beta_7$ is the coefficients of explanatory variables.

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RESULTS AND DISCUSSION

Table 4.1. Description of Variables

	LE	FER	IM	AS	AE	INF	LIQCO
Mean	49.31	6.03	101.72	34.39	45.64	18.80	42.50
Median	48.07	6.04	101.00	35.20	46.21	12.55	40.46
Maximum	54.42	6.49	124.30	39.18	59.30	72.84	68.68
Minimum	46.98	5.53	78.50	28.65	27.30	5.39	27.29
Std. Dev.	2.58	0.26	16.86	3.14	7.61	17.74	11.12
Skewness	0.69	-0.09	0.04	-0.47	-0.31	1.91	0.83
Kurtosis	1.97	2.23	1.43	2.06	2.59	5.42	2.80
Jarque-Bera	3.36	0.70	2.77	1.98	0.61	23.10	3.14
Probability	0.19	0.71	0.25	0.37	0.74	0.00	0.21
Probability	0.19	0.71	0.25	0.37	0.74	0.00	0.21

Source: Computed by author 2022 with E-view

From the descriptive analysis in Table 4.1, the mean of life expectancy stood at 49.31, ranging from about 47 to 55 years life span. Fertility rate remains very high, having an average mean of 6 children per woman. Issues of mortality remain high with the child mortality average being 101 per 1,000 childbirths with a minimum value of 78 deaths per 1,000 child births. Inflation stood high at the mean average of 18.8, an indication that the prices of goods are high with effect on household living standard and well-being.

The standard deviation presents how far observed data are from the sample average. The skewness measures the degree of asymmetries of the series. All variables in the model, except inflation (INF), have normal skewness of 0, an indication that the distributions are symmetric while inflation positive skewness indicates having higher values than the mean value. The kurtosis measures the flatness of the variables; all variables except inflation and female labour force participation are platykurtic having lower values below the sample means. While inflation is leptokurtic with high value, carbon dioxide emission from liquid fuel is close to kurtosis of 3.

Table 4.2. Stationarity Test: Auto Regressive Dickey Fuller Unit Root Test

Variables	Adf stat: level	1%	5%	Adf stat.1st diff	1%	5%	result
LE	-1.646	-3.711	-2.981	-3.690	-3.769	-3.004	I(1)
CM	-1.226	-3.724	-2.986	-4.558	-3.724	-2.986	I(1)
FE	1.079	-3.724	-2.986	-3.553	-3.711	-2.981	I(1)
AE	-2.196	-3.724	-2.986	-5.169	-3.724	-2.986	I(1)
AS	-0.134	-3.679	-2.967	-3.814	-3.689	-2.971	I(1)
LIQCO	-1.515	-3.711	-2.981	-3.785	-3.831	-3.029	I(1)
INF	-2.027	-3.679	-2.967	-4.358	-3.689	-2.971	I(1)

Source: Computed by author 2022 with E-view

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Using ADF unit root test, all variables of the model were not stationary at level but attained stationarity at the first difference, that is, integrated of order one. With the result of the stationarity test, testing for level of cointegration requires the use of Johansen cointegration estimating techniques which help in estimating the cointegration existing in model series having variables that are stationary at first difference.

Table 4.3. Test for Cointegration Among Variables: Johansen Cointegration Test Result

Trace test result					Maximum Eigenvalue test result				
Hypothesized		Trace	0.05		Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigen value	Trace Statistic	Critical Value	Prob.**	No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.97	294.77	125.62	0	None *	0.97	91.03	46.23	0
At most 1 *	0.94	203.74	95.75	0	At most 1 *	0.94	70.29	40.08	0
At most 2 *	0.83	133.45	69.82	0	At most 2 *	0.83	44.50	33.88	0.0019
At most 3 *	0.76	88.95	47.86	0	At most 3 *	0.76	35.22	27.58	0.0043
At most 4 *	0.62	53.73	29.80	0	At most 4 *	0.62	24.21	21.13	0.0178
At most 5 *	0.53	29.52	15.49	0.0002	At most 5 *	0.53	19.13	14.26	0.0079
At most 6 *	0.34	10.39	3.84	0.0013	At most 6 *	0.34	10.39	3.84	0.0013
Trace test indicates 7 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypo. at the 0.05 level					Max-eigenvalue test indicates 7 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypo. at the 0.05 level				

The result of the Johansen cointegration test presented in table 4.3 revealed that 7 cointegrating equations exist among the variables at 5% level of significance for both the trace and the max-eigen statistics. This result indicates that a long-run relationship exists among the variables with all the variables having statistically significant relationships with one another. Also the existence of a long-run relationship indicates that these variables can be combined in a linear way and shocks in the short run can be corrected in the long run. This result led to further use of the VECM model with restricted var. The VECM is useful for determining short-term dynamics among variables by restricting long-run behaviour of variables. It restricts the long-run relationship through their cointegration relations and error correction terms represented by the deviation from the long-run equilibrium.

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Table 4.4. Vector Error Correction Model Test Result (Short-term Dynamics)

	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.0495	0.0053	-9.3280	0.0000
D(LE(-1))	1.1230	0.0230	48.8862	0.0000
D(AE(-1))	-0.0003	0.0005	-0.5970	0.5576
D(FER(-1))	-1.0578	0.2377	-4.4504	0.0003
D(CM(-1))	0.0246	0.0070	3.5004	0.0024
D(INFCPI(-1))	0.0003	0.0001	1.8094	0.0862
D(AS(-1))	0.0015	0.0019	0.8287	0.4175
D(LIQCO(-1))	-0.0009	0.0003	-3.5282	0.0022
C	-0.0195	0.0127	-1.5355	0.1412
R-squared	0.99			
Adj.R-squared	0.99			
F-statistics	1991.67			
Prob (F-statistics)	0.0000			

Source: Computed by author 2022 with E-view

Result in Table 4.4 provided information on the relationship existing between the dependent variable and the independent variables in the short run, the cointegrating Eq(-1) coefficient is -0.05 and significant at 1% and 5% level, an implication that about 5% of the previous equilibrium is adjusted in the model. Considering variables with significant statistical values at 5%, we found that the lag of life expectancy has a positive relationship with life expectancy while fertility rate and carbon dioxide emission exhibit a negative relationship with life expectancy. Although inflation and improved sanitation have a positive relationship with low coefficient, yet, the result is not significant, thus suggesting that an improvement in inflation due to price index and improvement in sanitation may not stimulate life expectancy in Nigeria due to the initial poor state of the variable in the past decades.

Table 4.5a. Breusch-Godfrey Serial Correlation LM Test

Null hypothesis: No serial correlation at up to 1 lag			
F-statistic	2.081548	Prob. F(1,18)	0.1663
Obs*R-squared	2.902333	Prob. Chi-Square(1)	0.0885
	2.902333	Prob. Chi-Square(1)	0.0885

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Table 4.5b. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity			
F-statistic	0.332376	Prob. F(14,13)	0.9749
Obs*R-squared	7.380591	Prob. Chi-Square(14)	0.919
Scaled explained SS	2.332503	Prob. Chi-Square(14)	0.9998

Source: Author 2022 result from E-view

Further tests to ascertain the stability of the model are presented in Table 4.5 a & b. The Breusch-Godfrey test affirms that there is no presence of serial correlation while the Breusch-Pagan test reveals that there is no heteroscedasticity among the variables of the model.

DISCUSSION OF FINDINGS

Findings of the Johansen test for long-run cointegration revealed that there is a long-run relationship among demographic factors (fertility, child mortality), environmental factors (sanitation, carbon dioxide emission) and life expectancy in Nigeria. The fertility rate has a negatively significant relationship with life expectancy, thus signifying that in the long run, an increase in fertility rate will adversely affect life expectancy. This result indicates that there is a need to reduce fertility rate and improve the reproductive health of women through improving childbirth and delivery systems towards promoting longevity. The lag of access to electricity was found to have a negative effect on life expectancy although it exhibits an insignificant relationship, thus signifying that in Nigeria, a positive effect of access to electricity is not felt on life expectancy and this can be attributed to the epileptic supply of electricity in the country. Environmental factors of carbon dioxide emission also negatively affect life expectancy in the short run; issues of emission have been classified by the World Bank (2015) to be such that it causes health disorder in children at households, thereby posing threat to life and survival. In line with the work of Popoola (2018) and Ilker et al. (2019), improved sanitation was found to have a positive significant relationship with life expectancy and this can be attributed to the benefits of good hygiene from an increase in improved sanitation and the improvement on the standard of living.

CONCLUSION

This paper recognizes life expectancy as an acceptable indicator of economic development of a country and considers the need for Nigeria to ascertain what role demographic and environmental issues can play on life expectancy. The paper found that a long-run effect of demographic and environmental factors exist on life expectancy in Nigeria. It indicates that to raise life expectancy in Nigeria, issues of demographic factors involving high fertility rate and child mortality must be taken into consideration. The environment also plays an important role on life expectancy and emission should be reduced with improvement in sanitation, use of basic hygiene and access to good water put into practice.

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