

Assessment of Indirect Cost of Onchocerciasis Illness among Farming Households of North-Central Nigeria

Ogebe, F.O.^{1,*}, Adanu, D.O.²

¹Department of Agricultural Economics, Federal University of Agriculture, Makurdi, Benue State, Nigeria.

²Department of Agricultural Extension and Communication, Federal University of Agriculture, Makurdi, Benue State, Nigeria.

*Corresponding Author

Abstract:-The study assess the indirect cost of Onchocerciasis illness among Onchocerciasis infected households of North-Central Nigeria. Well- structured questionnaires was used to collect primary data from a sample of 556 respondents from three states: Benue State having 206 respondents, Nasarawa State and Plateau State with 217 and 133 respondents respectively. Data were analyzed using descriptive statistics and Cost of Illness Approach (COI). The results showed that majority (72.7%) of the respondents were males and married (82.6%). The average age of the respondents was 46.4 years with average household size of 9.9 persons. On the average, economically active patients lost 26.62 workdays valued at ₦29289, Care-givers lost 15.36 workdays valued at ₦16896 while the illness limited 20.32 days of work valued at ₦2552 per cropping season. The results revealed that households incurred a total indirect cost of ₦289, 780.26 as a result of seeking treatment from Orthodox healthcare facilities (time lost cost) On the average, the indirect cost of illness was estimated at ₦338, 517.26 per household (time lost cost and workday lost cost) which is high enough to stretch the already tight expenditure budgets of the poor rural households The study therefore recommends that the services of Ivermectin distribution be brought closer to the patients in the remote areas regularly to reduce transportation cost and cost of time in order to improve timeliness of treatment.

Keywords: Indirect, Cost, Onchocerciasis, Ivermectin, Cost of Illness, Treatment, Households.

I. INTRODUCTION

Onchocerciasis is a skin and eye infection caused by a parasitic worm *Onchocerca volvulus* which affects humans via the bite of the intermediate host, the black-fly. The disease is the second leading cause of blindness in Africa. The manifestations of the disease include disabling itching, severe skin disease, partial or total blindness, scrotal elephantiasis, lizard skin. These symptoms make it difficult for affected individuals to concentrate, work and interact socially (Ubachukwu, 2006). Agricultural production is usually affected through the impact of the disease on agricultural labor supply. The direct effect of this disease on labor 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 labor productivity by the household. This is because the sick abstain completely or partially from work during the period of illness. The potential effect of onchocerciasis therefore lies in the productive time lost by the

sick and the members of the family. The coping mechanisms that may be adopted such as hiring of labor to substitute family labor have cost implications. In addition, hired labor may not be a perfect substitute for family labor (Chimaet *al.*, 2003).

The “indirect” effect results in a productive time lost by care-givers in attending to the infected household member/s and this seriously limits the family labor supply of the household (Ajani and Ugwu, 2008). Productive time diverted from farm to care for the sick may reduce farm labor. The most serious effect of onchocerciasis is on vision. A blind man is not capable of feeding himself and therefore becomes a burden to the society. He takes usually a young boy/girl as escort and so denies that person education of any sort. According to TDR (2001), Onchocerciasis have been reported to be responsible for high school dropout among children. It is reported that children were at least twice likely to drop out of school if the head of their household suffered from troublesome itching or pruritus. The story is different where blindness is in the young: education and manpower are paralyzed.

Onchocerciasis imposes great burden on the country in terms of pain and trauma suffered by its victims as well as loss in outputs and enlarged burden of costs of treatment and prevention. According to WHO (2007), people with Onchocercal Skin Disease (OSD) were found to spend US\$20 more each year (15% of their annual income) on health-related expenditure than people without OSD. Substantial ‘time costs’ were also found: people with severe OSD made significantly more visits to health care facilities and spend more time seeking health care. It can be concluded that people with severe OSD consequently spend significantly less time on productive activities. This is serious because the labor of the farm family constitutes the most limiting factor in peasant farming especially in an environment less conducive to strenuous physical exertion. In North-Central Nigeria in particular, endemic onchocerciasis is causing serious concern because of its formidable impact on the medical, social, economic, religious and political development of the affected areas. The stigma associated with Onchocerciasis cuts across the entire aspects of life in the communities and these include low marriage rate, falling birth rate, and decline in productivity, economic stagnation and social disintegration..

More so, prolonged illness of farmers which overlaps the critical period of farming activities is affecting agricultural productivity and other industrial activities thus causing poverty, starvation and misery as food scarcity worsened by unchecked inflation prevalent in Nigeria.

Although, it is generally accepted that Onchocerciasis is a serious problem in Nigeria and North-Central Nigeria in particular, evidence on the magnitude of the Onchocerciasis burden in North-Central Nigeria is scanty. Literature abounds on the study of cost and effects of Onchocerciasis on agricultural production but such studies were limited to direct cost of health care services and impact of Onchocerciasis on productivity. For instance, Ogebe *et al.* (2017) studied the impact of Onchocerciasis on agricultural production of farmers in North-Central Nigeria. The study reported that Onchocerciasis impacts negatively on the productivity of farmers. WHO (1997) studied the effect of Onchocerciasis on agricultural labor supply and reported that about 50 million man-days are lost annually. Similarly, Allen *et al.* (2008) studies the burden of Onchocerciasis on rural households and reported loss of outputs and enlarged burden of costs of treatment and control.

In spite of the aforementioned studies, little or no assessment of the indirect costs which are more catastrophic in health spending have been studied. It is against this backdrop that this research work empirically assessed all the indirect cost components incurred in Onchocerciasis control/prevention by the affected households faced with Onchocerciasis scourge in North-Central Nigeria. This will be helpful in making policy recommendations. The specific objectives of the study are to: describes the socio-economic characteristics of the respondents in the study area, assesses time lost in seeking orthodox healthcare treatment by Onchocerciasis patients and determine workdays lost by households due to Onchocerciasis illness in the study area.

II. THEORETICAL FRAMEWORK

One of the most immediate economic impacts of onchocerciasis derives from morbidity. Due to incapacitation, an individual may stop work completely or may work partially due to debility associated with the disease on temporary basis and this affects household productivity. The episode requires patients to stay at home to recuperate themselves or to take care of the sick. The subsequent decline in output due to absenteeism from work in this case is termed *indirect cost*. These costs mainly represent loss of potential productivity.

Honeycut (2003), identified the indirect costs of Onchocerciasis to include the mortality costs, morbidity costs due to absenteeism or, informal care costs (in terms of opportunity cost of hiring outside care). According to Honeycut (2003), these indirect costs are substantial and can be significantly greater than direct medical care. Indirect costs also include the travel time to seek treatment or buy drugs from health facilities or drug stores (Alaba, 2009). According

to Chima *et al.* (2003), another indirect cost of a disease is attributed to the permanent loss of labor hours due to mortality. The potential loss of productivity is usually valued using market wage rate and the earnings in the future are discounted at a constant rate (Asante and Asenso-Okyere, 2003). The premature death represents a loss of economic product, equal to the discounted stream of earnings that otherwise would have been earned over the remaining expected life (Hodgson and Meiners, 1992).

According to Hodgson and Meiners (1992), there are three primary approaches to estimate indirect costs and these includes: the human capital method, the friction cost method and the Willingness to pay method. The Human Capital method measures the lost production in terms of lost earnings of a patient or care-givers. For mortality or permanent disability costs, the approach multiplies the earnings lost at each age by the probability of living to that age. In this method, earnings in future years are discounted and often, a 1% real annual growth rate in earnings is assumed (Hodgson and Meiners, 1992). The Human capital approach often includes the value of the household work, usually valued as the opportunity cost of hiring a replacement from the labor market (Hodgson and Meiners, 1992)

(Koopmanschap *et al.*, 1995) stated that the Friction Cost method measures only the production losses during the time it takes to replace a worker. This approach assumes that short-term work losses can be made up by an employee and the loss of an employee only result in cost in the time it takes a new employee to be hired and trained, known as the *friction period*. On the other hand, Hirsh *et al.* (2000) stated that the Willingness to Pay Approach measures the amount an individual would pay to reduce the probability of illness or mortality. This method is determined by surveys, examining the additional wages the patient will be willing to pay to avert the disease.

III. EMPIRICAL MODEL AND METHOD

The Study Area: The study covered three States of the North-central Zone of Nigeria namely: Benue, Plateau, and Nasarawa States. The geographical coordinates of North central Nigeria are longitudes 3⁰E and 14⁰ E and latitude 4⁰ 30N and 11⁰ 20N with a landmass of about 296,898km² (FAO, 2004). The population was estimated at 21, 556,993 people (NPC, 2007). The population density is estimated at about 75 persons per km² with the rural population consisting about 75 percent in the zone. The average annual rainfall in the zone ranges from 800-2000mm with high relative humidity and temperature of 13-17⁰C. A large population of the rural adults (82%) are involved in agriculture while the main off-farm activities include technical professionals, administrative, clerical and sale services. Major crops grown in the area are rice, groundnut, yam, cassava, cereals and other Nigerian staples. The sampling frame was established by obtaining a list of all affected households in the Local government Area / villages from the National Onchocerciasis Control Unit.

A 3-stage multi-stage random sampling technique was used to draw the sample. The first stage involved a purposive selection of six endemic Local Government Areas (three from each State) namely Nasarawa and Benue States and two (2) Local Government Areas from Plateau State. The second stage involves a selection of two (2) communities per ward in each local government area making a total of fourteen (14) communities. The third stage was a random selection of 10% of households infected with Onchocerciasis from each of the sampled communities. A total of 556 infected households were sampled and interviewed. Data were collected using questionnaires administered by trained enumerators.

The tools of data analysis were descriptive statistics and cost of illness model.

Model Specification

The *indirect cost* of onchocerciasis (Y) includes mortality costs, morbidity costs due to absenteeism and informal care costs. The indirect cost of onchocerciasis (Y) can be expressed as the sum of all time lost in production due to onchocerciasis infection, multiplied by the daily agricultural wage rate. Thus:

$$Y = W (t_1 + t_2 + t_3 + t_4)$$

Where:

t_1 = time spent travelling to obtain health care

t_2 = waiting time for treatment at the onchocerciasis unit

t_3 = time spent caring for the sick by the care-giver

t_4 = time lost due to incapacitation including illness duration and convalescence

W = daily agricultural wage rate

The sum of $t_1 \dots t_4$ gave the value of productive time lost by the patient and care-givers, and the substitute labor attributed to onchocerciasis morbidity. The study employed the net productive time lost by multiplying the number of days or hours lost from farm work by the value of the output lost during that period. The daily agricultural wage rate/ labor wage by age and sex was obtained through field survey and was used for this valuation.

IV. RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

Table 1 showed that most of the respondents surveyed were males in the three States: Benue State (76.0%), Nasarawa State (65.0%) and Plateau State (80.3%). Overall, 72.7% of the respondents were males and 27.3% were females. This result indicates that males are usually household heads and

actively involved in agricultural and economic activities. This result agrees with findings by Anonguku, *et al.* (2010) who reported that males are usually the household heads and they principally dominate in farming activities. In overall, 82.6% of the respondents were married with average age of 46.4 years. Overall, the average household size for the combined sample was 9.9. The means that households in the study area can supply enough family labor to realize the goal of agriculture (food security) if their production strength is not affected by onchocerciasis or other incapacitating diseases. This agrees with the report of Ogebe *et al.* (2017) who reported a mean household size of 10 persons in North-Central Nigeria.

However, the large household size in the study area 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 household. Accordingly, Russell (2004) agrees that 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. The commonly owned household asset in the study area was radio while the least owned household asset was car. Overall, about 80% of the households had radio for the combined sample and 16% households had cars. Farmers' ownership of fewer personal wealth indicators such as motorcycles, motor-cars and cement plastered houses arises as a result of their lower standard of living

Most (45.2%) of respondents have a farm size of between 0 – 2 hectares. The mean farm size was 4.0 hectares for the combined sample implying that farmers in the study area have enough farmland that if effectively put into use can produce the desired output for family consumption. The mean annual farm income of households was higher (₦197, 632.05) for Plateau State compared to Nasarawa and Benue States with ₦183, 525.81 and ₦184, 466.50 respectively. Overall, ₦188, 541.45 was the average annual farm income for combined sample. This indicates that households in the study area earn an average monthly income of ₦15, 711.79 indicating low income earning. The result further revealed that households in the study area earn ₦523.73 per day which is below the poverty line of \$3.00 per day at ₦360 per Dollar (CBN, 2017). More so, a mean household size of 9.9 persons indicates that household members in the study area live on ₦52.90 per day indicating a poor living condition of the households. However, farmers in the study area produce food crops they need for daily feeding, thus this might lessen the burden on their farm income. Nevertheless, the burden of onchocerciasis, other diseases and non-food expenditures cannot be overemphasized.

Table 1: Socio-economic Characteristics of Respondents (n=556)

Variable	Benue n=206	Nasarawa n=217	Plateau n=133	Pooled n=556
<u>Sex</u>				
Male	157 (76.0)	141 (65.0)	107 (80.3)	404 (72.7)
Female	49 (24.0)	76 (35.0)	26 (19.7)	152 (27.3)
<u>Age (years)</u>				
1-19	5 (2.2)	7 (3.0)	3 (1.8)	13 (2.4)
20-24	3 (1.4)	12 (5.6)	4 (3.0)	19 (3.4)
25-29	21 (10.0)	15 (6.7)	9 (7.0)	44 (8.0)
30-34	17 (8.2)	26 (12.0)	11 (8.5)	55 (9.8)
35-39	25 (12.1)	16 (7.5)	13 (9.5)	54 (9.7)
40-44	23 (11.2)	27 (13.0)	17 (13.0)	68 (12.3)
45-49	20 (9.8)	20 (9.0)	14 (10.6)	54 (9.7)
50-54	22 (10.4)	22 (10.0)	17 (12.4)	60 (10.7)
55-59	28 (4.2)	24(11.2)	20 (15.2)	74 (13.3)
60 and above	42 (20.5)	48 (22.0)	25 (19.0)	11 (20.7)
Mean	45.9	46.9	46.3	46.4
<u>Marital Status</u>				
Married	155 (75.0)	185 (85.2)	120(57.0)	459 (82.6)
Single	16 (8.0)	13 (6.0)	7 (5.0)	36 (6.5)
Widow	24 (11.5)	12 (5.5)	5 (4.0)	41 (7.3)
Others	11 (5.5)	7 (3.3)	1 (0.9)	20 (3.6)
<u>Education (years)</u>				
Non formal	46(22.5)	73(33.5)	46 (35.0)	166 (29.8)
Primary	62 (30.0)	58 (26.5)	35 (26.0)	154 (27.7)
Secondary	78 (38.0)	44 (20.5)	33 (24.5)	155 (27.9)
Tertiary	20 (9.5)	42 (19.5)	19 (14.5)	81 (14.6)
<u>Household Size</u>				
1-5	41 (20.0)	47 (21.5)	33 (25.0)	121 (21.78)
6-10	74(36.0)	88 (40.5)	56 (42.0)	217 (39.20)
11-15	45(22.0)	54 (25.0)	22 (16.5)	122 (21.86)
16-20	38(18.5)	17 (8.0)	14 (10.5)	70 (12.49)
21-25	7 (3.5)	11 (5.0)	8 (6.0)	26 (4.68)
Mean	10.5	9.7	9.6	9.9
<u>Farm Size (Ha)</u>				
0-2.0	95(46.0)	96 (44.5)	60 (45.0)	251 (45.2)
3.0-5.0	72(35.0)	73 (33.5)	40 (30.0)	185 (33. 2)
6.0-8.0	26(12.5)	30 (14.0)	24 (18.0)	80 (14.4)
9.0-11.0	9(4.5)	11 (5.0)	8 (6.0)	28 (5.1)
12 and above	4(2.0)	7 (3.0)	1 (1.0)	12 (2.2)
Mean	3.9	4.1	4.1	4.0
<u>Farm Income (₦)</u>				
50,000-100,000	8(4. 0)	15 (7.0)	8 (6.0)	31 (5.65)
100,001-150,000	59(28.5)	56 (25.5)	36 (27.0)	150 (26.97)
150,001-200,000	69(33.5)	70 (32.0)	49 (37.0)	188 (33.75)
200,001-250,000	48(23.5)	48 (22.0)	2 (1.5)	98 (17.65)
250,001-300,000	7 (3.5)	18 (8.5)	3(2.5)	29(5.21)
300,001-350,000	5 (2.5)	4(2.0)	25(18.5)	34(6.13)
350,000 and above	9 (4.5)	6(3.0)	10(7.5)	26 (4.64)
Mean	184,466.50.	183,525.81	197,632.05	188,541.45

Source: field survey, 2018, Figures in parentheses are percentages.

Value of Time lost in Seeking Orthodox Health care by Onchocerciasis Patients

Table 2 shows the distribution of the travelling and waiting times spent by households seeking treatment for onchocerciasis from orthodox health care facilities. Analysis of the results showed that a total of 166.69 minutes was spent by households on the average to seek treatment for onchocerciasis episode. About 77.94% of the total treatment time was spent on waiting at the facility while travel time accounted for 22.06%. This result is in conformity with the findings of (WHO, 2007) which revealed that the debilitating effects of dermal and ocular onchocerciasis leads to considerable loss of working time by attendance at hospitals and clinics for treatment.

The indirect cost of the average treatment time of 166.69 minutes spent by households in seeking treatment from the orthodox health facilities was valued at ₦520.54 per household. In Benue State, the indirect cost per household amounted to ₦518.85 and a corresponding value of ₦542.16 and ₦490.59 for Nasarawa and Plateau States respectively. From these estimations, the value of the opportunity cost of the productive time lost was obtained. Thus, the surveyed households incurred a total of ₦289, 780.29 indirect costs as a result of seeking orthodox Onchocerciasis treatment (Table 2). The results further indicated that while households in Benue state lost ₦106, 883.10 in indirect costs, the households in Nasarawa and Plateau States lost ₦11, 7648.72 and ₦65, 248.47 respectively.

Table 2: Average Travel and Waiting Time to seek treatment for Onchocerciasis at Health facilities (inMinutes)

Item	Benue State	Nasarawa State	Plateau State	Pooled Sample
Waiting time at the facility Per Household				
Registration	25.31 (21.02)	25.55 (18.20)	25.76 (20.20)	25.51 (19.64)
Consultation	28.32 (23.52)	30.56 (21.77)	29.61 (23.22)	29.50 (22.71)
Laboratory	30.51 (25.34)	33.78 (24.07)	32.67 (29.54)	32.30 (24.86)
Injection	15.00 (12.46)	9.82 (6.70)	8.64 (6.78)	11.50 (8.85)
Dispensary (drugs)	10.67 (8.86)	15.06 (10.73)	15.08 (11.83)	21.67 (16.68)
Other (in-between activities)	10.61 (8.81)	25.60 (18.24)	15.76 (12.36)	17.71 (13.63)
Total time spent at facility	120.42 (100)	140.37 (100)	127.52 (100)	129.92 (100)
Travel time to facility	35.74	38.96	34.66	36.76
Total time spent to visit Orthodox Healthcare facilities for treatment	156.16	179.33	162.18	166.69
Cost of Treatment time per household (₦)	518.85	542.16	490.59	520.54
Cost of Treatment time incurred by all Households (₦)	106,883.10	117,648.72	65,248.44	289,780.26

Source: Survey data, 2015

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

Value of Workdays Lost to Households Due to Onchocerciasis Attack

Table 3 shows that the economically active patients who could not perform their normal activities lost an average of 26.62 days due to their onchocerciasis related illness. During the period of illness, healthy household members sacrificed their productive activities to take care of the sick individuals. Time cost was calculated by converting days off of individual

care-givers within the family to monetary terms using the current wage rate for day laborers to produce a proxy for the opportunity cost of time. The result revealed that more than fifteen work days on average was sacrificed by care-givers to take care of the sick.

Table 3 further revealed that among those who work below their normal capacity (part-time), the lost period ranged between 7.42 days in Plateau State and 27.79 days in Benue

State. The averagedays of work limitation as a result of Onchocerciasis illness was 20.32 days for the patients. Nevertheless, in some instances, work days lost was often compensated for by other members of agricultural households. Some household units in the states hired labor to make up for the activities meant for the sick persons. In this case, loss of productivity to household was estimated through the extra expenses on the hired substitute for the sick persons. The estimated cost of the work days lost to households due to Onchocerciasis illness was calculated using the gender-specific average agricultural daily labor wage in each state. The result revealed that the average cost of patient's productivity loss was ₦29289 and it was higher among patients in Nasarawa (₦38643) and Benue (₦36456) States. Similarly, the cost of productivity loss was also highest among caregivers in Nasarawa State (₦25333) compared to Benue and Plateau States with ₦21348 and ₦5786 respectively. Cost of work limitation due to Onchocerciasis

illness ranged between ₦8162 in Plateau State and ₦33348 in Benue State. Overall, the total cost of lost productivity was ₦48737.

The high average daily work loss (26.62 days) as well as the substantial work-limited days reported raised an issue of concern. This contradicts the findings of Adeleke, *et al.* (2010) who reported that patients lost 14 days monthly due to illness resulting from Onchocerciasis. The average monthly cost of productivity loss of ₦46185 from patients and caregivers could be considered a huge economic burden on the affected individuals and their families, largely subsistence farmers whose consumption depends largely on their productivity ability. The absence of risk-pooling mechanism in Nigeria to protect households from financial shocks that could arise from common healthcare expenditures mean that households and more importantly poorer households, are likely to experience a disproportionate burden of the disease.

Table 3: Average yearly Socio-economic Status (SES) Differences in the Number of Work days Lost Due to Onchocerciasis Illness

Variables	Benue State	Nasarawa State	Plateau State	Pooled sample
Patient lost an entire day of work	82 (39.81)	90 (41.48)	60 (45.11)	232 (77.33)
Number of Days Mean	30.38	35.13	14.35	26.62
Care-givers lost an entire day of work	48 (23.30)	59 (27.19)	22 (16.54)	129 (23.34)
Number of Day Mean	17.79	23.03	5.26	15.36
Work limitation for Patients	75 (34.41)	66 (30.42)	31 (23.31)	172 (29.38)
Number of days Mean	27.79	25.76	7.42	20.32
Cost of Patient's missed work-days (₦)	36,456	38,643	15,785	29,289
Cost of Caregiver's missed workdays (₦)	21,348	25,333	5,786	16,896
Cost of Work limitation for Patients (₦)	33,348	28,336	8,162	2,552
Average total cost of Work-days lost by Household due to Onchocerciasis illness (₦)	91,152	92,312	29,733	48,737
Estimated cost of Work-days lost to Households (₦ million)	18.777	20.032	3.955	14.255-----

Source: Survey data, 2015 *Figures in parenthesis are percentages.

V. CONCLUSION AND RECOMMENDATIONS

The study concludes that Onchocerciasis is exposing affected households in North-Central Nigeria to the risk labor, wages which in turn affect the economic well-being of the communities. Therefore, for sustainability of agricultural production and enhancement of income of the farm families, the following recommendations are pertinent:

1. The services of Ivermectin (drugs) distribution should be brought closer to the patients to minimize

the indirect costs of travel and waiting time at health facilities by patients.

2. Focused health promotion intervention such as health education campaigns should be scaled up in Onchocerciasis endemic communities.
3. Prioritizing domestic resource allocation for the treatment of Onchocerciasis is important for significant and sustained reduction in the burden of the disease.

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