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IMPACT OF MALARIA DISEASE ON SWAMP RICE FARM LABOUR SUPPLY AND COPING STRATEGIES UNDER INCAPACITATION BY RURAL FARMERS IN SOUTH EAST, NIGERIA

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Abstract

The study dealt on impact of malaria disease on swamp rice farm labour supply and coping strategies of malaria incapacitated farmers in South East, Nigeria. Multi-stage random sampling technique was employed in the selection of 900 respondents. The study made use of primary data. Data were collected using pre-tested and validated structured questionnaire. The data were subjected to descriptive (means and frequencies) and inferential statistics (Ordinary Least Square regression). Result showed that the mean number of days of malaria incapacitation and distance travelled to health care facilities by the swamp rice farmers in South East, Nigeria were 10.5 days and 1.5km respectively. Majority of the swamp rice farmers hired labourers (93.8%), cultivated less labour intensive crops (78.9%), reduced varieties of crops cultivated (77.2%), reduced area of farm land cultivated (70.8%) and withdrew savings/sold off their farm assets (75.6%) respectively as coping strategies during malaria incapacitation days. The Ordinary Least Square regression estimates of impact of malaria disease on labour supply to swamp rice farms in South East, Nigeria with exponential functional form as the lead equation posted R^2 and F-ratio values of 0.729 and 100.757 respectively. The result showed that health status, access to health information, distance to health facilities, side effects of malaria drugs and annual farm income were significant at varying alpha levels. There should be interventions in form of mobilizing resources, formulating and implementing policies and programmes that will promote awareness and measures that ensure effective prevention and control of the disease.

Key words**:** *incapacitation, labour supply, malaria, rice farmers*

INTRODUCTION

Malaria is prevalent and perennial in all parts of Nigeria with seasonal variations [17]. The duration of malaria transmission season in Nigeria varies from one geographical region to another. This depends on the length of the dry season during which there is a little transmission. In the Southern part of Nigeria, there is a 6–7 months transmission season with the highest number (50–60%) of cases occurring between April and November [14].
Malaria parasite reproduces in the blood and in the liver, and in some cases can be transferred via organ transplant or blood transfusion. In addition, malaria parasite can cross the placenta, and so can be transmitted from a mother to her unborn child, either in the womb or during childbirth. This is known as congenital malaria [19].

Malaria conditions and agricultural activities are interwoven. This stems from the fact that many farms in tropical countries serves as breeding ground for the malaria vector (mosquito). Human health and economic development are impeded by malaria. According to [27] malaria impedes economic development by reducing population growth, productivity of workers, savings and investment, and increasing absenteeism from work, mortality and medical costs. Malaria can have devastating negative effect on smallholder farmers. For instance, [14, 25] noted that when a farmer takes ill at planting season he/she may not be energetic enough to cultivate available farmlands or adopt intensive farming practices. As a coping strategy to malaria, the affected farmer may resort to planting less labour-intensive crops,

changing cropping patterns, and cultivating crops with lower output and returns.

Farmers especially swamp rice farmers in the South-Eastern part of Nigeria are mostly exposed to mosquitoes due to the nature of their farm work. Mosquitoes are in abundance during the rainy season, when farming activities are more pronounced. Farming is done in bushes and swampy lands where mosquitoes rest and breed. Also, due to the nature of swamp rice farmers' work, they are sometimes compelled to cross rivers, streams and ponds which are breeding places for the vectors of the parasites that cause malaria [17]. An increase in malaria infection rates during rainfalls is majorly responsible for decrease in agricultural swamp rice labour supply output [31]. During critical farming periods such as planting, weeding, and harvesting, malaria often result to loss of manpower hours among infected farmers. A study by [23] reported that malaria illness caused decrease in the percentage of supplied farm labour. The study of [15] revealed that malaria contributes to both poverty and underdevelopment in Nigeria through reduced productivity/output and absenteeism from work. Consequently, recent intervention efforts have focused on effective prevention and control measures. Successive governments have attempted to eradicate malaria through anti malaria campaign, seminars and workshops and free distribution of mosquito nets. Adolescents and young adults are now dying of severe forms of the disease. Air travel has brought the threat of the disease to the doorsteps of industrialized countries, with an increasing incidence of imported cases and deaths from malaria by visitors to endemic-disease regions. A number of factors contribute to the extent to which malaria disease occurs: 1) rapid spread of resistance malaria parasites to chloroquine and the other quinolines; 2) frequent armed conflicts and civil unrest in many countries, forcing large populations to settle under difficult conditions, sometimes in areas of high malaria transmission; 3) changing rainfall patterns as well as water development projects such as dams and irrigation schemes, which create new mosquito breeding sites; 4) adverse socio-economic conditions leading to a much reduced health budget and gross inadequacy of funds for drugs; 5) high birth rates leading to a rapid increase in the susceptible population under 5 years of age; and 6) changes in the behaviour of the vectors, particularly in biting habits, from indoor to outdoor biters. Malaria affects labour mobility, mortality, investment and fertility decisions of the household, the result of which could be efficiency and productivity losses to the household [18]. There seems to be a consensus among several researchers that malaria affects the "poorest of the poor" households and it poses a considerable economic burden on the society [1, 12, 16, 18, 24].

In reality, data from health facilities are potentially useful for monitoring time trends in the number of malaria cases that can guide interventions. However, trends of routinely collected data over a prolonged period and over a wide geographical area can be useful for local programmes planning and can engender major investments in improving both access to health services and monitoring changes. The study will advocate for interventions in the form of mobilizing resources, formulating, implementing policies and programmes that will ensure effective labour supply by improving the standard of living of farmers. Farmers through this study will be guided on the appropriate and effective farming practices/technologies that can be adopted to reduce days of incapacitation and also improve their quality of life and boost food production. The broad objective of this study was to analyze the impact of malaria disease on swamp rice farm labour supply and coping strategies under incapacitation in South East, Nigeria.

The study specifically:

(i) described the socio-economic characteristics of swamp rice farmers in South-east Nigeria;

(ii) described coping strategies by farmers under incapacitation due to malaria in the study area;

(iii) determined the impact of malaria disease on labour supply to swamp rice production among farmers in in South-east Nigeria.

Hypothesis of the study

To guide the study, the following hypothesis was tested in null form

HO_1: labour supply is not influenced by health status, health information, distance to farm, drug supply, drug side effect, housing, farm income.

MATERIALS AND METHODS

Study area

The study was conducted in South-east geo-political zone of Nigeria. South-east Nigeria is made up of five states namely: Abia, Anambra, Ebonyi, Enugu and Imo. The study area is located between Latitudes $5^0 06^{'}$N and $6^0 34^{'}$N of the Equator and Longitudes $6^0 38^{'}$ E and $8^0 08^{'}$ E of the Greenwich Meridian. It covers a land area of about 109,524km^2 or 11.86% of the total land area of Nigeria. The population of the area was 16,381,729 persons, comprising of 8,306,306 males and 8,075,423 females [20].

South-East geo-political zone shares boundaries with Kogi and Benue states to the north, Edo state to the north-west, Cross River state to the east, Akwa-Ibom and Rivers States to the south, Bayelsa state and Delta state to the south-west and west respectively. The region experiences two main seasons in the year, namely: the rainy season (late march – early November) and the dry season (late November – early March). The average annual rainfall amounts to about 1,730mm in about 110 rain days. Its maximum monthly atmospheric temperature is about 32.5^{o}C and humidity is often above 80% during the rainy season. The inhabitants of this zone are predominantly farmers cultivating food crops such as cassava, yam, cocoyam, maize and rice, and cash crops such as oil palm, cocoa and cashew [22].

Sampling technique

Multi-stage random sampling technique was employed in the selection of states, local government areas (ADP blocks), circles and respondents. In the first stage, three states (Abia, Enugu and Ebonyi States) of the five states in South-East Nigeria, were selected at random. Secondly, five local government areas representing five Agricultural Development Project (ADP) blocks were selected at random from each of the states. This gave a total of 15 LGAs or ADP blocks. Deliberate efforts were taken to ensure that the chosen LGAs were spread across the agricultural zones of the states. In the third stage, three circles were randomly chosen from each of the 15 selected blocks (LGAs), summing up to 45 circles. The fourth stage involved the random selection of two (2) hospitals (primary and/or secondary health Institution) in each chosen circles to give a total of ninety (90) hospitals. Finally, a random selection of ten (10) diagnosed malaria patients (in and out) who are swamp rice farmers was made from the selected hospitals to give a total of nine hundred (900) diagnosed malaria patients.

Method of data collection

The data for this study were obtained mainly from primary sources through field survey using a well-structured pre-tested and validated questionnaire. Respondents who cannot read and write had the questionnaire administered through personal interview method. Primary data collected included those on socio-economic characteristics such as age, annual farm income, number of days of incapacitation, distance to health care facilities and coping strategies.

Analytical tools

The data collected were subjected to both descriptive and inferential analyses. Objectives (i) and (ii) were achieved using descriptive statistics tools of frequency, tables, means and percentages. Objective (iii) was achieved using ordinary least square regression model.

To determine impact of malaria disease on labour supply ordinary least square regression model was used as described by [14].

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e)$… .....(1)

where:

Y= Labour Supply (Mandays)

X_1= Health Status (dummy variable; healthy = 1, not healthy = 0)
X_2= Health Information (access to information = 1, no access to information = 0)
X_3=Distance (Km)
X_4= Drug supply (Gram)
X_5=Drug Side Effect (dummy variable; yes=1, no=0)
X_6=Housing (₦)
X_7= Farm Income (₦)
e = error term
The multiple regression model was expressed in four functional forms (linear, semi-log, double-log and exponential forms).

RESULTS AND DISCUSSIONS

Socio-economic characteristics of the swamp rice farmers

The distribution of the rice farmers with respect to their socio-economic characteristics is shown in Table 1. As shown in the table, 30.7% of smallholder swamp rice farmers in South East, Nigeria were between the ages of 40 years and 49 years. This result suggests that smallholder rice farmers in this age range (i.e. between 20 years and 59 years) were economically active and thus carryout major swamp rice production activities in the rice farms in the study areas. The greater participation of smallholder swamp rice farmers that were between 20 years and 59 years in swamp rice production activities lead to greater exposure to mosquito's bites and malaria disease among the youth. This age bracket (20 years and 59 years) contained the hub of the youth with greater strength and energy to increase rice production, productivity and invariably welfare. The mean age of the smallholder swamp rice farmers in South-East, Nigeria was 45.5 years. This is productive age and is requisite for manual labour supply necessary for swamp rice production and farming as observed by [28]. Also, smallholder farmers within this age bracket (20 years and 59 years) are more conscious of their health and more likely to seek care on malaria ill-health [13].
Table 1 also revealed that 59.2% of the smallholder swamp rice farmers had annual farm incomes within the range of ₦60,000.0 and ₦109999.0. Mean annual farm income of the farmers was ₦133,362.2. This amount translates to average monthly farm income of ₦11,113.5 which is far below the country's monthly minimum wage of ₦30,000.00. This means that in the face of the prevailing inflation and economic crunch experienced in Nigeria, this income level may not be adequate for the farmers to cater for the needs of their households and still set some aside for meeting costs associated with malaria treatment, prevention and investment in swamp rice production. The economic cost of seeking malaria services for low income farmers can account for a large share of household income and deplete savings and investments in their farms [10]. This result lends credence to finding of [7] among farmers in South-east Nigeria.
Table 1 revealed further that 48.1% of the smallholder swamp rice farmers in South East, Nigeria had between 7 and 11 days of incapacitation. The mean number of days of incapacitation of the farmers was 10.5 days. This implies that smallholder swamp rice farmers lost valuable productive time to malaria. This is in line with the findings of [5] that malaria attacks an individual on average of four times in a year with an average of 10-14 days of incapacitation in the agrarian households. The days of incapacitation caused by malaria could cause serious consequences on agricultural production in the area. This number of days lost has implications for productivity level as the threshold productivity level may not be achieved [30].
Lastly, Table 1 showed that 62.8% of the rice farmers travelled a distance within the range of 0.50 km and 1.79km to get to health care centres. The mean distance travelled by the farmers from home to health care centres was 1.6km. Close proximity to health care facilities reduced the odds of progression from mild to severe malaria. Distance is the most important factor that influences utilization of health care facilities and closeness to health facilities could ease access to treatment. [11] was of the opinion that closeness to health care centres and facilities increase the level of awareness

and orientation on the possible causes of malaria infection and measures to control its incidence.

Table 1. Socio-economic characteristics of smallholder swamp rice farmers with malaria incidence in South-East, Nigeria

Socio-Economic Characteristics	Frequency	Percentage
Age (Years)		
20-29	74	8.2
30-39	186	20.7
40-49	276	30.7
50-59	247	27.4
60 and above	117	13.0
Mean (years)	45.5	
Std dev.	11.4	
Annual Farm Income (₦)		
60,000.00-109,999.00	533	59.2
110,000.00-159,999.00	168	18.7
160,000.00-209,999.00	102	11.3
210,000.00-259,999.00	15	1.7
260,000.00 and above	82	9.1
Mean (years)	133,362.2	
Std dev.	83,120.5	
Days of Incapacitation		
2-6	202	22.4
7-11	433	48.1
12-16	146	16.2
17 and above	119	13.2
Mean (Days)	10.5	
Std dev.	4.9	
Distance to Health Care Facilities (Km)		
0.50-1.79	565	62.8
1.80 and above	335	37.2
Mean (Km)	1.6	
Std dev.	0.8	
Total	900	100.00

Source: Field Survey, 2022.
Exchange Rate (710.00 = 1.0 USD

Alternative arrangement by smallholder swamp rice farmers during incapacitation due to malaria in South East, Nigeria

The distribution of smallholder swamp rice farmers according to alternative arrangements adopted to ensure swamp rice production during incapacitation due to malaria disease is presented in Table 2. The table shows that 93.8% of the smallholder swamp rice farmers in South East hired labourers as coping strategy during incapacitation by malaria. The prevalence of malaria illness among farmers would result to momentary incapacitation and decrease in physical strength which invariably reduces their ability to engage in income earning activities, leads to irregular visits to their farms, imposes health cost and leads to decreased farm yield. [8] asserted that malaria disease leads to incapacitation of the economically active labour force, reduces capacity to work, affects the quality and quantity of available labour and decreases overall productivity. Thus productive time and income are lost as a result of malaria illness, treatment and control.

Table 2 also shows good proportion of smallholder swamp rice farmers in South-East, Nigeria (78.9%, 77.2% and 70.8%) cultivated less labour intensive crops, reduced varieties of crops cultivated and also reduced area of farm land cultivated as an alternative coping strategy during malaria disease incapacitation. Malaria illness would cause reduction in variety of crops grown in the study area [21]. Increase in poverty among swamp rice farmers in malaria endemic agrarian communities in South East may give rise to a vicious circle of decline in the variety of crops grown. Malaria-specific incapacitation therefore constitutes an important poverty dimension that causes reduction in variety of crops. The farmers may resort to planting less labour-intensive crops and also change cropping patterns, thereby raising fewer crops which give lower returns [9]. A sick farmer during the planting season may be incapacitated to cultivate a vast area of land due to the self labour loss and unable to engage in intensive farming practices which could exhaust him/her due to a high-energy requirement of such practices. This may resort to the farmers planting less labour-intensive crops like maize, okro and fluted pumpkin which give them lower returns [14]. Malaria incapacitation of swamp rice farmers results to little use of land for rice cultivation by the farmers. There are less use of effective methods of rice production and fewer efforts are put into other farming activities. This situation then culminates to less rice being harvested, climaxing in less income and, therefore less money available to pay for prevention and treatment of malaria [9].

The table further shows that 75.6% of smallholder swamp rice farmers in South East, Nigeria withdrew their savings and sold off their assets in period of incapacitation. For instance, due to costs of treatment and other expenses as well as lower incomes from loss

of self labour, disease affected households usually draw on assets. After the onset of diseases, savings and financial assets are usually the first to be depleted. The cost of healthcare for sick persons and of funerals drive many households into debt, and they resort to using their savings and remittances received or even sell household and farm assets to defray the costs. In addition, households may have to sell off productive assets such as tools, draught animals, and land [29] just to cope with the devastating effect of ill-health. Swamp rice farmers may also borrow money from friends to settle treatment bills with very little improvements made to their farms, thereby decreasing their productivity very remarkably because of malaria disease. Malaria transmission usually coincides with the planting and harvesting seasons, making the illness's impact particularly damaging.

Finally, 50.0% of the smallholder swamp rice farmers in South East, Nigeria were involved in the reallocation of labour as a result of malaria induced ill-health. During the period of malaria incapacitation, a typical farmer may stop work partially or completely due to debility arising from malaria infection. Consequently labour availability and productivity may suffer a setback under severe malaria attack and self labour may not be available on the farm at all during the period of incapacitation while in a situation of mild malaria attack, the intensity of productivity of labour which is measured by work done per unit time, may be reduced. The loss of workdays as a result of malaria-specific illness had accounted for the decline in farm outputs [4, 26].

Table 2. Distribution of Smallholder Swamp Rice Farmers according to Adopted Alternatives during Malaria Disease Incapacitation in South East, Nigeria

Adopted Alternatives	*Frequency	Percentage
Reallocation of labour	450	50.0
Hiring of labour	844	93.8
Reduction in farm size	637	70.8
Withdrawal of savings/assets sales	680	75.6
Cultivating of less labour-intensive crops	710	78.9
Reduction in variety of crops planted	695	77.2

Source: Field survey, 2022.
* Multiple responses recorded

Determinants of impact of malaria disease on labour supply to swamp rice production among the swamp rice farmers in South East, Nigeria

The estimates of the Ordinary Least Square (OLS) multiple regression model used to determine factors that influenced labour supply to swamp rice farmers production induced by malaria diseases in South East, Nigeria is presented in Table 3. The F-values of all the tried functional forms of the regression model were significant at 1.0% alpha level indicating goodness of fit and implying that any of the functional forms can be used for predictive purposes. However, the exponential logarithmic functional form gave the best fit to the data having produced highest R^2 value of 0.729, F-value of 100.757 and number of significant variables. The R^2 (coefficient of multiple determination) value of 0.729 implies that 72.9% of the variation on the impact of malaria diseases on labour supply to swamp rice farmers production was explained by the joint action of the independent variables included in the model. Specifically, the coefficient of health status was positive (0.010) and statistically significant at 1.0 percent alpha level. This implies that an increase in the health status of the smallholder swamp rice farmers increased labour supply to swamp rice production. Health is wealth and represents a key ingredient of human capital. Thus, when health is endangered as a result of malaria disease, labour supply is reduced. There is greater likelihood of swamp rice farmers with good health status being relatively more productive as a result of uninterrupted labour supply with the complement of reduced level of malaria disease affecting them. Healthier farmers are thus expected to earn more. According to [6], Poor health affects agricultural production as the health status of the farmers affect their physical ability to work, efficient utilization of resources as well as ability to adopt innovations and thus impact negatively on their labour supply [9].

The coefficient of access to health information (0.002) was positive and statistically significant at 5.0% alpha level.

The implies that the more the access to health information, smallholder swamp rice farmers have, the more they are able to eradicate malaria disease and reduce the effect of malaria disease. This will increase the labour supply in their swamp rice farms. Also, health information helps in early diagnosis and treatment of malaria, reduces malaria disease, reduces days of malaria disease incapacitation, prevents deaths and contributes to reducing its transmission [30]. This is in line with *a priori* expectation.

The coefficient of distance to health facilities was negative (-0.003) and significant at 1.0 percent level. This implies that a unit increase in distance to health care facilities in which the swamp rice farmers receive treatment for malaria disease, the quality and quantity of labour supplied by the swamp rice farmers decrease. This is in line with *a priori* expectation. The implication of this finding is that the likelihood of increased malaria incidence and number of days is reduced with farmers who are closer to health facilities. Closeness to health facilities could ease access to malaria treatment. Also, it could increase the level of awareness and orientation on the possible causes of malaria disease and measures to control its incidence [11].

The coefficient of side effects (-0.789) of the malaria drugs was negative and statistically significant at 1.0% alpha level. This implies that increase in side effects of malaria drugs increases the days of incapacitation of a swamp rice farmer and thus reduced the number of labour supplied in swamp rice farm. According to [2], increase in days of incapacitation as a result of malaria reduces amount that would have been invested in rice production (hiring of labour), because the more the number of days, the greater the loss incurred during treatment, and the less the annual income. Under severe condition, labour may not be available on the farm at all during the period of incapacitation while in a situation of mild side effect of malaria drugs, the intensity and efficiency of labour supply is reduced.

Table 3. Pooled Data Estimate of Malaria Factors that Influenced Labour Supply to Swamp Rice Production among the Farmers in South East, Nigeria

Variables	Linear	Exponential+	Double-log	Semi-log
Constant	753.176***	1.329***	5.585***	36,992.728**
	(10.006)	(16.519)	(14.243)	(2.286)
Health Status	0.073	0.010***	0.727***	353.008*
	(0.079)	(6.294)	(3.619)	(1.652)
Access to health information	23.264**	0.002**	0.496	-10,515.298
	(2.063)	(2.537)	(1.068)	(-0.680)
Distance to health care facilities	-0.0003	-0.003***	-0.244*	-12,274.134
	(-1.442)	(-2.928)	(-1.687)	(-1.233)
Drug supply	-2.703	-0.098	0.348*	-6,327.851*
	(-0.963)	(1.026)	(1.772)	(-1.558)
Drug side effect	-8.852	-0.789***	1.406	1,585.993*
	(-0.481)	(-2.805)	(0.727)	(1.790)
Housing	-2.682*	0.392	1.361	3,402.867
	(-1.758)	(1.256)	(0.496)	(1.442)
Farm income	12.124**	-5.014E-008***	0.044	14,544.469**
	(1.975)	(-3.630)	(1.104)	(2.483)
R^2	0.300	0.729	0.595	0.480
Adjusted R^2	0.257	0.720	0.520	0.415
F-ratio	25.441***	100.757***	47.883***	39.256***

Source: Field Survey data, 2022.
*,**&*** implied Significant at 10.0%, 5.0% and 1.0%
$^{+}$ = lead equation

The coefficient of farm income (-5.014E-008) was negative and significant at 1.0 percent level. This negates *a priori* expectation and implies that increase in farm income is channelled towards remediation measures and thus reduced labour supply in swamp rice farm. The result is in line with [3] who reported that direct cost of malaria treatment (which includes the out-of-pocket expenditures on treatment, and cost of transportation/round-trip associated with receiving medical care) reduced the money that would have been used for crop production. Also, [8] observed that the cost of

treating and preventing malaria could lead households to reduce farm area under cultivation, planting of less labour intensive crops, changing cropping pattern, adoption of labour-scarce innovations that may be less productive.

CONCLUSIONS

The study has shown that smallholder swamp rice farmers made use of various alternatives during the period of malaria incapacitation to include hiring of labour, reduction in farm size, withdrawal of savings/assets sales, cultivating of less labour -intensive crops and reduction in variety of crops. The study further showed that health status, health information, distance to health facilities, side effect of the malaria drugs and farm income were the determinants of impact of malaria on labour supply in swamp rice farms in south-East Nigeria.

The study therefore recommends that there should be interventions by government at all levels (federal, State and local) in form of mobilizing resources, formulating and implementing policies and programmes that will promote awareness and measures that ensure effective prevention and control of the pandemic disease.

An effective health management policy strategy with emphasis on health development by the government will be a welcome idea. To this effect, health education seminars on the impact of good health on labour supply will be ideal.

There is a need for adequate preventative measures and affordable medical treatments in the study area because days lost due to malaria average more than a week, which obviously reduces labour supply and output. For farmers to receive the medical care they require, hospitals and clinics must also be quickly reachable, widely accessible, and reasonably priced. Therefore government at all levels (federal, state and local) and non-governmental organizations should invest more in building of health centers in the study areas for easy access by farmers.

Medication that can reduce the days of incapacitation should be intensified and made available to farmers at affordable prices in order to improve the quality of life, labour supply and productivity of farmers..

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