Effects of Direct Costs of River blindness Illness and Perceived Benefits of Community-Directed Treatment with Ivermectin in Rural Households of Benue State, Nigeria

ABSTRACT

The study assessed households' direct cost of Onchocerciasis illness and the perceived benefits of community-directed treatment with ivermectin in Benue State, Nigeria. A survey method was used and primary data were collected using structured questionnaires. The survey covered a period of six (6) months between June, 2019 and December, 2019. The population of the study consisted of households affected with Onchocerciasis in Benue State, Nigeria. Random sampling technique was used in selecting a sample size of 200 respondents from three Local Government Areas of Benue State. Descriptive statistics, Cost of illness approach, household expenditure model and multiple regression models were used to analyze the data. The descriptive statistics showed that majority (63.7%) of the respondents were males and married (66.7%) with average age of 48.8 years and average household size of 10 persons. The average farm size was 4.0 hectares with an annual farm income of ₦167, 266.16. The most perceived symptoms of onchocerciasis by the respondents were severe itching (29%), skin rashes (25.5%) and swelling (17.3%). Ivermectin was cited as the most effective treatment for onchocerciasis as 57.0% of the respondents attested to its effectiveness. The average cost of onchocerciasis illness was ₦77, 923.84. The direct cost of illness was estimated at ₦34, 503.20 per household which is high enough to stretch the already tight expenditure budgets of the poor rural households. The household expenditure model revealed negative and statistically significant relationship between onchocerciasis (health shock) and food expenditure ($P<0.05$), education expenditure ($P<0.01$) and housing expenditure ($P<0.1$). The study revealed a positive relationship between health consumption of affected households and household income, borrowing, sale of assets, de-saving and sale of food reserves. The study identified social and health benefits of community-directed treatment with ivermectin (CDTI). The social benefits include: ability to work better (70.7%), acceptance by peers (52.3%) and respect in the community (47.7%) while the health benefits to the respondents were improved vision (69.4%), reduced itching (65.1%) and deworming (61.1%).The factors associated with perceived benefits of CDTI in the study area are age ($P=0.029$), marital status ($p<0.012$), length of stay in the onchocerciasis endemic community ($p<0.001$) and individual susceptibility to onchocerciasis infection ($p<0.0001$). The study recommends continuing sensitization of members of the public on the consequences of Onchocerciasis and the importance of Mectizan as curative drug. This will improve the overall health status, enhance the social interactions and increase the economic productivity of the households of North-Central Nigeria, as well as ensure food security and the development of the nation at large.

Keywords: River blindness, Ivermectin, Perception, Cost of Illness, Nigeria

1. INTRODUCTION

Onchocerciasis is a skin and eye infection caused by the filarial nematode (*Onchocerca volvulus)* which is transmitted through the bites of *Haematophagus simulium* (change for "simuliids") (black-flies) which breed in fast flowing rivers and streams, thereby increasing the risk of infection to people living near the water bodies. 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 (Okwa *et al.,* 2009) (exchange for latest available information) . Nigeria is believed to have more persons infected with onchocerciasis than any other country in the world, now accounting for over one-third of global cases with the disability-adjusted years (DALYs) lost due to

onchocerciasis estimated at 1.49 million (Uttah *et al*., 2004). The manifestations of the disease include disabling itching, severe skin disease, partial or total blindness, scrotal elephantiasis, lizard skin among others. These symptoms make it difficult for affected individuals to concentrate, work and interact socially (Ubachukwu, 2006).

Incidences of onchocerciasis in endemic areas have major implications for household's economy and natural schedule of activities and interactions with the system (Ubachukwu, 2006). Either temporary or permanent impairment in the health status of a family member often evokes resource adjustment by other persons in such system. Families are often forced to re-adjust time from activities that contribute to long-term health or development to caring for family members with impaired health status due to onchocerciasis attacks. The household budgets are affected by the need to adjust component of household expenditure to accommodate the medical bills and transport expenses relating to the treatment. Thus, rural households without any form of social protection and health insurance are likely to be impoverished due to the burden of the illness. (Xu *et al*., 2003). In terms of agriculture, production is usually affected through the impact of the disease on agricultural labour supply. The direct effect of this disease on labour results when a working member of the household is prevented from working on the farm through disease infection. Incapacitation of the economically active population affects quality and quantity of labour productivity by the household. This is because the sick abstain completely or partially from work during the period of illness which has adverse effect on food security of the households.

Several drugs have been used (was used) in the treatment of onchocerciasis in different parts of the world. Examples of such drugs include *Dimethyl Carbemazin*, *Suramin*, *Benzimidazole*, *Levamisole* and *Ivemectin* (Amazigo *et al.*, 1998). At present, Ivermectin has been the drug of choice against onchocerciasis. Several approaches have been tested for the distribution of Ivermectin in endemic villages. However, the main obstacle has been the high cost of delivery to needy who are usually very poor (Amazigo *et al*., 1993). The use of community members as agents for mass distribution of Ivermectin in the treatment of onchocerciasis has been evaluated and the results showed that it was most effective because it provides a component of community participation which is absent from mobile team delivery methods (Meredith *et al.*, 2012). Therefore, Community based distribution is dependent on ability of the endemic community to mobilize, train and treat its residents, following standard procedures and guidelines.

Given the dynamics of influence of onchocerciasis on income earning capacity and poverty, it is important to empirically investigate households' direct cost of Onchocerciasis illness and the perceived benefits of community-directed treatment with Ivermectin in the study area. Specially, the study ascertained the respondents' perceptions of effectiveness of Ivermectin in the study area; estimate the households' direct costs associated with onchocerciasis illness in the study area; estimate the effects of onchocerciasis illness on households' expenditures and identify the health and social benefits of community-directed treatment with Ivermectin; and identify the factors associated with health and social benefits of community-directed treatment with Ivermectin in the study area.

2. EMPIRICAL MODELS AND METHODS

2.1 Description of the Study Area

The study area was Benue State Nigeria. The survey covered a period of five (5) months from March to July, 2019.The geographical coordinates of Benue State are longitudes 7^0 47 E and latitude 6^0 25N. The State has a landmass of about 32,518km^2 (NBS, 2004). The average annual rainfall in the zone ranges from 1500-1800mm with

high temperature of 21^0C-25^0C. The total population of Benue State is estimated at 4,780,389 people (NPC, 2006). Benue State shares boundaries with five other States namely; Nasarawa State to the North, Taraba State to the East, Cross Rivers to the south, Enugu to the South-West and Kogi to the West. Agriculture is the mainstay of the people 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.

2.2 Sampling Techniques

The random and purposive sampling techniques were employed by the study. The purposive sampling procedure was adopted to select 3 endemic Local Government Areas (one from each Zone) namely Zones A, B and C. The research adopted a case study design whereby descriptive and explanatory data were captured by the study. Hence both qualitative and quantitative data were collected through well-structured questionnaire and in-depth interview. A 3-stage multi-stage random sampling technique was used to draw the sample. The first stage involved a purposive selection of Three 3 endemic Local Government Areas (one from each Zone). The second stage involves a selection of 2 wards from each local government making a total of 6 wards. From the available records obtained at the State Onchocerciasis Control Unit, there were 2,039 onchocerciasis affected households (sample frame) across the 6 sampled wards of the State. The third stage involves simple random sampling technique to select 200 onchocerciasis affected households across the 6 Wards in the study area.

2.3 Estimation of Households' Direct Cost of Illness

The cost of illness model was used to estimate the households' direct costs of Onchocerciasis in the study area (Hodgson and Meiners, 1982). Direct costs consists of direct medical expenses such as hospital in-patient, nursing home care, physician in-patient and out-patient, etc., as well as non-medical direct costs that is, transportation cost to the health care providers (Hodgson and Meiners 1982).

Direct cost (X) is expressed as:

$$X = H \qquad (1)$$

Where:

H = cost of prevention, treatment and control of onchocerciasis by households

Therefore, the household cost (H) consists of direct medical cost and direct non-medical costs. It is expressed as:

$$H = C_1 + C_2 + C_3 + C_4 + C_5 + C_6 \qquad (2)$$

Where:

C_1 = prescription costs/ cost of drugs (₦)

C_2 = fees paid for registration (₦)

C_3 = consultation cost/fees (₦)

C_4 = diagnostic cost (₦)

C_5 = out of pocket cost for patient and care-giver (₦)

C_6 = cost of onchocerciasis prevention to the households (₦)

2.4 Household expenditure model

Household consumption expenditure is the value of consumer goods and services acquired, or used by a household for the satisfaction of the needs and wants of its members. Expenditure on a consumable item is a

function of total household expenditure (a proxy variable for income) and household size. To estimate the household expenditure on onchocerciasis illness, four models were used. These are expenditures on *education, food, housing, and health.* Expenditures on food, housing, education and other items were used as dependent variables. The health shock variable enters the regression equation as a dummy variable while the household socio-economic variables in the model included household size, the level of education of the household head. The expenditure on health, food, education, housing, others, were used as dependent variables in separate regressions.

2.5 Education expenditure model

Household expenditure on education was a function of total income of household (TY), log of total expenditure incurred as a result of health shocks (LnHshock), level of education of household head (LE) and household size (HHS);

Edu = f (TY, LnHshock, LE, HHS) …… (3)

The specific form of the model is given by;

$Edu = \alpha_0 + \alpha_1 TY + \alpha_2 LnHshock + \alpha_3 LE + \alpha_4 HHS + U$,…… (4)

The *a priori* expectation α_1 and $\alpha_3 > 0$; α_2 and $\alpha_4 < 0$

2.6 Housing expenditure model

HSE = f (TY, LnHshock, LE, HHS, PB)…….. (5)

Where:

HSE = housing expenditure

LnHshock = log of total expenditure incurred as a result of health shock

TY = total income of household

LE = level of education of household head

HHS = household size

PB = prices of household items other than food

The specific form is;

$HSE = \beta_0 + \beta_1 TY + \beta_2 LnHshock + \beta_3 LE + \beta_4 HHS + \beta_5 PB + U_2$…… (6)

The *a priori* expectation β_1 and $\beta_3 > 0$ while β_2, β_4 and $\beta_5 < 0$

2.7 Food expenditure model

FS = f (TY, LnHshock, HHS, LE, PF)…….. (7)

Where:

FS = expenditure on food

TY = total income of household

LnHshock = log of total expenditure incurred as a result of health shock

LE = level of education of household head

HHS = household size

PF = prices of food items consumed

The specific form of the model becomes:

$FS = \delta_0 + \delta_1 TY + \delta_2 LnHshock + \delta_3 HHS + \delta_4 LE + \delta_5 PF + U_3$…….. (8)

The *a priori* expectation $\delta_1, \delta_4 > 0$; $\delta 2, \delta_3, \delta_5 < 0$

2.8 Health expenditure model

This was used to estimate the coping strategies of consumption smoothing;

$$C_i = K_0 + K_1 TY + K_2 DESAV + K_3 ABOR + K_4 SAL + K_5 OTHER + K_6 LE + K_7 HHS + K_8 SH + K_9 AH + U_2 \quad (9)$$

The *a priori expectation*, $K_1 K_2, K_3 \ldots . K_9 > 0$

Where:

C = log of expenditure showing change on expenditure level on (health) of the i^{th} household affected by the Onchocerciasis health shock

TY = total income of the household

DESAV = de-saving in ₦

ABOR = amount borrowed in ₦

SAL = sales of assets in ₦

OTHER = other strategies for consumption smoothing

LE = level of education of household head

HHS = household size

AH = age of household head

SH = sex of household head

Ki = parameters to be estimated

Ui = random error term

3. RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

Table **2** showed the results of socio-economic characteristics of respondents in the study area. The results indicated that majority (84.0%) of the households have 1-3 members of their households affected with onchocerciasis. The mean number of members affected with onchocerciasis in a household is 4. Most (66.0%) of the respondents surveyed were males. It is not surprising to notice male dominance in agriculture because in rural families males are usually the breadwinners and they are the ones who acquire and cultivate land. This result agrees with findings by Nnagi and Ozo (2001), who reported that more males are involved in farming in the Onchocerciasis infected area than females due to greater exposure of these males in the farms. Females are usually confined to domestic duties within the house. This shows that there is a significant relationship between sex roles and the effect of the disease. (Is this small sample of n = 200 representative of the larger number? Are there not some areas where female strength is at least equal (depending on the type of activity)? This questioning is only to be verified if there are some peculiar areas in Nigeria, which are differentiated from the others.

Over seventy percent of the respondents were married. This implies that such households with children were at the greatest risk of onchocercal infection as reported by Jimoh, *et al.* (2007). The average age of the

respondents was 43 years implying that the respondents were within productive age category and can actively and effectively use their energies on agricultural production and other economic activities. Majority (60.50%) of the respondents are educated and over thirty percent (39.50%) of the respondents in the study area had spent 0 to 4 years in school with average number of 9.8 years spent in school. As the years of schooling increased, it was expected that people would understand the advantages of onchocerciasis control better than illiterates and this agreed with the findings of Asante and Asenso-Okyere (2003). The results showed an average household size was 10 persons and on the average, there are 2 orphans in a household. This result is contrary to the findings of Awoniyi *et al*. (2012), who reported average household size of 5.5 in Niger State of Nigeria. The high household size reported in this study 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.

Most (36.0%) of respondents in the study area had a farm size of between 0.5 – 3.5 hectares. The mean farm size was 4.5 hectares. The result implies that farmers in the study area had enough farmland that if effectively put into use can produce the desired output for family consumption. The result agrees with the report by Oluwepo (2010), who found that over 90% of the Nigeria's local food production comes from farms, which are usually not more than 10 hectares in size. The mean annual farm income of households was ₦156, 395.73. This indicates that households in the study area earned an average monthly income of ₦13, 032.98 indicating low income earning. This showed that households in the study area earned ₦434.432 or $1.2 per day which was below the poverty line of $3.00 per day at ₦360 per Dollar (CBN, 2017). This indicates a poor living condition of the households. However, households in the study area produced most of the food crops they needed 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. The mean annual income in the study area was slightly higher when compared with the findings of Ugwuja, *et al.* (2011) who estimated the average annual income of farmers in Ekiti State to be ₦145, 282.00.

Table 1. Socioeconomic characteristics of respondents in the study area

Variables	Frequency	Percentage
Affected members in a household		
1-3	168	84.0
4-6	24	12.0
7-9	5	2.5
>10	3	1.5
Mean	**4.0**	

Source: Field Survey, 2019

Table 1. Cont'd.

Variables	Frequency	Percentage
Sex		
Male	132	66.0
Female	68	34.0
Age(years)		
20-30	10	5.0
31-41	40	20.0
42-52	88	44.0
53-63	44	22.0
64-74	11	5.5
>74	7	3.5
Mean	**48.1**	
Marital status		
Single	16	8.0
Married	147	73.5
Divorced	24	12.0
Widowed	13	6.5
Household size		
1-10	133	66.5
11-20	57	28.5
21-30	7	3.5
31-40	2	1.0
>40	1	0.5
Mean	**10.0**	
Educational level (years)		
0-4	79	39.5
5-9	61	30.5
10-14	43	21.5
15-19	17	8.5
>19		
Mean	**9.8**	
Annual Farm income (₦)		
1-100000	99	49.5
100001-200000	46	23.0
200001-300000	36	18.0
300001-400000	8	4.0
400001-500000	8	4.0
500001-600000	1	0.5
>600000	2	1.0
Mean ₦156,395.73		
Farm size (hectares)		
< 0.5	1	0.5
0.5-2.5	74	36.0
3-5	47	23.5
5.5-7.5	17	8.5
>7.5	61	30.5
Mean	**4.5**	

Source: Survey Data, 2019.

Perception of Ivermectin as Most Effective Treatment and Susceptibility to Onchocerciasis

Table **2** showed that the most cited symptoms of the respondents think they are susceptible to was severe itching (30.0%). This was followed by skin rashes (27.5%). Cases of blindness was common across the surveyed states, though minimal (15.5%). This constitutes a major problem as a blind man is not capable of feeding himself and therefore becomes a burden to the society as his labor and that of his care-giver is denied. This invariably affects agricultural productivity and food of the affected households.

Ivermectin was cited as the most effective treatment for Onchocerciasis with a high percentage of respondents (67.50%) attesting to its effectiveness. This figure is slightly lower than that reported in Democratic Republic of Congo (DRC) and Uganda where 83.8% of the respondents attested ivermectin as the most effective treatment for Onchocerciasis (Joseph *et al.*, 2011).

Table 2. Distribution of respondents by perception of Ivermectin as effective treatment/ susceptibility to onchocerciasis

Perception of ivermectin/ Susceptibility	Frequency	Percentage
Likelihood of getting		
Severe itching	60	30.00
Skin rashes	55	27.50
Swelling	44	22.00
Blindness	31	15.50
Hanging groin	3.0	1.50
Others	7.0	3.50
Best treatment for onchocerciasis		
Traditional	33	16.50
Banocide	6.0	3.00
Ivermectin	135	67.50
Albendezole	22	11.10
Do not know	4.0	2.00

Source: Survey Data, 2019.

Estimation of Total Direct Cost of Onchocerciasis Illness

Table **3** presents average total direct cost of onchocerciasis treatment from orthodox healthcare providers and self-medication in the study areas. On the average, a total of ₦106, 874.02 was spent for treatment/ prevention of onchocerciasis illness in the study area. The average cost incurred through self-medication is ₦62, 346.58 which accounts for 58.37% of the total direct cost of onchocerciasis illness. On the other hand, the average cost illness for the orthodox healthcare provider is ₦13, 069.95 or 12.23% of the total direct cost of treatment. Drug cost besides Mectizan (₦13, 193.12) constituted 12.35% of the total direct cost of onchocerciasis illness. This is closely followed by other treatment costs such as referrals and transportation which constituted 12.06% and 2.10% of the total direct cost, respectively. The drugs were either supplied by the health facility or were purchased from outside the facility on prescription. On the average, households paid ₦8, 647.99 for drugs in the study area.

The cost of prescribed drugs bought from outside the health facility was 4.25% of the total direct cost of onchocerciasis illness in the sampled area which was greater than the amount spent on drugs from the orthodox health facility (8.09%). This is 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 diseases such as onchocerciasis and malaria.

Transportation costs to the facility averaged ₦663.65 which represented 0.62% of the total direct cost. This showed that households in the study area paid relatively lower amounts of money to get to the health facility because of the proximity of the Health Centre to the patients. Cost of registration (1.34%) was relatively lower in the sampled area. The cost of laboratory test was 1.09% of the total direct cost of onchocerciasis illness. The results further revealed that patients incurred several other costs in the process of seeking further treatment. These costs included cost of referrals, injection, reviews, extra medication and food. These costs formed relatively low proportion (7.28%) of the total direct cost of onchocerciasis illness. This agrees with the findings of Russell (2004) and Asante and Asenso-Okyere (2003) who reported that cost of consultation, referrals and laboratory costs form a relatively low proportion of the total treatment cost of Malaria. The treatment cost of ₦106, 874.02 reported in this study is an indication that those who sought treatment for onchocerciasis illness incurred significant costs which may constitute an important component of the socio-economic burden of the disease in endemic communities. Furthermore, the study revealed that out-of- Pocket (OOP) spending has serious effects on poor households. However, OOP health expenditures depends on types of health care service used by patients when insurance is unavailable. Public facilities typically involves less OOP health spending than private facilities since they are subsidized, but the quality of services of public facilities in rural household settings is poor. This agreed with other works for instance, OOP expenditures associated with a single hospital stay in a private facility for cancer in India accounted for between 80-90% of annual per capita household income compared to 40-50% of annual per capita income for care obtained at a public facility (Mahal *et al*., 2010).

Table 3. Mean direct cost of onchocerciasis illness to households

Items	Amount (₦)	Percentage
Treatment through self-medication	62,346.58	58.34
Treatment for the orthodox healthcare provider	13,069.95	12.23
Amount spent on drugs from the orthodox health Care facility	8,647.99	8.09
Amount spent on drugs bought from outside the Health facility	4,545.13	4.25
Transportation to the health facility	663.65	0.62
Registration fees	1,434.92	1.34
Consultation fees	510.10	0.47
Laboratory test	1,173.62	1.09
Transportation to buy prescribed drugs	1,590.65	1.48
Costs incurred during referrals, reviews, extra medication and food	7,781.21	7.28

Prevention cost	5,200.22	4.87
Total direct cost	**106,874.02**	**100.00**

Source: Field Survey, 2019.

Effects of Onchocerciasis on Household Expenditures

Table **4** showed the results of the effects of onchocerciasis illness on household consumption expenditures (feeding, housing, education, and health expenditures). The results of the feeding expenditure model showed R^2 of 0.61 suggestive of good fit. The total income (TY) of the household was positive, indicating a positive relationship with the feeding expenditure of the households. This implies that increase in the total income of the household would the feeding expenditure of the households. The coefficient of the health shock variable was negative and statistically significant ($p<0.01$) signifying an inverse relationship between the health shock and the feeding expenditure as well as feeding pattern of the households. This implies that once a household is effected with onchocerciasis, the feeding expenditure reduces. A reduction in feeding expenditure presupposes a reduction in the quantity and/or quality of food as well as the number of meals/day consumed by the households. The coefficient of household size (HS) was positive and statistically significant ($p<0.01$) implying that increase in household size would increase the feeding expenditure of the household. Prices of food items consumed were observed to have a negative relationship with the feeding expenditure and was statistically significant ($P<0.1$). As the prices of food items consumed rises, the household feeding expenditure declined. The implications of this is that households with ill-health members and high medical expenditures must sacrifice their consumptions on other goods such as food, clothes and social activities which have both short and long term negative impacts on human development. This agreed with the findings of Hong *et al*. (2006) who reported that the impact of ill-health on household consumption patterns are more significant in low income households of rural China.

The results of the housing expenditure model showed that $R^2= 0.70$. The coefficient of total household income (TY) [0.007] showed a positive and significant ($p<0.1$) relationship with the housing expenditure. This results agrees with the findings of Beegle *et al.* (2008) who reported that illness shocks have a negative and statistically significant effect on consumption or income. The health shock variable has negative [-0.170] coefficient and was statistically significant ($p<0.01$) implying an inverse relationship with housing expenditure. This suggests that increase in onchocerciasis infection would lead to reduction in the household expenditure on housing items. The household size was positively [0.098] related with the housing expenditure of households. This indicates that as the number of persons in the households increases, the expenditure on housing items would also increase. Prices of housing items has a positive [0.017] relationship with housing expenditure but were not statistically significant. Poorer households with small reserves had fewer choices. Relatively well-to-do households had more produce and plant materials to store more livestock, more savings and other sources of income than poorer households. Selling off part of these goods did not drastically affect next season's farming operations but would however reduce farmer's capacity to invest and spend on future projects.

The results of education expenditure model showed the R^2 =0.52. Total income of the household (TY) was positively related to the households expenditure on education. This implies that a one percent increase in the

household's income would lead to about 1% increase in the household's expenditure on education. The household size was positively related with the household's education expenditure. This implies that as the number of persons in the household increases, the expenditure on education increases. The health shock variable have a negative relationship with the expenditure on education of the households. This implies that in event of ailment of the households, the expenditure on education of the household would decline. The level of education of the household head (LE) also was statistically significant at ($p<0.05$). The results from this study indicated that ill-health expenditures, especially due to incapacitation significantly influence household's investment on education expenditure. Household with ill-health members are more likely to have less investment on education than household without ill-health members. For example, a study in rural China found that households with hospitalization spent 54 fewer Yuan per capita on education than households without hospitalization, a 23% difference in investment in education (Liu *et al*., 2003). Thus, households forgo long-term benefits to meet immediate health needs, especially among poor families.

The results of health expenditure model revealed R2 = 0.66. The results showed a positive relationship between the amounts borrowed by households and the expenditure on health. This implies that increase in the health expenditure of households would lead to increase in the amount borrowed from friends, financial institutions, etc. when faced with the health shocks. The total income (TY) of the household had a positive significant (P =.05) relationship with the health expenditure implying that increase in the income of the households would increase the expenditure on health. Also the amount of money de-saved by the households when faced with health shocks was statistically significant (P <0.01) and positively related with the expenditure on health, implying increases in the households' expenditure on health would increase the amount de-saved when faced with health shock. The estimates of the model depicted a positive and statistically significant (P <0.1) relationship between the sale of household's assets and reserves when faced with health shock and the expenditure on health of such households. The implication of this is that, if households increase the sales of assets and reserves when faced with health shock, the expenditure on health of such households would correspondingly increase. Other socio-economic characteristics of the respondents such as sex, and age of the household also showed a positive relationship with health expenditure of the households faced with health shock. In the case of age, the older a household head is, the higher the tendency of such a house head to explore ways to finance health expenditure of the household when faced with health shock. However, the study revealed that household size and level of education of head of household were negatively related with the health expenditure. This is contrary to the a priori expectation. As household size increases, the household is likely to spend more on medical care. This implies that household with a large number of household members increase the odds of incurring catastrophic costs due to direct healthcare costs.

Table 4. Socio-economic factors influencing household expenditures

Variable	Coefficient (β)	t-Statistics	Significance
Feeding Expenditure			
Constant	44173.10	7.120***	0.000
TY	0.05	2.578*	0.010
LnSHOCK	-0.01	- 4.099***	0.000

LE	-927.72	2.688 ***	0.001
HS	456.14	3.208***	0.001
PF	-0.046	1.675 **	0.007
R^2 =0.61			
F-Statistic =8.938			

Source: Field Survey, 2019.

Table 4. Cont'd.

Variable	Coefficient (β)	t- statistics	Significance
Housing Expenditure			
Constant	96420.831	6.403	0.000***
TY	0.007	0.064	0.119**
LnSHOCK	-0.170	- 4.121	0.000*
LE	0.153	3.702	0.000***
HS	0.098	2.369	0.018**
PF	0.017	0.528	0.001
R^2 = 0.70			
F-Statistics = 10.331			
Education Expenditure			
Constant	5.040	4.073	0.000***
TY	0.009	-1.435	0.152*
Ln Shock	-0.103	-2.371	0.018**
LE	0.084	1.966	0.050*
HS	0.055	1.308	0.191*
R^2= 0.52			
F-Statistics= 3.487			
Health Expenditure			
Constant	- 6.511	-6.69	0.000***
TY	0.052	1.418	0.014*
DE-SAVING	0.366	0.551	0.024*
BORROW	0.433	12.034	0.032*
ASSET SALE	0.059	2.063	0.006**
SEX	0.667	2.523	0.012*
Level EDU	- 0.018	- 0.128	0.898
HHSIZE	- 0.271	- 4.097	0.000***
AGE	0.081	3.716	0.000***
R^2=0.66			
F-Statistics=4.824(0.000) ***			

Source: Field Survey, 2019. * (P<0.01), ** (P<0.1) and * (P<0.05)**

Health and Social Benefits of Community-Directed Treatment with Ivermectin (CDTI)

The results of social and health benefits of community-directed treatment with Ivermectin is presented in Table **5**. The results showed that respondents listed individual social benefits such as ability to work better (76.3%), acceptance by peers (59.1%), respect in community (50.5%), and other social benefits. Among these, ability to work better and acceptance by peers were important contribution of the CDTI programme at the household level because it enhances improve productivity. Improve productivity was important mainly because most farming households are being able to work without itching or fear of being bitten by black flies was a value shift. Households in the study area stated that people with symptoms of onchocerciasis were better able to sleep at night compared to the past when they would spend the whole night scratching their bodies, sometimes using rough items such as cobs of maize and

stones. Rest at night was seen as having significantly contributed to their social, psychological and economic well-being.

Beyond the social benefits of CDTI, the study revealed a number of health benefits of CDTI for the individuals and households which include improve vision (81.7%), cure scabies (65.6%) kill lice (55.1%), and deworming (42.1%). This agrees with the findings of Lawrence et al. (2005), who reported the health benefits of CDTI as reduce itching, deworming and control scabies among children in Solomon Islands. Respondents praised the drug as 'the best drug' and restated their desire to continue taking it every year so long as it is freely available in the community.

Table 5. Percentage distribution of respondents based on social and health benefits of taking ivermectin in the study area

Types of benefits	Frequency	Percentage
Social		
Ability to work better	153	76.5
Acceptance by peers	118	59.0
Election to office	52	26.0
Improve attendance	80	40.0
Respect in community	101	50.5
Improve productivity	61	30.5
Reduce stigma	30	15.0
Social integration	25	12.5
Health		
Deworming	84	42.0
Kill lice	110	55.0
Cure scabies	131	65.6
Improve vision	163	81.5
Improve skin	40	20.0
Improve well-being	25	12.5
Increase libido	35	17.5
Improve fertility	32	16.0
Reduce itching	71	35.5

Source: Field Survey, 2019. Percentage >100 due to multiple responses

Factors Associated With Perceived Benefits of Community-Directed Treatment with Ivermectin (CDTI)

The respondents' perception of benefits was compared across selected demographic variables as well as other factors that might influence the perception of benefits in the community (Table **6**). The analysis used perceived benefits as dependent variable. The results in Table **6** showed that important demographic factors that influenced perception of the benefits of taking Ivermectin include age,(P = 0.029), marital status (P = 0.012) and length of stay in the onchocerciasis-endemic communities (P = 0.001). Another factor was individual perception of susceptibility of onchocerciasis infection (P = 0.000). Younger, unmarried respondents and newcomers were less perceptive of benefits. All respondents irrespective of sex, education and occupation perceived the social benefits of Ivermectin in the study area. The older and married respondents as well as those who stayed longer in onchocerciasis-endemic community showed greater appreciation for CDTI and were more aware of the impacts of onchocerciasis before CDTI. The older people remembered when the destructive attributes of onchocerciasis kept people impoverished and in pain. People who resided in the community for short period were less perceptive of the benefits.

The perceived susceptibility plays an important role with those who considered themselves to be at risk of infection been more appreciative of the benefits of CDTI. Those who think they are at risk were more likely to acknowledge CDTI's impact because they could relate to the suffering they would have endure in the absence of treatment. This confirms the health belief model (HBM) assertion that if one perceives a risk, there is more possibility of adopting and associating with an aspect that is protective. This could explain why those who consistently take Ivermectin are more cognizant of the benefits than those who missed treatment. Perceived susceptibility to infection with onchocerciasis was also strongly associated with perception of the benefits of Ivermectin treatment (P<0.01). Those who think they have a possibility of infection showed more appreciation of the drug. This agrees with the theory of HBM which holds that levels of susceptibility and severity of infection are associated with perception of benefits of intervention.

Table 6. Demographic and other social factors and perception of benefits of community- directed treatment with Ivermectin

Variables	coefficient	Standard error	P-value
Education	-0.00712201	0.043402	0.876
Age	0.00117733	0.043411	0.029***
Marital status	0.06655721	0.045310	0.012***
Length of stay	0.13048122	0.042773	0.001***
Occupation	-0.03020471	0.038821	0.679
Religion	0.23772882	0.042072	1.943
IVER sign	0.04822622	0.048577	0.558
Many times	0.04076642	0.044785	0.243
Susceptible	0.22831493	0.044822	0.000***
Best drug	0.08657785	0.087715	0.812
Take IVER	-0.50418600	0.338256	0.248
STIGMA	0.06147082	0.044766	0.772
Y- intercept	1.5513058		
F-statistics	5.79		

Source: Field Survey, 2019. ***: (P <0.01)

Regression analysis used high perceives benefits as dependent variable.

Correlation coefficient*:* r^2=0.03: ra^2=0.01

4. CONCLUSION

The study has shown that Onchocerciasis constitutes considerable economic burden on the income and well-being of the affected households as the latter expended substantial amounts of their income as direct health care payments. The results from the cost of illness approach showed that the direct cost N16, 806.68 which is huge enough to push the affected households into poverty trap as it is an Out-of-Pocket expenditure. The study further revealed the heavy burden of Onchocerciasis on households in terms of high dependency ratio, diversion of resources from household expenditures to take care of medical expenses and other assets depletion to cope with Onchocerciasis scourge. The study highlighted the perception of effectiveness of Ivermectin and the factors that

have sustained CDTI in the communities over the years. The benefits of taking Ivermectin were acknowledged by all households. Respondents listed social benefits as including improved productivity, improved school attendance as well as respect in the community. Improved food security was cited as one of the positive impacts of CDTI in the study area, mainly because of increased food production. This could be because of the fact that as people become better physically, they begin to focus on production, leading to higher yields. Beyond the social benefits of CDTI, the study also highlighted the health benefits of CDTI. These include reduced itching, improved vision deworming amongst others. The study concluded the use of Ivermectin has added health and social benefits to the lives of the affected households.

5. RECOMMENDATIONS

The following policy recommendations are pertinent in this study:

i. The proximity to the orthodox facility affected the cost of transportation and the cost of time. The health service should be brought closer to patients in the remote areas through establishment of Onchocerciasis Units in the health centres in rural areas.

ii. Road infrastructure should be improved by government, communities and private sectors to reduce the cost of transportation to the health facility for treatment.

iii. Social security scheme should be introduced to protect households against the financial burden of direct health care payments. This would minimise the sales of households' productive assets to pay medical bills when faced with illness shocks.

iv. Innovative policies and programmes that will help to effectively tackle Onchocerciasis need to be designed and implemented by the government and donor agencies.

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