Original Research Article

Climate Change Adaptive Capacities to Poverty Diseases of Farmers Along River Niger in Edo and Kogi States, Nigeria.

ABSTRACT

Globally, extreme weather is predicted to become more common on animals, plants and crops, which are all expected to be badly affected. In Nigeria, the effects of climate change are expected not to stop at just affecting the agricultural production, it will surely affect the lives, health and overall development of the country. This studydeterminingclimate change adaptive capacities to poverty diseases of farmers along River Niger in Edo and Kogi States. Primary data were collected from respondents, multistage sampling techniquewere used to select respondentsin Edo and Kogi States. Descriptive statistics, using the threshold concept for discrete variables results shows thatland preparation pattern was the most used adaptive capacity to climate changein the study areas. The findings also show that gender, types of accommodation, sanitation, visit to hospital, amount spent on treatment, education and irrigation were the major factors influencing climate changeadaptative capacities to poverty diseases. It was concluded that the major factors influencing adaptive capacities to poverty diseases and climate change were education, household size, off farming income, access to credit, distance to health Centre, cost of treatment, visit to hospitals and irrigation farming. The study recommends that to reduce effect of poverty disease, there is need for policy makers to engage communities when taking decisions relating to their health. This will improve transparency and ease of obtaining information from respondent relating to their health for appropriate solution.

Keywords: Climate Change, Adaptive Capacities and Poverty Diseases

Introduction

Poverty is a major cause of diseases and a barrier to accessing health care when needed (WHO, 2021). Poverty and diseases are closely tied with each factor aiding the other (Stevens *et al.*,2021). This relationship is financial, the poor cannot afford to purchase those things that are needed for good health, including sufficient quantities of quality food and health care. Diseases, in turn, is a major cause of poverty. This is partly due to the costs of seeking health care, which include not only out-of-pocket spending on care (such as consultations, tests and medicine), but also transportation costs and any informal payments to health care providers which can reduce farmer scares resource (Bennett *et al.*,2019). Poverty disease is a term sometimes used to collectively describe diseases, disabilities and health conditions that are more prevalent among the poor than among

wealthier people. In many cases, poverty is considered the leading risk factor or determinant for such diseases and in some cases, the diseases themselves are identified as barriers to economic development that would end poverty (Singh *et al.*,2018).

At the global level, there are three primary poverty-related diseases (PRDs) acquired immune deficiency syndrome (AIDS), malaria and tuberculosis (TB). Developing countries account for 95% of the global AIDS prevalence, 98% of active tuberculosis infections and 90% of malaria deaths occur in sub-Saharan Africa (Adjei *et al.*, 2012). Diseases of poverty kill approximately 14 million people annually (Stevens *et al.*, 2016). For example, malaria attacks an individual on average of four times in a year with an average of 10 to 14 days of incapacitation in Africa (Alaba *et al.*,2006). On a global perspective, between 400 and 900 million of children under the age of five experience acute malaria annually in this malaria endemic region and this number may double by year 2020 if effective control measures are not implemented, Multilateral Initiative on Malaria, 2018. In 2017, an estimated US$ 3.1 billion was invested in malaria control and elimination efforts globally by governments of malaria endemic countries and international partners (WHO, 2018).

In terms of health, poverty includes low income, low education, social exclusion and environmental decay (Adjei *et al.*, 2012). The poor within most countries are trapped in a cycle in which poverty breeds ill health and ill health breeds poverty (Adam, 2009). Many diseases that primarily affect the poor serve to also deepen poverty and worsen conditions (Wiggins, 2019). Poverty also significantly reduces people's capabilities, making it more difficult to avoid poverty related diseases (Stevens *et al.*,2016). Majority of the diseases and related mortalities in poor countries are preventable and treatable diseases for which, medicine and treatment regimens are readily available. Poverty is in many cases the single dominating factor in higher rates of prevalence of these diseases. Poor hygiene, ignorance in health-related education, non-availability of safe drinking water, inadequate nutrition and indoor pollution are factors exacerbated by poverty (Wiggins, 2019).

Climate extremes may promote the transmission of certain infectious diseases, and the vulnerability of populations to these diseases will depend on the baseline levels of

pathogens and their vectors. Insub-SaharanAfrica, over 10million people currentlyliveinregions proneto malariaepidemics.Climatechangecould add20-70 milliontothisfigurebythe2080s (WHO, 2018). Any suchincrease would exacerbatepovertyandmakeithardertoachieveand sustainhealthimprovements. Some links betweenclimatechangeand human healtharecomplex.Forexample,thepredicted drynessinsub-Saharan Africa couldincreasetheincidenceof HIVinfection,asimpoverishedruralfarmingfamilies move tocities whereconditionsfostersexwork andunsafesex(McMichael *et al.,* 2006).Chronic diseases such as diabetes and ischemic heart disease magnify the risk of death or severe illness associated with high ambient temperatures (Sokolnicki *et al.,* 2009). Climate change is expected to aggravate Africa's poverty level with rising global temperatures which are expected to increase flooding in coastal areas, cause declines in agricultural production, threaten biodiversity and the productivity of natural resources, increase the range of vector-borne and waterborne diseases, and worsen desertification; thus, they have a disproportionately adverse impact on Africa's agriculture-based economy (Mendelsohn *et al.,* 2008). To make matters worse sub-Saharan Africa has a low adaptive capacity due to its dependence on rain-fed agriculture, low levels of human and physical capital, and poor infrastructure. This study will therefore examine effects of poverty diseases and adaptive capacities to climate change on farm income along river Niger in Edo and Kogi States, Nigeria

Poverty diseases, is not only a health problem, it is also an economic problem. Diseases at the household level affect productivity of the people and their assets acquisition capacity. Households also frequently spend substantial share of their incomes and time on poverty diseases such as malaria prevention and treatment, as well as an effort to control mosquitoes (Ajani *et al.,* 2008). The cost of prevention and treatment continue to consumes scarce households' resources. In addition, as some household members spend their productive time caring for those under disease attack, they themselves in turn seek rescue from the onslaught of the diseases (Yusuf *et al.,* 2010). Rural farmers unlike the fixed wage earners not only lose valuable working hours in treating the sickness but also lose income that would have been generated at this period. This poor health status thus directly affects the productive capacity of the households.

Furthermore, climate variability also has the potential to worsen existing vulnerabilities such as Malaria, HIV/AID Sand TB (Ajani *et al.,* 2008). Climate change such as rising temperatures, increases flooding, drought and heavy rainfall will be most dangerous for poor people in developing countries (Bennett *et al.*,2013). There is difficulty in predicting the effects of changes in frequency and intensity of heatwaves on mortality rates in high temperature regions like in Africa due to the lack of data about mortality in these regions. Improved modelling of climate change, including regional models will allow for more reliable predictions of the potential impacts on human health, and improved regional understanding. So far, the majority of wide scoping climate-health research has been carried out in the developed world, where the tools, technology and capacity for carrying out this research are available. This leads to very tentative results not the least because the greatest health risks due to climate change are expected to be borne amongst those least capable to responding, in the developing world (Ramin, 2009).

Ill healthis able to fuel poverty situation of farmers in Edo and Kogi States along river Niger, Nigeria by inhibiting critical investment plans at the households' level;Productivity and income losses from diseases infection in this area is likely to linked with the growing poverty, among rural households. In trying to find possible solutions to the problem of poverty diseases and adaptive capacities to climate change on farmers' income, the following research questions will be addressed in this study: What are the socio-economic characteristics of respondents in the study area and what are the factors influencing adaptive capacities to poverty diseases and climate change in the study areas?

Global warming islikelyto increase disease, death and injuryfrom heat waves, floods,storms,drought, and fireexpand the geographicrangeofmalaria, HIV/AIDsandTBin thepoorcountriesofthe world (Oluyole *et al.*, 2011). Gaps in knowledge of climate and health research is still in a rather primitive stage and many of the direct and indirect health effects of climate change in the regional have not been fully identified or understood. Hence, although a lot is known about the science of climate change, there remain many uncertainties of its potential impact on health (IPCC, 2018). Yet, this message has failed to penetrate public discussions on climate change and health policies. At the moment, few

studies that have considered diseases and climate change were at global perspective or regional aggregates. This research has narrowed it down to two States along River Niger in Nigeria for easy use by policy makers. Thus, this study is expected to add to the scanty knowledge in this area of research

METHODOLOGY

Data for this study were collected from primary sources. The data were obtained through administration of questionnaire to elicit information from the respondents, on the socio-economic characteristics of the farmers such as age, marital status, gender, education, household size, farming experience, farmland size, the extent of awareness of poverty diseases, annual income, types of treatment used and various adaptation measures to poverty diseases. The researcher was assisted by trained enumerators from the State's Agricultural Development Programme to carry out data collection.

METHODS OF DATAANALYSIS

Objectives were achieved using descriptive statistics tools such as, mean, frequencies and percentages, multivariate probit (MVP) and ordered logit model were employed.

The multivariate probit (MVP) model

Multivariate Probit regression method was used to analyse the factors influencing climate change adaptive capacity to poverty diseases. This is because of the binary nature of the dependent variable. The model is stated as follows:

$$Y_i = \eta + \beta_i \sum_{i=1}^{n} Z_i + e_i \qquad (1)$$

Y_i = Dependent variable
Y_1 = Malaria
Y_2 = HIV/AIDS
Y_3 = Tuberculosis
β_i = Estimated as the parameters, while
Z_i = are the explanatory variables as presented on Table 1

Table 1: Explanatory variable influencing respondents, climate change adaptive capacity to poverty diseases

Variable	Definition and measurement	Expected sign
AGE.	Age (Years)	Positive
GED	Gender (male=1, female=0)	Neutral
MAR	Marital status (Married=1,0 otherwise)	Positive
TOA	Types of accommodation (Modern = 1, otherwise=0)	Positive
EDU	Education (Years)	Positive
EXP	Experience (Years)	Positive
ASD	Amount spent on drugs (Naira)	Negative
SOE	Sanitation of environment (yes=1, No=0)	Positive
OFFARM	Income obtained from off-farm business (Naira)	Positive
ACREDIT	Access to credit(Naira)	Positive
VTH	Visit to hospital (kilometres)	Negative

Factors Influencing Adaptive Capacities to Climate Change

Objective iv was achieve using ordered logit model following the classification of Asante and Egyir (2006), farmers were categorized into low, moderate and high adapters to climate change. The three dependent variables (low, moderate and high) obviate the applicability of a binary choice model and allows for the use of the ordered logit model. Hence, representing farmers' adaptive capacity as *AC*, and predicting the probability that a farmer will have a particular adaptive capacity given his characteristics:

$$Prob\ (AC_{ij}) = Z_{ij}\theta + \tau_{ij} \qquad (2)$$

Where:

AC = low, moderate and high adaptive capacities which were assigned values of 0, 1 and 2, respectively in equation (2).

Z = vector of explanatory variables;

θ' = a vector of regression coefficients; and

τ = the error term with a logistic distribution.

The marginal effect was derived as:

$\frac{\partial AC_{ij}}{\partial Z_i} = AC_{ij}(\theta_{jk} - \sum_{m=n}^{j-1} b\,\theta_{m=n} ACmk)$ (3)

The variance (Var) of the error term of adaptive capacity to climate change τ is:

$Var(r_{ij}) = \frac{\pi 2}{6}$ (Green, 2003) (4)

The variable influencing respondents, adaptive capacity to climate change in the study areas is specified as: $AC_{ij} = \theta_0 + \theta_1 AGE + \theta_2 MAR + \theta_3 HHS + \theta_4 OFFARM + \theta_5 AILAND + \theta_6 ACREDIT + \theta_7 HEDU + \theta_8 DTM + \theta_9 COT + \theta_{10} VTHC$ (5)

Table 2: Variable Influencing Respondents, Adaptive Capacity to Climate Change

Variable	Definition and measurement	Expected sign
AGE.	Age of farmer (in years)	Positive
MAR	Marital status (married=1,0 otherwise)	Positive
HEDU	Education (Numbers of years of formal education)	Positive
HHS	Household size (Numbers of individuals)	Positive
OFFARM	Income obtained from off-farm business (Naira)	Positive
SHIL	Sizes of hectares of irrigable land (Hectare)	Positive
ACREDIT	Access to credit. (Access=1, No access=0)	Positive
DTM	Distance to market from resident (kilometer)	Negative
COT	Cost of treatment of diseases (Naira) and	Negative
VTHC	Numbers of visit to healthcare/facility (kilometer)	Negative

RESULTS AND DISCUSSION

Factors influencing adaptive capacities to poverty diseases

The results of factors influencing adaptive capacities to poverty diseasesfrom multivariate probit model are presented in Tables 3. The result in revealed that Chi Square value was 33.0 which implies that the entire model was significant at P<0.01 level probability. The result shows that off farm business and gender were statistically significant at P<0.05 and P<0.10 level affects malaria respectively. Which show that malaria tends to increases by

0.419 and 0.466 implying malaria occurrence increases with increased in off farm business and gender by 41.9% and 46.6% probability level respectively. The finding agrees with WHO (2018) which reported that available evidence suggested that given equal exposure, adult men and women are equally vulnerable to malaria infection, except for pregnant women who are at greater risk of severe malaria in most endemic areas. The findings were also supported by Wiseman *et al.* (2003) who reported that malaria inhibits agricultural productivity such as ill-health or premature death of farmers, which leads to decrease in farm output. This decrease in output may discourage respondents from solely depend on farming for their livelihood, therefore engaged in off farm businesses activities.

Furthermore, the result revealed that experience was statistically significant at $P<0.01$ affects malaria. Which indicated that malaria is likely to decrease by 0.022 implies that malaria occurrence decreases with increased in experience by 2.2% probability level. This is in agreement with findings of White (2011) who revealed that people who have experienced cycles of malaria attacks will be able to tell the signs and symptoms of the diseases and build strong adaptive capacities.

The result shows that of types of accommodation, education and sanitation of environment were statistically significant at $P<0.05$ and $P<0.10$ level affects HIV/AIDS. Which show that malaria tend to increases by 0.499, 0.313 and 0.080 implying HIV/AIDS occurrence decreases with increased in types of accommodation, education and sanitation of environment by 49.9%, 31.3% and 8.0% level of probability respectively. The finding agrees with the report of WHO (2012) which affirmed that HIV/AIDS education is a common and well-proven intervention strategy for providing information on adaptive capacities to HIV/AIDS in communities especially the young people.

Table 3: Estimate of Factors Influencing Climate Change Adaptive Capacities to Poverty Diseases.

	Pooled			Edo State			Kogi State		
Variables	Malaria	HIV/AIDS	Tuberculosis	Malaria	HIV/AIDS	Tuberculosis	Malaria	HIV/AIDS	Tuberculosis
Constant	0.5650	-1.1537**	-1.9064***	3.3089	-0.1474**	-2.3409***	0.5650	-1.1537**	-1.9064***
	(0.557)	(0.616)	(0.570)	(0.668)	(0.699)	(0.730)	(0.557)	(0.616)	(0.570)
Age (Years)	-0.0009	-0.0007	0.0119	-0.0128	-0.0024	0.0186	-0.0009	-0.0007	0.0119
	(0.008)	(0.010)	(0.009)	(0.133)	(0.010)	(0.011)	(0.008)	(0.010)	(0.009)
Gender	0.4654*	0.1636	-0.0669	0.0333*	0.1080	0.2388	0.4654*	0.1636	-0.0669
	(0.260)	(0.246)	(0.281)	(0.371)	(0.292)	(0.239)	(0.260)	(0.246)	(0.281)
Marital status	-0.01575	-0.1048	0.5181	-0.1358	0.0461	-0.0203	-0.01575	-0.1048	0.5181
	(0.114)	(0.137)	(0.126)	(0.175)	(0.142)	(0.162)	(0.114)	(0.137)	(0.126)
Types of accommodation	0.1276	-0.4993**	-0.3334	-0.2880	-0.2157**	-0.0994	-0.1276	-0.4993**	-0.3334
	(0.177)	(0.204)	(0.229)	(0.327)	(0.210)	(0.232)	(0.177)	(0.204)	(0.229)
Education (Years)	-0.0185	-0.0263*	-0.0295*	0.0115	-0.0242*	-0.0174*	0.0185	-0.0263*	-0.0295*
	(0.018)	(0.014)	(0.016)	(0.029)	(0.019)	(0.020)	(0.018)	-(0.014)	-(0.016)
Farming experience	-0.0220***	-0.0133	-0.0043	0.0095***	0.0041	0.0229	-0.0220***	0.0133	0.0043
(Years)	(0.075)	(0.008)	(0.010)	(0.011)	(0.010)	(0.010)	-(0.075)	(0.008)	-(0.010)
Amount spent on drugs	0.0749	0.1716	-0.2329	-0.0521	0.1572	-0.2592	0.0749	0.1716	-0.2329
(Naira)	(0.167)	(0.191)	(0.237)	(0.347)	(0.212)	(0.241)	(0.167)	(0.191)	(0.237)
Sanitation of environment	-0.1244	-0.3134*	0.1176	0.5029	-0.1587*	0.2175	0.1244	0.3134*	0.1176
	(0.169)	(0.179)	(0.223)	(0.169)	(0.202)	(0.223)	(0.169)	(0.179)	(0.223)
Off-farm business (Naira)	0.4185**	0.0987	0.3294	0.4982**	0.0009	-0.2563	0.4185**	0.0987	0.3294
	(0.183)	(0.207)	(0.251)	(0.307)	(0.253)	(0.291)	(0.183)	(0.207)	(0.251)
Access to credit (Naira)	0.02388	0.0804	0.7739***	-0.4326	-0.0235	-0.7800***	0.02388	0.0804	0.7739***
	(0.233)	(0.271)	(0.256)	(0.371)	-(0.259)	-(0.270)	(0.233)	(0.271)	(0.256)
Visit to spiritual head	-0.1804	-0.2885	-0.3090	0.0176	-0.2163	0.1160	-0.1804	-0.2885	-0.3090
(Kilometer)	(0.175)	(0.211)	(0.252)	(0.258)	(0.226)	(0.245)	(0.175)	(0.211)	(0.252)
Model chi^2	33.000			75.62			32.000		
Prob > Chi^2	0.0001			0.0000			0.0001		

*Standard errors in parentheses, *p<0.10 level of significance, **p<0.05 level of significance, ***p<0.01 level of significance.*

Source: Field survey, 2017.

Furthermore, the result revealed that education was statistically significant at P<0.10 affects tuberculosis. Which indicated that tuberculosis is likely to decrease by 0.029 is implies that tuberculosis occurrence will decrease with increase in education by 2.9% level of probability.This finding agrees with Nankabirwa *et al. (*2014) who affirmed that malaria infection is an important cause of school absenteeism among African children, which may affect their school performance.

Access to credit was statistically significant at P<0.01 affecting tuberculosis. This indicates that tuberculosis will likely increase by 0.774. this implies that tuberculosis will increase with increased access to credit with 77.4% level of probability. According to the WHO (2018) which reported that in 2017, an estimated 1 million children became ill with tuberculosis and 230 000 children died due to fact that most people in rural areas are poor and lack funds to purchased curative and preventive drugs.

The result in Edo State, indicated that education and off farm business were statistically significant at p<0.01 and P<0.10 level of probability affecting malaria. This shows that malaria is likely to decrease by 0.009 and 0.498 respectively which implies that malaria occurrence will decrease with increased education and off farm business by 0.9% and 49.8% level of probability respectively.The findings were in agreement with Ansah *et al.* (2006) who reported that health education impacted positively caregivers' knowledge of malaria and their adaptive capacities to access antimalarial treatment when their children have fever.

The result further, revealed that gender was statistically significant at p<0.10 probability level affecting malaria. This indicate that malaria tends to increase by 0.033, implying that malaria occurrence will increase with increased in gender by 3.3% probability level.Evidence from some northern part of the Nigeria, indicates that restricted mobility of women as a result of traditional believes or region may also impede their attendance at primary health care clinics for malaria testing.

Furthermore, the result revealed that type of accommodation, education and sanitation of environment were statistically significant at p<0.05 and p<0.10 level of probability affecting HIV/AIDS. This shows that HIV/AIDS infection is likely to decrease by 0.22, 0.24 and 0.16

respectively, which implies that HIV occurrence will decrease with increased in type of accommodation, education and sanitation of environment by 22%, 2.4% and 16% level of probability respectively. The result also revealed that access to credit was statistically significant at $p<0.10$ level of probability affecting tuberculosis. This shows that tuberculosis tends to increase by 0.78, implying that tuberculosis occurrence will increase with access to credit by 78% probability level.

The result in Kogi State, revealed that gender was statistically significant at $p<0.10$ level influence malaria. This shows that malaria will likely increase by 0.46, implying that malaria occurrence will increase with increased in gender by 46% probability level. This finding is in agreement with Reuben (2003) who reported that in some societies, men have a greater occupational risk of contracting malaria than women if they work in mines, fields or forests at peak biting times, or migrate to areas of high endemicity for work. similar findings were also reported by Vlassoff (2008) that women who get up before dawn to perform household chores may also be exposed to mosquitoes and consequently to malaria infection.

Furthermore, the result revealed that education and off farm income were statistically significant at $p<0.01$ and $p<0.10$ level affecting malaria. This shows that malaria tends to increase by 0.22 and 0.418, which implies that malaria occurrence will increase with increased in off farm business and education by 2.2% and 41.8% probability level. This finding was in line with Barat (2004) who reported that malaria is a preventable disease, a child dies of malaria every 30 seconds, education can serve as a gateway to teaching prevention measures that can be carried with the student for life and shared with the community

The result also, revealed that type of accommodation, education and sanitation of environment were statistically significant at $P<0.01$ and $p<0.01$ probability level affecting HIV/AIDS. This shows that HIV/AIDS is likely to increase by 0.499, 0.026 and 0.313 implying that HIV/AIDS occurrence will decrease with increased in type of accommodation, education and sanitation of environment by 49.9%, 2.6% and 31.3% probability level respectively.

Education was also and statistically significant at $p<0.10$ level affecting tuberculosis. This shows that tuberculosis is likely to increase by 0.029, implying that tuberculosis will decrease

with increase in education by 2.9% probability level. This finding is in line with a study in south-eastern Nigeria by Dike (2006) who found out that higher levels of education are associated with improved knowledge of adaptive capacities to malaria disease. Access to credit was and statistically significant at $p<0.01$ level of probability affecting tuberculosis. This shows that tuberculosis tends to increase by 0.29 implying that tuberculosis increases with increased in access to credit by 29% probability level.

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