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Energy Poverty and Household Wellbeing in Nigeria

Patricia I. Ajayi
Department of Economics
University of Ibadan, Ibadan. Nigeria
e-mail: patajayi71@gmail.com

Abstract

This study analysed the effect of energy poverty on household wellbeing in Nigeria. Energy poverty in the household is defined as lack of accessibility and affordability to cleaner energy sources. Households who do not have access to or cannot afford cleaner fuels depend heavily on inefficient fuels, and this tends to affect their wellbeing. Here, wellbeing is captured by the health status of household members. A key objective of this study is to investigate how energy poverty impacts the wellbeing of household(s) in Nigeria. The study utilized the 2015/2016 Wave 3 General Household Survey (GHS) data set, obtained from the National Bureau of Statistics (NBS), Nigeria. The estimates show that energy poverty increased the probability of a household member suffering from a respiratory disease, it also affects children below 18 years old as they also have a probability of being sick with a respiratory disease. Ensuring that households have access to cleaner fuels for cooking and other activities is a policy option that needs to be explored by government and all stakeholders.

Keywords: Energy Poverty, Health, Fuel choice, Income

Introduction

Many developing countries are well endowed with energy resources (renewable and non-renewable). Despite this, most developing countries are characterized by energy poverty and poor energy access, this is a reflection of the general low-income level as well as economic under-development. The poor access to clean energy in sub-Saharan Africa is quite enormous. Compared to other African regions, records for SSA show that 905 million people do not have access to clean cooking energy, while, 848 million people rely on traditional biomass for cooking (IEA, 2019).

Nigeria a rich energy resource country is faced with a high rate of lack of access to clean energy for cooking, heating and lighting. This remains a serious challenge for many households as they still rely heavily on solid fuel (biomass and coal) to meet their cooking, heating and lighting needs. Nigeria has the potential to generate 12,522 MW of electric power from existing plants, but it is only able to dispatch around 4,000 MW, which is insufficient for a country with over 180 million people (USAID, 2020). Electricity is generated through thermal and hydro power sources. But the main generation comes from fossil fuels especially gas, which accounts for 86% of the capacity in Nigeria, with the remainder generated from hydropower sources. This poor energy supply and access is against the background of an increasing population of the country. Since households are an important component of energy consumption. Therefore, the study focuses on energy poverty at the household level in Nigeria. The objective of the study is to investigate the impact of energy poverty and how it affects household wellbeing.

In Nigeria, over 66% of the population relied on firewood for cooking (Quedraogo, 2017). Access to modern energy sources such as electricity and gas has always been a major

challenge for many households and this has serious effects on their health. Exposure to indoor air pollution from combustion of traditional biomass fuels (wood, charcoal, dung) pose significant health hazard which affects poor rural and urban communities (WHO, 2006). Burning solid fuels produces very high levels of indoor air pollution and since cooking takes place every day, most people using solid fuels are exposed to high levels of small particles which are quite higher than even the accepted limit for outdoor pollution (WHO, 2006; Aigbokhaode et al, 2021). The Global Burden of Disease Assessment 2010 and 2013, assert that Household air Pollution is a leading risk factor when using solid fuels and inefficient cook stoves for cooking indoors. HAP has high injurious consequences and it affects all ages of life (both young and old). Some of the health burden from household air pollution due to burning of solid fuel include, child and maternal malnutrition, pneumonia in children less than five, Chronic Obstructive Pulmonary Disease (COPD), cardiovascular disease, cataracts, eye irritation, headaches and lung cancer in adults, low birth weight and tuberculosis. Even though there has been a reduction in the use of solid fuels worldwide, exposure to Household air Pollution (HAP) from the use of these fuels for cooking remains a leading risk factor for global disease burden (Bernitt et al 2021). Further, it is estimated that 3.5 million premature deaths were caused by household cooking fuels. In terms of lost healthy life years (DALYs), Household Air Pollution (HAP) was the second most important risk factor among those examined worldwide after high blood pressure, thus, energy is indeed a health issue (Smith et al, 2013).

Energy use in households in Nigeria remains a serious challenge, because it reflects poor access to clean energy often highlighted by heavy reliance on solid fuel (biomass and coal) which are not only inefficient but also have harmful effect on health. The National Bureau of Statistics reports that more than two-thirds of Nigerian households use firewood for cooking (NBS, 2005; 2010). The use of firewood is moderate in urban areas but high in rural areas, while the percentage of households that cook indoors in urban areas is higher (43%) than in rural areas (38%) (Aigbokhaode et al, 2021). The use of these fuels exposes households to all forms of air pollution. The household sector which is the largest consumer of energy still depends on inefficient alternative forms of energy to meet her basic needs of cooking and lighting. This study therefore, investigates the negative effects of energy poverty on health conditions of households.

Access to Clean Energy in Households

Access to clean cooking facilities means access to modern fuels and technologies including natural gas, liquefied petroleum gas (LPG) and electricity. The (IEA, 2020), defined energy access as a household having reliable and affordable access to both clean cooking facilities and to electricity which is enough to supply a basic bundle of energy services. This definition serves as a benchmark to measure progress towards the attainment of sustainable development goal 7.1 which is to ensure affordable, reliable, sustainable modern energy for all by 2030. Even though many countries are trying to ensure access to modern energy for cooking, more than 2.6 billion people still lack access to clean energy facilities with many relying on firewood, coal or kerosene for their primary cooking fuel. Sub-Sahara Africa is the worst hit region with a deteriorating picture. Access to clean energy only slightly increased from 15 percent in 2015 to 17 percent in 2018. This implied that since 2015 only 25 million people have gained access to clean cooking energy in the region while the number without access as at 2018 has increased to over 900 million due to population growth. It is the only region where the number of people without access continue to rise significantly (IEA, 2020). In light of this, a clean energy revolution in sub-Saharan Africa is urgently needed to win the fight against energy poverty, if Africa is to meet the SDG 7 and other related SDGs (Elinwa et al., 2021). Access to clean cooking energy by region is shown in figure 1. Compared to North Africa, South Africa and Developing Asia, sub-Saharan Africa lags far behind in access to clean cooking energy. Furthermore, figure 2 shows that sub-Sahara Africa has a large population of people without access to clean energy and those using biomass fuels. In Nigeria household cooking accounts for a large percentage of energy consumption (Gujba et al, 2015) yet many

households' lack access to clean cooking energy like LPG and electricity. Many households in urban areas rely on kerosene for cooking and lighting (Ajayi, 2018; Megbowon et al 2018), while those in rural areas rely on firewood. About 75 percent of the population rely on solid fuels for their household cooking and heating needs. These inefficient cooking fuels do not only lead to environmental degradation, it also contributes to climate change through emission of greenhouse gases. While exposure to smoke from open fires and inefficient fuels have led to over 64,000 deaths annually (WHO, 2022). In fact, LPG use in Nigeria is the lowest in Africa, despite being one of the world's leading exporters of natural gas and having large gas reserves, the number of households using LPG remains very low (Ajayi, 2018; Ozoh et al, 2018).

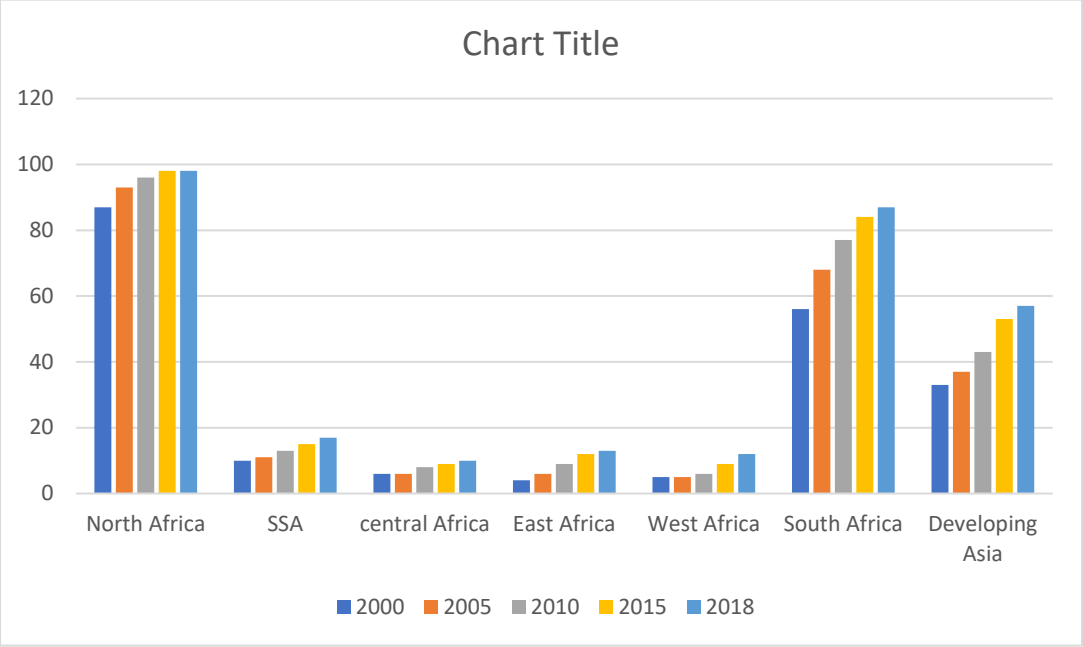

Figure 1: Access to Clean Cooking Energy by Region in Africa
Source: IEA World Energy Outlook, 2019

Access to Electricity

Access to electricity is very important for poverty alleviation, economic growth and improved standard of living. Nigeria has an installed electricity generation capacity of 12,500GW which is largely dependent on hydropower and thermal (gas) power sources of 12.5% and 87.5% respectively. Currently only 3,500MW to 5,000MW is available for transmission to the final consumers. Given this the country can be said to be in deep energy crisis, largely due to losses as a result of non-availability of installed capacity and technical and non-technical issues in the power supply chain. Electricity remains a marginal source of energy in Nigeria with a share of 2% in total final energy consumption, it only represents 9% of the household's total energy consumption. Compared to other West African countries, Nigeria's electrification rates are relatively high but have progressed slowly. Access has been very slow over the years, for instance, only 27.3% of the population had access to electricity in 1990 and only 56.5% in 2018. Access rates also vary significantly amongst states. Lagos state has the highest access with 96% and Taraba state the lowest with 21%. Other states with higher access are located in the South-west and South-south geo-political zones respectively while the North-west and North-east had lowest access. Despite over a decade of power sector reforms to revamp the sector the situation still remains very bleak.

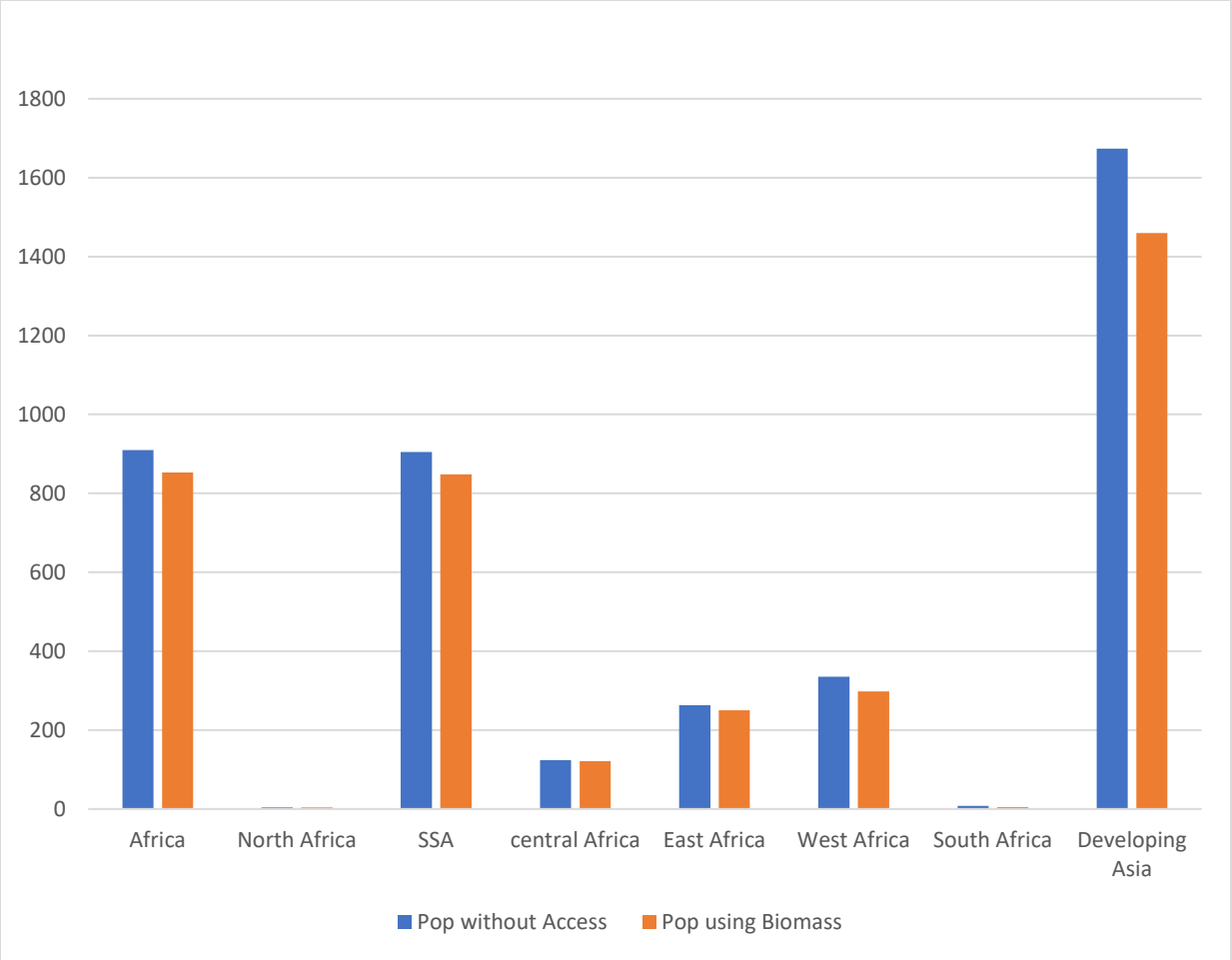

Figure 2: Population without Access and Using Biomass
Source: IEA, World Energy Outlook, 2019

Literature Review

The starting point in many theoretical discourses on energy is the theory of energy transition. The basic idea of this theory is that, as households' income increases, it is expected that households switch from using traditional fuels such as firewood to more efficient and cleaner fuels such as electricity and LPG (Leach, 1992). However, there are large number of households who still rely on solid fuels for cooking and heating, this could be due to non-affordability, lack of access and low income of consumers. When this occurs such households are said to be energy poor. Energy poverty occurs when households lack or have limited access to clean energy resources such as electricity and gas. Household energy wellbeing on the other hand is often viewed from the point of energy access, and access goes beyond households having access to modern energy sources, it also involves having adequate access as well as using these energy sources efficiently. Access to energy is crucial for economic development as it contributes to improved health conditions by reducing indoor air pollution. A lack of access to modern energy is believed to hamper economic growth and reduce welfare of the citizens (World Bank, 2014). Energy poverty, a key factor that affects household wellbeing is likely to result in inadequate lighting, indoor air pollution, respiratory health risks and lack of learning educational opportunities.

Exploring the negative effects of energy poverty on health conditions of households has been of great concern to scholars over the years. Household Air Pollution (HAP) due to biomass cooking fuel use is an important risk factor for a

range of diseases among adult women. Sehgal et al., (2014), found that Chronic Obstructive Pulmonary Diseases (COPD), Tuberculosis (TB), Cataract and still births were caused by exposure to biomass cooking fuel. Furthermore, the largest health impacts of energy systems come from the extraction and combustion of solid fuels; biomass and coal, Smith et al., (2013). Even though energy is essential for human wellbeing, energy systems contribute substantially to the global burden of disease. Household air pollution leads to diseases such as COPD, TB, and Pneumonia especially in children under-fives, low birth or premature birth and a host of others. Junfeng et al., (2007) found that exposure to smoke from coal leads to lung cancer. In fact a high percent of lung cancer was found among non-smoking women due to exposure to coal smoke. Other ailments include respiratory diseases such as chest pain, cough, phlegm, shortness of breath, rhinitis and tonsillitis in children. The prevalence of cough and pneumonia among infants (1-3years) were attributed to effects of household coal use. There is an increasing body of empirical evidence from an economic perspective showing a relationship between energy poverty, poor health and mental health (Churchill and Smyth, 2020; Llorca et al, 2020; Kahouli, 2020; Rodriguez-Alvarez et al, 2019 and Thomson et al, 2017). For instance, in the UK, inability to adequately heat one's home is associated with poor health and physical health in both adolescents and adults. Heather and Vera-Toscano (2021), discussed the cross-dependency effects of health and energy poverty. They explored a bi-directionality effect of health and energy poverty by estimating associations between energy poverty and health. They showed that subjective energy poverty and health was more significant, that is, people's perception or feelings of their situation in terms of financial stress and debt and inability to meet their energy needs tended to affect their mental health. When the incidence of energy is quantified, (Phoumin et al, 2019) found that energy poverty of a household was highly correlated to the type of fuel used and the level of consumption of modern energy sources in the home. Energy poverty impacts on households' is quite huge. Households' who use less efficient energy types have a high probability of her members suffering from various respiratory problems. Such households' are also characterised as low income earners, whose children are likely to drop out of school due to insufficient funds. These poor households' are also likely to have out of pocket expenses related to sickness. Having access to stable electricity supply also helps to improve households' well-being. Electricity is environmentally friendly and an adequate supply of it leads to development of the society. This means that access to electricity which is the peak of the energy ladder is highly correlated with development. In Nigeria, inadequate supply of electricity has hindered development across all sectors thereby leading to energy poverty. Residential electricity consumption in Nigeria is quite low (see Olaniyan et al, 2018; Sanusi et al., 2016), With the low rate of electricity consumption per capita, it is clear that electricity supply is grossly inadequate in Nigeria.) although there is fair access to electricity the urban areas, it is usually for lighting only. In addition to inadequate electricity supply many households are energy poor because they rely on inefficient energy sources for their cooking and lighting needs. Over 75 percent of households' use inefficient cook stoves such as firewood for cooking (Ogwumike et al, 2015; Megbowon et al (2018)). This dependence on traditional fuels negatively affects the environment through deforestation and desertification.

In summary, having access to modern energy sources in both rural and urban communities will impact the welfare of households' positively. Energy is an important component of development and households' must be encouraged to embrace modern energy sources. Governments can ensure access to these modern energy sources by improving households' money income.

Methods

This study used the 2015/2016 Wave 3 General Household Survey (GHS) data set, obtained from the National Bureau of Statistics (NBS), Abuja, Nigeria. The GHS is a survey conducted by NBS, the apex statistical agency in Nigeria. The GHS is a survey on households and their members, on housing conditions, education, energy use, expenditure on energy goods, economic activities, production and income, health, expenditure on health, consumption and a lot

more. The GHS data set is available and open to researchers for research and analysis. Drawing from Phoumin et al., (2019), two concepts of energy poverty is defined so as to form the probability function of energy poverty for each household. The first concept is a multidimensional approach that considers various income groups and pattern of energy expenditure in each income group. Here it is assumed that the household is rational in allocating resources for its basket of consumption. The household energy expenditure is important because it is one of the crucial elements in the household's basket of consumption. It is assumed that higher income group spend a small proportion of their income on energy expenditure, because at that level their energy consumption has reached a saturation point, as they tend to spend more on luxury goods. On the other hand, the poor income groups tend to switch their expenditure in favour of traditional energy instead of modern energy. The second approach dwells more on the type of energy used. In this approach it is assumed that a household is energy poor if it uses more of biomass for cooking. It is further assumed that a household that uses biomass for cooking does not have access to clean and modern energy sources. These two approaches form the probability function of a household being energy poor. Therefore, a household is said to be energy poor if it meets the following criteria (i) if its per capita expenditure is in the bottom quintile (ii) if its per capita energy expenditure exceeds 10 percent of the total household expenditure (iii) if it uses biomass for cooking.

Empirical model for impact of energy poverty on well-being

Literature has shown that energy poverty greatly impacts household's well-being (health) because it is important for everyday life (Smith, et al, 2013). Lighting is expected to have a positive impact on schooling as it helps students to study late into the night. Access to modern energy sources makes household chores such as cooking and cleaning easier for women as they can work extensively in the night, it also helps to boost their productivity at income generating activities. Conversely, use of traditional and unclean energy sources such firewood for cooking and kerosene lamps for lighting leads to indoor air pollution, which affects the health of household members. Indoor air pollutants include particulate matter, carbon monoxide, oxides of nitrogen and sulphur (Phoumin et al, 2019). Exposure to these pollutants increases the risk of respiratory health diseases. Energy poverty is endogenous with well-being outcome: health, schooling and income. It is equally important to find other variables in the data set which are correlated with energy poverty but not correlated with the error term.

The model specification can be written as;

$$wellbeing = \alpha_0 + \beta_i EnPov_i + \beta_2 \chi_i + \mu_{i1} \quad (1)$$

$$EnPov_i = \gamma_0 + \alpha_i IV_i + \mu_{i2} \quad (2)$$

Where,

Wellbeing is the dependent variable and it represents health outcome, income and schooling outcome.

The proxy variable for 'health outcome' is 'respiratory disease'.

The proxy variable of 'income' is the per capita income of the household.

The proxy variable of 'schooling outcome' refers to a child within a specific age group reported to be in school or have dropped out of school.

The ordinary least square (OLS) method is used to estimate structural equation (1).

Since the dependent variables of structural equation (1) are dichotomous for the variable of health outcome and schooling outcome; if the household has at least one sick person with a respiratory disease it takes the value of 1 and the value of 0 if otherwise; if the household has one school child as a drop out it takes the value of 1 and the value of 0 if otherwise. Thus, if the regression of the structural equation on sets of independent variables takes the form of the probit model in which the estimation is expressed in a latent variable as below;

$wellbeing_i^* = \chi_i\beta + \varepsilon_{it}$ (3)

$\chi_i\beta = \alpha_0 + \beta_i EnPov_i^* + \beta_2\chi_i$ (4)

$\varepsilon_{i1}(\chi_i \sim N(0,1)$

Where $\chi_i\beta$ is the aggregated form of the explanatory variables and hence the dependent variable can be observed as

$Wellbeing_i \equiv 1\ (Health_i^* > 0)$

$Pr\left(Wellbeing = \frac{1}{\chi_i}\right) = G(\alpha_0 + \beta_i EnPov_i^* + \beta_2\chi_i) = G(\chi_i\beta) = \Phi(z)$ (6)

Results

Table 1: Descriptive Statistics of the Data

Variable	Obs	Mean	Std.Dev.	Min	Max
HHsize	3518	5.904	3.536	1	29
Age	3518	49.917	15.261	17	130
AgeSq	3518	2724.581	1654.439	289	16900
Child_No	3518	2.525	2.446	0	21
MaleHH	3518	.789	.408	0	1
Rural	3518	.593	.491	0	1
Married	3518	.948	.222	0	1
Dropout	3518	.112	.315	0	1
Nonformal	3518	.123	.328	0	1
Primary	3518	.254	.435	0	1
Secondary	3518	.235	.424	0	1
Tertiary	3518	.191	.393	0	1
RespDis	3518	.215	.411	0	1
HltExp	3518	7435.884	32338.25	0	1510000
PCI	3518	12852.44	59131.08	0	1320000
lnpci	3518	3.41	4.609	0	14.095
FirewExp	3518	.615	1.12	0	14
CharcExp	3518	.11	.397	0	4
KeroExp	3518	.639	.998	0	14
GasExp	3518	.536	1.291	0	12.8
EnPov	3518	.812	.391	0	1
Computer	3518	.053	.224	0	1
TV	3518	.54	.498	0	1
Refrigerator	3518	.283	.451	0	1
AirCon	3518	.028	.164	0	1
Fan	3518	.536	.499	0	1
Vehicle	3518	.12	.325	0	1
Generator	3518	.304	.46	0	1
WashingMac	3518	.026	.159	0	1

Table 1 shows the descriptive statistics of the data used for this study. Three thousand five hundred and eighteen observations were used. The estimated household size is approximately 6, while the average age of the household head is about 49 years old. Estimates show that household spend an average of N7500 on their health, this is a huge amount for energy poor households to spend on their health. Per capita income is very low at N12, 852.44, this further shows the level of poverty in the country. The statistics also show that many households use firewood and kerosene equally for cooking this is shown at a maximum value of 14, which is about 61 and 63 percent respectively. Only 53 percent use LPG for cooking. Energy poverty is high at 81 percent. In terms of energy access, only households that had refrigerators and fans had

access to electricity. Table 2 presents empirical results for determinants of energy poverty and the effect of energy poverty on household wellbeing in Nigeria. Energy poverty is a categorical variable. Thus, the study employed a suitable approach by using a probit model, as the linear probability model becomes inefficient in this regard. Different determinants of energy poverty such as expenditure on kerosene, charcoal, and firewood, area (rural), gender (male), and per capita income were considered. The energy expenditures are positive and statistically significant with low marginal probabilities. This implies that a slight increase in expenditures on kerosene, firewood, and charcoal does not address energy poverty. This is expected as these forms of energy are largely used by poor households in Nigeria. This is line with Ogwumike and Ozughalu (2015) and Megbowon et al. (2018). Further the results reveal that energy poverty is more pronounced in rural areas, this is because there are more households in the rural areas and they rely on inefficient energy sources unlike their urban counterparts. Per capita income plays a significant role in reducing energy poverty. A high per capita income allows people to have access to modern and efficient energy sources. Therefore, an increase in per capita income will improve the capacity of households to rise above the energy poverty line. Although education measures are positively related to energy poverty, it does not necessarily move households above the energy poverty line.

Table 2: Determinants of Energy Poverty

	Probit Model	Marginal Effect
Dependent Variables (Energy Poverty)	Coefficient	Coefficient
KeroExp	0.0006***	0.00011***
	(0.00004)	(0.00007)
CharcExp	0.0007***	0.00012***
	(0.0001)	(0.00002)
FirewExp	0.0008***	0.00013***
	(0.00006)	(0.00001)
Rural	1.0804***	0.1814***
	(0.0646)	(0.0094)
MaleHH	-0.1239	-0.0208
	(0.0781)	(0.0131)
ln_pci	-0.0902***	-0.0151***
	(0.0066)	(0.0010)
Nonformal	1.1045***	0.1854***
	(0.1898)	(0.0315)
Primary	0.4198***	0.0705***
	(0.0815)	(0.0136)
Secondary	0.1435*	0.0241*
	(0.0762)	(0.0128)
Married	-0.0230	-0.0039
	(0.129)	(0.0216)
HHsize	-0.0136	-0.0023
	(0.0114)	(0.0019)
Constant	0.0662	-
	(0.142)	

Observations	3,518
Pseudo-R-squared	0.394
Log-Likelihood	-1031
Chi-squared	1342
prob > F	0.000

Note: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses

The next discussions focus on the effect of energy poverty on households' wellbeing. Three measures of wellbeing are considered. Specifically, the wellbeing of household captures income, health status, and education. Thus, this study considers health outcome (respiratory disease), school outcome (dropout), and earning outcome (per capita income). The results for the effect of energy poverty on wellbeing are presented in Tables 3-5. Table 3 shows that energy poverty significantly influences health and earning outcomes compared to education outcomes. Specifically, energy poverty increases the marginal probability of household members facing health challenges by 0.04. Poor households always explore poor energy sources which expose them to health challenges, especially respiratory disease. This result points to the fact that respiratory diseases are largely associated with poor energy sources such as firewood, kerosene, and charcoal. Additionally, other factors such as the number of children, household expenditure, and place of residence also influence respiratory disease. As the number of children increases, the likelihood of the prevalence of respiratory disease among the energy poverty group. Also, out-of-pocket expenditure affects respiratory disease challenges in the energy poverty group. The respiratory problem is further worsened by the area of residence as energy poverty group in the rural area increases the predicted probability of respiratory disease relative to urban dwellers. Energy poverty also influences school enrolment (as presented in Table 4). The result suggests that energy poverty reduces the predicted probability of household members facing the challenge of dropping out of school. This implies that the influence of energy poverty is likely weak. However, household size contributes to the rate of dropout. This suggests that children in large households are likely to drop out of school. In Table 5, the estimated result shows that energy poverty, level of education, household assets, gender, and area of residence influence earning capability. The result points to the fact that secondary education and university degree determine the ability to improve earnings. In sum, the result largely suggests that energy poverty and other critical factors significantly affect household wellbeing.

Table 3: Impact of Energy Poverty on Health (respiratory disease)

	Probit Model	Marginal Effect
Dependent Variable (respiratory disease)	Coefficient	Coefficient
EnPov	0.161*	0.0422*
	(0.0887)	(0.0233)
HHsize	0.0227*	0.0060*
	(0.0130)	(0.0034)
Child_No	0.0422**	0.0111**
	(0.0183)	(0.0048)
lnHltExp	0.128***	0.0336***
	(0.0102)	(0.0026)
Age	-0.0140	-0.0037
	(0.0102)	(0.0027)
AgeSq	0.00007	0.00002
	(0.00009)	(0.00002)
Firewood	0.0246	0.0065
	(0.0693)	(0.0182)
Charcoal	-0.0644	-0.0169
	(0.0846)	(0.0222)
Kerosine	-0.0133	-0.0035
	(0.0661)	(0.0173)
Rural	0.122**	0.0320**
	(0.0574)	(0.0150)
MaleHH	-0.0068	-0.0018
	(0.0697)	(0.0183)
Married	0.589***	0.1545***
	(0.171)	(0.0448)
Nonformal	0.0424	0.0111
	(0.0818)	(0.0215)
Primary	-0.0719	-0.0189
	(0.0668)	(0.0175)
Secondary	0.0494	0.0130
	(0.0701)	(0.0184)
Generator	-0.0065	-0.0017
	(0.0619)	(0.0162)
Inverter	0.193	0.0506
	(0.381)	(0.1001)
Vehicle	0.130	0.0340
	(0.0845)	(0.0221)
Constant	-2.252***	
	(0.301)	
Observations	3,518	
Pseudo-R-squared	0.0981	
Log-Likelihood	-1652	
Chi-squared	359.5	
prob > F	0.000	

Note: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.

Table 4: Impact of Energy Poverty on Education (School Dropout)

	Probit Model	Marginal Effect
Dependent Variable (Dropout)	Coefficient	Coefficient
EnPov	-0.222**	-0.0373**
	(0.104)	(0.0175)
HHsize	0.0488***	0.0082***
	(0.0136)	(0.0023)
Child_No	0.104***	0.0175***
	(0.0195)	(0.0032)
Firewood	0.102	0.0171
	(0.0819)	(0.0137)
Charcoal	-0.0240	-0.0040
	(0.0996)	(0.0167)
Kerosine	-0.00238	-0.0004
	(0.0763)	(0.0128)
Rural	-0.0237	-0.0040
	(0.0697)	(0.0167)
MaleHH	-0.167**	-0.0280**
	(0.0803)	(0.0135)
Primary	0.0975	0.0164
	(0.0724)	(0.0121)
Secondary	-0.121	-0.0203
	(0.0818)	(0.0137)
Generator	-0.207***	-0.0347***
	(0.0826)	(0.0138)
Vehicle	0.130	0.0218
	(0.101)	(0.0170)
Computer	-0.112	-0.0187
	(0.155)	(0.0261)
TV	-0.104	-0.0175
	(0.0735)	(0.0123)
Constant	-1.486***	
	(0.124)	
Observations	3,518	
Pseudo-R-squared	0.109	
Log-Likelihood	-1097	
Chi-squared	269.3	
prob > F	0	

Note: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.

Table 5: Impact of Energy Poverty on per capita income

	OLS with Robust Standard Error
Dependent Variable (Log per capita income)	Coefficient
EnPov	-1.457***
	(0.200)
Primary	0.418**
	(0.179)
Secondary	1.068***
	(0.193)
Tertiary	4.204***
	(0.227)
Refrigerator	0.464**
	(0.182)
Fan	1.217***
	(0.163)
AirCon	0.527
	(0.442)
Computer	0.821**
	(0.338)
HHsize	0.0408**
	(0.0194)
Rural	-0.586***
	(0.150)
MaleHH	0.283*
	(0.171)
Constant	2.476***
	(0.271)
Observations	3,518
R-squared	0.295
F-test	133.4
Prob > F	0
R-Squared	0.295

Note: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: Author's Computation

Conclusion

This study investigated the effects of energy poverty on household wellbeing in Nigeria. The key findings suggests that energy poverty increased the probability of a household member suffering from respiratory disease. Children aged 18 years and below of energy poor households 'are also likely to have a higher probability of being sick with respiratory disease, this is because they are always with their mothers while meals are prepared. Further, children from large families who are energy poor are more likely to drop out of school because of the time spent in collecting firewood and doing endless household chores unlike children who are not energy poor. The level of education greatly determined the economic ability of households, for instance, having a university education enhanced the income ability of households. Higher per capita income will significantly reduce the level of energy poverty and increase the wellbeing of households.

Policy Recommendation

The findings of this study have shown that energy poverty is real and it affects households in diverse ways especially in the area of their health. Since many households use biomass for cooking and kerosene lamps for lighting, it is important that households switch to cleaner fuels. Smoke from firewood and kerosene lamps pose a lot of health challenges associated with using it, there is need for private sector, government and related NGOs to partner with communities so as to increase the penetration of cleaner fuels at an initial subsidized rate possibly for a period of time. Ensuring a steady supply of cleaner fuels and close proximity to consumers is germane to having a successful switch. Nigeria is faced with inadequate supply of electricity for lighting and cooking, there is need for government and private investors to provide renewable energy for household use. Solar PVs can be installed in parts of the country where there is adequate sunlight to power communities and this can start on a small scale, with households paying for it. Using modern fuels for cooking and lighting is a basic need of households and the society at large, public private partnership is very important to providing this.

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