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**DETERMINANTS OF WILLINGNESS TO PAY (WTP) FOR RIVER-BLINDNESS  
(ONCHOCERCIASIS) CONTROL/ ERADICATION AMONG AGRICULTURAL  
HOUSEHOLDS IN NORTH-CENTRAL NIGERIA**

Ogebe, F.O<sup>1</sup>, Umeh, J.C<sup>1</sup> and Idoko, D.A<sup>2</sup>

<sup>1</sup>Department of Agricultural Economics, Federal University of Agriculture  
P.M.B. 2373 Makurdi, Benue State, Nigeria

<sup>2</sup>Department of Agricultural Education, College of Education, Oju, Benue State, Nigeria

**ABSTRACT**

The study was conducted to assess the determinants of Willingness to Pay (WTP) for Onchocerciasis control/ eradication among Agricultural Households in North-Central Nigeria. A survey method was used for the study and primary data were collected using structured questionnaire. The population of the study consisted of households affected with Onchocerciasis in North-Central Nigeria. Random Sampling Technique was used in selecting a sample size of 556 respondents from three states: Benue State having 206 respondents, Nasarawa State and Plateau State with 217 and 133 respondents respectively. The Nigerian Onchocerciasis Control Programme list of endemic Local Governments/ Villages was used to identify households infected with Onchocerciasis. Descriptive Statistics, Cost of illness Approach, Willingness to Pay for Onchocerciasis control using Logistic model were used in analysing the data. The descriptive statistics showed that majority (72.7%) of the respondents were males and married (82.6%) with average age of 46.4 years and average household size of 10 persons. Majority (70.2%) of the respondents were educated with only (29.8%) being illiterate. The Cost of illness approach revealed that the average direct cost of Onchocerciasis illness in the study area was N9, 886.57 per Household which is high enough to stretch the already tight expenditure budgets of the poor rural households. The results of Willingness to Pay indicated that on average, households were willing to pay N5, 300.30 per month to avoid Onchocerciasis attack. The variables that significantly discriminated among the amounts households will be willing to pay to eradicate Onchocerciasis were household income (0.542), level of education (0.127), marital status (2.413) and dependency status (1.855). The study recommends prioritizing domestic resource allocation for the treatment of Onchocerciasis for significant and sustained reduction in the burden of Onchocerciasis. This will improve the overall health status, enhance the social interactions and increase the economic productivity of the agricultural households of North-Central Nigeria and ensure food security of the nation.

**Keyword:** Onchocerciasis, Productivity, Willingness to Pay, Financial costs

**INTRODUCTION**

Onchocerciasis is a skin and eye infection caused by the filarial nematode *Onchocerca volvulus* and transmitted through the bites of *Haematophagussimulium* (black flies) which breed in fast flowing rivers and streams, increasing the risk of infection to people living near the water bodies. The disease is endemic in large areas of Africa especially isolated and remote communities close

to the fast flowing rivers and streams. It is estimated that 18 – 20 million people in the world are infected, 1- 2 million people are visually impaired and 270, 000 people are rendered completely blind by the disease (Richards *et al.*, 2001). Onchocerciasis is almost exclusively an African disease. Almost all (96%) of the estimated 122.9 million at risk globally live in Sub-Saharan Africa and 17.5 million of the estimated 17.7 million who are infected live in Africa (McLeod, 2008).

Nigeria has the highest cases in the world; 3.3 million people are infected and about 114, 000 are going blind from the disease (Okwaet *al.*, 2009; Njepuome, 2009). Areas with the highest prevalence of blinding Onchocerciasis in Nigeria are found mainly in parts of the nine northern and middle Savannah States where the impact of blindness on a community is reflected in an increased mortality rate, mortality among blind people being four times higher than that of non-blind persons of the same age in a community (WHO, 1994). The fear of blindness resulted in depopulation of the fertile river valleys, and this made Onchocerciasis a major obstacle to socio-economic development in West African Savannah regions.

Incidences of Onchocerciasis in endemic areas have major implications for household's economy and natural schedule of activities and interactions with the system (WHO, 1977). The household income is affected by having to trade labour market participation and earnings for either of illness or care-giving, the magnitude of which depends on the status of the sick individual or the care-giver in the household system. Also, household budget are affected by the need to adjust component of household expenditure to accommodate the medical bills and transport expenses relating to medical care seeking (Xu *et al.*, 2003).

Agricultural production is usually affected through the impact of the disease on agricultural labour supply. The direct effect of the disease on labour results when a working member of the household is prevented from working on the farm by disease infection. Incapacitation of the economically active population affects quality and quantity of labour productivity by the household. The indirect effect results when a working member of the household is delayed from working on the farm because he has to take care of other members of the household infected with the disease (Ajani and Ugwu, 2008). Productive time diverted from farm to care for the sick may reduce farm labour.

In North-Central Nigeria in particular, endemic Onchocerciasis is causing serious concern because of its formidable impact on the medical, social, economic and political development of the affected areas. Treatment of the disease takes a long time and it is costly. Literature abounds on the study of cost and effects of Onchocerciasis on agricultural production. For instance Ajani and Ugwu (2008) studied the impact of Onchocerciasis on agricultural productivity of farmers in Kanji Basin of North-Central Nigeria and reported adverse effect of the disease on farm efficiency of the farmers. Allen *et al.* (2008) studied the burden of Onchocerciasis on rural households and reported loss of outputs and enlarged burden of costs of treatment and control. Little or no work has been done in the area of willingness to pay for Onchocerciasis control/eradication. It is therefore important to ascertain the exact amount an individual would be willing and able to pay for Onchocerciasis control to reduce the probability of illness or mortality. It is for this reason that this research work is carried out to determine the ability and willingness to pay for Onchocerciasis control among agricultural households of North-central Nigeria.

Specifically, the study was conducted to:

- i. describe the socio-economic characteristics of households in the study area,
- ii. estimate the direct/ financial cost of Onchocerciasis in the study area,
- iii. estimate the amount the respondents would be willing and able to pay for Onchocerciasis control/ eradication in the study area, and
- iv. assess the socio-economic factors that influence the amount households would be willing to pay to control/ eradicate Onchocerciasis in the study area.

**EMPIRICAL MODEL AND METHOD**

The study was conducted in North-Central zone of Nigeria (Benue, Nasarawa and Plateau States). The zone consists of six States including the FCT, namely; Benue, Plateau, Nasarawa, Niger, Kwara, Kogi and Abuja (FCT). North Central Nigeria lies between longitude 3<sup>0</sup> E and 4<sup>0</sup> E of the equator and latitude 7<sup>0</sup>30N and 11<sup>0</sup> 20N of the Greenwich Meridian (FAO, 2004). The area occupies a land mass of about 296, 898 Km<sup>2</sup> and a population of 21, 566, 993 million people (NPC, 2007). The average annual rainfall in the zone ranges from 800 – 2,000mm with high relative humidity and temperature of 13 – 17 °C. The major crops of the area are Rice, Yam, Groundnut and other Nigerian staples.

Multi-stage sampling procedure was used in the selection of respondents. Firstly, Purposive Sampling was used to select three States based on their involvement in agricultural activities. Secondly, from each state two (2) Local Government Areas were randomly selected. Thirdly, two communities were randomly selected from each Local Government Area making a total of eighteen (18) communities. From each community, a random sample of ten (10) percent of households affected by Onchocerciasis was drawn. A total of 556 households in the three States were interviewed: Benue State having 206 respondents, Nasarawa and Plateau States with 217 and 133 respondents respectively. The Nigerian Onchocerciasis Control Programme list of endemic LGs/villages was used as sample frame. The primary data for the study were generated through the use of structured questionnaire that were administered to heads of households using simple random techniques. The data were analysed using both descriptive and inferential statistics. Socio-economic characteristics and Willingness to Pay (WTP) were actualised with descriptive statistics. Inferential statistics (Logit model) was used to estimate the socio-economic characteristics that influence the amount that households would be willing to pay for Onchocerciasis control/ eradication. Cost of illness model was used to estimate the direct or financial cost of Onchocerciasis in the study area.

**MODEL SPECIFICATION**

**1. Cost of Illness**

Cost of illness procedure adopted by Sauerborn *et al.* (1996) and Akinbode *et al.* (2011) was used to capture the financial burden of the disease as specified below:

$$F_c = \sum_{j=0}^n (F_d + F_m + F_t + F_{su}) \dots\dots\dots (1)$$

Where;

Fc = total financial cost of Onchocerciasis care in a year,

Fd = financial cost of drugs (₦)

Fm = financial cost of medical consultancy (₦)

Ft = financial cost of travel (₦)

Fsu = financial cost of subsistence (feeding) (₦)

Freg = financial cost of registration (₦)

Flab = financial cost of laboratory test (₦)

## 2. Willingness to Pay (WTP) Approach

The Willingness to Pay (WTP) approach measures the amount an individual would pay to reduce the probability of illness or mortality (Hodgson & Meiners 1982, Rice *et al.*, 1985). Mathematically, the willingness to pay for Onchocerciasis control/ eradication was determined by:

$$WTP = f(O, S, I)$$

Where;

O = Onchocerciasis prevalence

S = Socio-economic characteristics of the households

I = the household Income

Various factors were considered as explanatory variables for the logit analysis:

Sex (Male = 1 female = 0)

Marital status (Married = 1, otherwise = 0)

Number of years in School (Educated = 1, otherwise = 0)

Dependency status of household members (non-dependent = 1, otherwise = 0)

Distance travelled to attend Healthcare (Less than 5km = 1, otherwise = 0)

Healthcare facility usually attended (Govt. Facility = 1, otherwise = 0)

Monthly income (above N5, 000 = 1, otherwise = 0)

Onchocerciasis prevalence (High = 1, otherwise = 0)

## RESULTS AND DISCUSSION

### Socio-economic Characteristics

Results in Table 1 showed that majority (72.7%) of the respondents surveyed were males in the three States. This result indicates that males are usually household heads and actively involved in agricultural and economic activities and hence, would be willing to pay higher amounts for Onchocerciasis control/eradication. This result agrees with findings by Anonguku, *et al.* (2010) who reported that males are usually the household heads and they primarily dominate in farming activities. In overall, 82.6% of the respondents were married. This results showed that there is a higher probability of the respondents to pay higher amounts to control Onchocerciasis because such households with children are at the greatest risk of onchocercal infection as reported by Jimoh, *et al.* (2007). The average age of the respondents was 46.4 years in the pooled sample and this implies that the respondents were within productive age category and therefore can actively and effectively use their energies on agricultural and economic activities. The implication of this, is that there will be loss of agricultural productivity and fall in food

production in the study area as Onchocerciasis has been observed to incapacitate a large segment of the adult working population and prevent them from reaching their maximum productive capacity as reported by Russell (2004).

In all, 70.2% of the respondents were educated. The high literacy rate observed in the study area by implication means that the educated people would understand the advantages of Onchocerciasis control better than the uneducated ones and would be willing to pay to control the Onchocerciasis scourge than the illiterates. Overall, the average household size was 10 persons. This result is contrary to the findings of Awoniyet *al.* (2012) who reported average household size of 6 persons in Niger State of Nigeria. The high household size has implications on food security of the households. According to Jiang and Braun (2005), an increase in household size would increase the coping strategy index, meaning that increase in household size in general increases the food insecurity of the households as large household size could constitute a serious hindrance in the face of sickness, educational funding, feeding and other activities that compete for the meagre resources of the households (Russell, 2004).

The average farm size for the combined sample was estimated at 4 hectares. The result implies that farmers in the study area have just enough farmland that if effectively put into use can produce the desired output for family consumption. The mean annual farm income for the pooled sample was N188, 541.45. This indicates that households in the study area earn an average monthly income of N15, 711.79 indicating low income earning. The result further revealed that households in the study area earn N523.73 per day which is below the poverty line of \$3.00 per day at N360 per dollar (CBN, 2017). More so, a mean household size of 10 persons indicates that household members in the study area live on about N52 per day indicating a poor living condition of the households.

**Table 1: Socio-economic Characteristics Of Respondents in the Study Area**

Variables	n = 206		n = 217		n = 133		n = 556	
	Benue state		Nasarawa st.		Plateau st.		Pooled sample	
<u>Sex</u>								
Male	76.0		65.0		80.3		72.7	
Female	24.0		35.0		19.7		27.3	
<u>Age</u>								
1 – 19	2.2		3.0		1.8		2.4	
20 – 24	1.4		5.6		3.0		3.4	
25 – 29	10.0		6.7		7.0		8.0	
30 – 34	8.2		12.0		8.5		9.8	
35 – 39	12.1		7.5		9.5		9.7	
40 – 44	11.2		13.0		13.0		12.3	
45 – 49	9.8		9.0		10.6		9.7	
50 – 54	10.4		10.0		12.4		10.7	
55 – 59	14.2		11.2		15.2		13.3	
60 and above	20.5		22.0		19.0		20.7	
Average	45.9	46.9	46.3				46.4	
<u>Marital Status</u>								

Single	8.0	6.0	5.0	6.5
Married	75.0	85.2	90.1	82.6
Widow	11.5	5.5	4.0	7.3
Others	5.5	3.3	0.9	3.6
<b><u>Educational level (yrs)</u></b>				
No education	22.5	33.5	35.0	29.8
Primary/Adult educ	30.0	26.5	26.0	27.7
Secondary educ	38.0	20.5	24.5	27.9
Higher/Tertiary educ	9.5	19.5	14.5	14.6
<i>Average</i>	7.8	6.6	6.5	7.0
<b><u>Household size</u></b>				
1 – 5	20.0	21.5	25.0	21.78
6 – 10	36.0	40.5	42.0	33.26
11 – 15	22.0	25.0	16.5	21.86
16 – 20	18.5	8.0	10.5	12.49
21 – 25	3.5	5.0	6.0	4.68
<i>Average</i>	10.5	9.7	9.6	9.9
<b><u>Farm size (ha)</u></b>				
0 – 2	46.0	44.5	45.0	45.2
3 – 5	35.0	33.5	30.0	33.2
6 – 8	12.5	14.0	18.0	14.4
9 – 11	4.5	5.0	6.0	5.1
12 and above	2.0	3.0	1.0	2.2
<i>Average</i>	3.9	4.1	4.1	4.0
<b><u>Annual Farm income (₦)</u></b>				
50,000 – 100,000	4.0	7.0	6.0	5.65
100,001 – 150,000	28.5	25.5	27.0	26.97
150,001 – 200,000	33.5	32.0	37.0	33.75
200,001 – 250,000	23.5	22.0	1.5	17.65
250,001 – 300,000	3.5	8.5	2.5	5.21
300,001 – 350,000	2.5	2.0	18.5	6.13
350,000 and above	4.5	3.0	7.5	4.64
<i>Average</i>		184,466.50	183,525.81	197,632.05

**188,541.45**

*Source: Survey data, 2015*

### **Cost of Onchocerciasis Illness**

On the average, a total of ₦9,886.57 was spent by households for onchocerciasis treatment in the study area (Table 2). Drugs cost aside Mectizan (₦5980.72) constituted 61% of the total treatment cost. These drugs were either purchased at the health facility or are purchased from outside facility on prescription. This is in consonance with the findings of Asante and Asenso-

Okyere (2003) who reported that the cost of drugs formed a significant proportion of the total treatment cost of incapacitating diseases such as onchocerciasis and malaria.

Transportation cost to the facility averaged ₦858.33 which represents 8.68% of the total treatment cost while cost of registration was relatively lower in all the states, and ranges from ₦65 to ₦80 in Nasarawa and Plateau states respectively. Overall, laboratory cost constituted 6.33% of the total treatment cost.

The results further revealed that patients incurred several other costs in the process of seeking further treatment. These costs include cost of referrals, injection, and food. These costs form relatively low proportion of the treatment cost. This agrees with the findings of Russell (2004) and Asenso-Okyere (2003) who reported that cost of consultation and laboratory costs form a relatively low proportion of the total treatment cost of malaria.

**Table 2: Average Treatment cost of Onchocerciasis by Orthodox Health facilities**

<b>Item</b>	<b>Benue State</b>	<b>Nasarawa State</b>	<b>Plateau State</b>	<b>Pooled Sample</b>
Registration	76.0 (0.55)	65 (0.57)	80.3 (0.60)	72.7 (0.57)
Laboratory	580.6 (6.41)	670.82 (6.31)	620.41(6.23)	625.35(6.35)
Drugs cost	5562.72 (60.45)	6422.90 (60.38)	5905.10 (59.33)	5980.72 (60.50)
Transportation cost to facility	1043.71 (35.10)	1374.25 (12.92)	1446.46	1266.55 (14.54)
Others (food, injection)	1820.16 (20.10)	2110.22 (19.84)	1920.64	1957.70 (19.30)
Travel time to facility	9057.06 (100)	10638.19 (100)	9952.61 (100)	9886.57 (100)

*Source: Survey data, 2017*

*\*Figures in parenthesis are percentages of the total time spent at health facility*

**Willingness to Pay for Onchocerciasis Control/Eradication**

The amounts that respondents were willing to pay for onchocerciasis are shown in Table 3. The mean willingness to pay was estimated at ₦5, 300.29 per month. This was close to that found by Jimohet al. (2007) who reported WTP of ₦7, 324 for malaria prevention. This represents the amount of income that the household would be willing to give up for cessation of onchocerciasis attack, reduced swelling and improve social function associated with control of onchocerciasis for one year. This amount represents about ₦535.38 per head per month and ₦6, 424.56 annually, given 10 persons per household.

The annual economic value of preventing onchocerciasis is estimated based on the expected number of households willing to pay for the intervention and the mean WTP for these households. For North-Central Nigeria with a population of 21.6 million individuals and an average of 10 individuals per household, total annual monetary value of preventing onchocerciasis is approximately ₦ 138,770 million. This is the amount the community would be

willing to pay each year for prevention and hence, it estimates the annual value of reduced likelihood of infection for individuals who choose not to participate in the intervention but may nonetheless benefit by the reduced risk resulting from a community wide programme. The WTP value of ₦6,424.56/ year is likely to exceed actual medical expenses and productivity losses. However, the values estimated in this study reflects the value of avoided pain, suffering and reduced social functioning, as well as any expected medical expenses, savings or lost earnings.

**Table 3: Amounts Respondents were willing to pay for Onchocerciasis control in the study area**

Amount (₦)	Benue State	Nasarawa State	Plateau State	Pooled Sample
1 – 1,000	32.5	28.6	27.1	29.4
1,001 – 2,000	7.8	13.8	12.8	11.5
2,001 – 3,000	16.0	23.0	18.8	19.3
3,001 – 4,000	26.2	25.8	21.1	24.4
4,001 – 5,000	10.2	6.5	17.3	11.3
5,001 – 6,000	4.0	1.3	2.0	2.4
6,001 – 7,000	3.3	1.0	1.0	1.8
Mean WTP/ Month	5224.27	5252.53	5424.06	5300.29
Mean Household Size	10			
*Annual Monetary Value of Control (₦ Million)		138,770		

*Source: Survey data, 2017*

*\*Annual Monetary Value of control is a product of Mean WTP and Population of respondents divided by Mean Household Size.*

**Determinants of Households Willingness to Pay for Onchocerciasis Control/ Eradication**

Table 4 showed the socio-economic factors that influence the household’s willingness to pay for onchocerciasis control. The result of the Logistic Regression model shows that the variables that significantly discriminated among the amount households would be willing to pay are household income (0.542), level of education (0.127), marital status (2.413), occupation (1.971) and type of saving scheme (3.853).. The results confirm that in general, as people’s income increases, they are willing to pay more for the eradication of onchocerciasis in their households.

The level of education was significantly linked with WTP because with increasing educational level, there is assumed greater awareness about health care needs, resulting in the will to pay for personal and household protection. The consistent statistically significant relationship between WTP and type of occupation of the respondents was remarkable. Occupation in this instance could be viewed as a good proxy of income since the various occupation were grouped into higher progressive classes, and the higher the class, the more the income. The type of saving scheme was scored and the higher scores saved their money in banks and this variable is another good proxy of income.

The distance travelled to the healthcare facilities (DIST) did not meet the apriori expectation. It



was observed that those who travelled short distances ( $\leq 5\text{km}$ ) to attend clinic or to treat themselves of onchocerciasis and pay less transport charges were willing to pay more to control onchocerciasis. This may be due to public enlightenment campaigns created by Onchocerciasis Control Unit which creates more awareness of the implications of onchocerciasis particularly to the people living close to these facilities.

**Table 4: Estimated Results from the Logistic Model of WTP**

<b>Variables</b>	<b>Coefficients</b>	<b>Std. Error</b>	<b>Wald</b>	<b>Sig.</b>	<b>Exp (B)</b>
Constant		2.284	0.743		9.459
0.002	9.818				
SEX	0.581	0.242	5.780	0.016	0.559
MSTATUS	2.413	0.677	12.723	0.000	
YRSCH		0.127	0.136	0.875	0.349 0.881
OCCU	1.855	0.668	7.711	0.005	6.394
SAVINGS TYPE	3.583	0.688	0.124	0.003	7.661
DIST	-16.299	2.631E4	0.000		0.994 0.000
INCOME	0.542	0.262	4.281		0.039 1.719
ONCHO.PRE	3.022	3.276E3	0.000	0.992	2.199E14
HFACILITY	19.754	1.641E4	0.000	0.999	3.793E8
2 Log likelihood = 454.122					
Cox & Snell R <sup>2</sup> = 0.385					
Nagelkerke R <sup>2</sup> = 0.528					
df = 1					

*Source: Survey data, 2017.*

## CONCLUSION AND RECOMMENDATIONS

The study has shown that onchocerciasis constitutes a considerable economic burden on the income and well-being of the affected households as the latter expends substantial amounts of their income on direct healthcare payments. The mean willingness to pay for onchocerciasis eradication was estimated at ₦5, 300.30 which is equivalent to monthly premium the households would be prepared to pay if there were insurance policy for onchocerciasis eradication. This is far below the current average expenditure on onchocerciasis treatment cost of ₦9, 886.57 per month in the study area.

The study concludes that onchocerciasis is exposing affected households in North-Central Nigeria to the risk of losing labour, wage (income), which in-turn affect the economic well-being of communities, and reduced agricultural productivity, savings and consumption pattern.

Therefore, for sustainability of agricultural production and enhancement of income and standard of living of the farm families, the following recommendations are pertinent:

- Health services should be brought closer to patients in the remote areas regularly in order to improve timeliness of treatment.

- Social security scheme should be introduced to protect households against the financial burden of direct health care payments. This will minimise the sales of households' productive assets to pay medical bills when faced with illness shocks.
- The National Health Insurance Scheme (NHIS) should be scaled up to cover State and Local Government employees, and even unemployed individuals. This would help in reducing the burden of user-fees paid by households on certain services and drugs at health facilities.
- Prioritizing domestic resources allocation for the treatment of onchocerciasis is important for significant and sustained reduction in the burden of the disease.

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