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EFFECTS OF ONCHOCERCIASIS ILLNESS ON EXPENDITURES OF RURAL HOUSEHOLDS IN NORTH-CENTRAL NIGERIA

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ABSTRACT

The study assessed the effects of onchocerciasis illness on expenditures of rural households in North-Central Nigeria. A multistage sampling technique was adopted to collect data from 556 households affected with onchocerciasis in North-Central Nigeria. Descriptive statistics and household expenditure models were used for the analysis. Households affected with onchocerciasis ate fewer meals per day compared to past days of no onchocerciasis illness. The result showed that only 32.5% of the affected households in the study area had three meals per day during onchocerciasis attack compared to 67.5% before onchocerciasis attack. The household expenditure models revealed a negative relationship between onchocerciasis illness and food expenditure (-0.007), education expenditure (-1.103) and housing expenditure (-0.170). The study revealed a positive relationship between health consumption of affected households and household income (0.052), sales of assets (0.059), borrowing (0.433) and de-saving(0.024).There is need to realize how devastating the economic effect of onchocerciasis illness are on the expenditures of patients who suffer this illness. It is evident that most families do not have formal support, having to manage the high catastrophic cost burden that onchocerciasis illness place on them .The study recommends provision of Social security scheme so as to ameliorate the significant economic impacts of onchocerciasis illness on the expenditures of the households.

Keyword: Onchocerciasis, Expenditures, Households, Nigeria, North-Central

INTRODUCTION

Onchocerciasis is a skin and eye infection caused by the filarial nematode *Onchocercal volvulus* transmitted through the bites of *Haematophagussimulium* (black-flies) which breed in fast flowing rivers and streams, thereby 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.

Incidences of onchocerciasis in endemic areas have major implications for household's economy and natural schedule of activities and interactions with the system [1]. Onchocerciasis remains one of the greatest threats to family welfare out of all tropical diseases in the sub-Saharan Africa (SSA). Either temporary or permanent impairment in the health status of a family member often

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evokes resource adjustment by other persons in such system. Attacks often mean disruption in fundamental activities which determine members' propensity to earn income and welfare [1]. 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. There are good reasons to suggest that onchocerciasis has disruptive adverse consequences on affected individuals and household income and expenditure. The household income is affected by forgoing 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. 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.

In a rural society with widespread poverty without any form of social protection and health insurance household is likely to be impoverished due to the burden of the illness. [2; 3]. In most cases, onchocerciasis has become rampant especially among the economically active group in the rural areas. This has serious implications for rural economies where family labour is the dominant factor of production. Therefore, each hour lost at home or in hospital due to the ailment of a household member competes with welfare impact alternatives such as work in the labour market, schooling, work on farm, etc. Onchocerciasis does not directly cause death, but social and economic consequences can be devastating. It was estimated that between 1995 and 2010, mass treatment with ***Ivermectin*** averted 8.2 million DALYs due to onchocerciasis in Africa Programme for Onchocerciasis Control (APOC) areas, at a nominal cost of about US $257 million. It is expected that this will avert another 9.2 million DALYs from 2011 – 2015 at a nominal cost of US $221 million [4].

In 2011, the cost of mass treatment with ivermectin was estimated to be $257million equated to $41 per DALY averted. The Nigerian government pledges $5million to APOC, the first such contribution from an African country and a reflection of the continuing and increasing contribution and commitment of APOC member government in the fight to conquer the disease [4]. Despite a huge increase in the financing of Onchocerciasis and other Neglected Tropical Diseases (NTDs) Control Programmes, Onchocerciasis remains the priority of the public health in Africa. It is unfortunate that the target for elimination of Onchocerciasis in 2015 have not been met and was extended further to a proposed 2025.In Nigeria, onchocerciasis is still widespread and a cause of blindness in most rural communities. It is conceived that about 10 million Nigerians are infected with *Onchocercal volvulus* with about 1.2 million of these experiencing temporary incapacitation for a period of 2 – 4 months while about 114, 000 suffer blindness as a result of onchocerciasis [4]. Due to onchocerciasis, economically productive households in Nigeria may be losing about 50 million man-days annually [5].

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 [5], people with Onchoceral Skin Disease (ODS) 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. [5]further stressed that people with severe ODS consequently spend significantly less time on productive activities. This report

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is serious in view of the fact that the labour 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 health, social, economic, religious and political development of the affected areas. Onchocerciasis is associated with significant levels of stigma which cuts across the entire aspects of life in the communities. While some people pity those infected by the disease, others despise them. Treatment of the disease takes a long time and it is costly. Infected individuals are burdened with 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.

Given the dynamics of influence of onchocerciasis on income earning capacity and poverty, it is important to empirically establish linkages between mechanism of burden bearing within the household structure and expenditures of the household. The study showed the effect of onchocerciasis on expenditures of households in North-Central Nigeria. The relationship between the scourge and households' expenditures, and consequently on food security situation of the households. The broad objective of the study was to assess the economic effects of onchocerciasis scourge on households' expenditures of rural farmers in North- Central Nigeria. Specifically, the study was carried out to:

i. describe the socio-economic characteristics of households in the selected States in North-Central Nigeria;
ii. assess the effects of onchocerciasis on households' education expenditure in the study area;
iii. estimate the effects of onchocerciasis on households' housing expenditure in the study area;
iv. analyze the impact of onchocerciasis on households' consumption pattern expenditure in the study area;
v. estimate socio-economic variables influencing household food expenditure in the study area; and
vi. analyze the effects of onchocerciasis on households' health expenditure in the study area;

EMPIRICAL MODEL AND METHOD

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 3^0E and 14^0 E and latitude 4^0 30N and 11^0 20N with a landmass of about 296,898km^2 [6]. The average annual rainfall in the zone ranges from 800-2000mm with high relative humidity and temperature of 13-17^{0}C. 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

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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 logistic regression model.

2.1 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 onchocercal skin disease (OSD), four models were used. These are household expenditures on *education, food, housing, and health.*The logarithmic expenditure function was used because it is assumed to provide a 'good fit', ease of computation and automatic correction for heteroscedasity [7]. The assumption that the logarithmic transformation of expenditure observation corrects heteroscedasity [7] is consistent with the belief that expenditure observations are such that their standard deviations are proportional to their corresponding means [8].

Household expenditures on food, housing, education and other items were used as dependent variables and a full consumption smoothing in response to health shocks was conducted. 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.

Model Specification

2.1.1 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) …… (1)

Where:

Edu = expenditure on education

TY = total income of household

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

LE = level of education of household head

HHS = household size

The specific form of the model is given by;

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$Edu = \alpha_0 + \alpha_1 TY + \alpha_2 LnHshock + \alpha_3 LE + \alpha_4 HHS + U$…… (2)

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

2.1.2 Housingexpenditure model

$HSE = f$ (TY, LnHshock, LE, HHS, PB)…….. (3)

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;

$HSE = \beta_0 + \beta_1 TY + \beta_2 LnHshock + \beta_3 LE + \beta_4 HHS + \beta_5 PB + U_2$… (4)

The *a priori* expectation β_1 and $\beta_3 > 0$ while β2, β4 and $\beta_5 < 0$

2.1.3 Foodexpenditure model

$FS = f$ (TY, LnHshock, HHS, LE, PF)…….. (5)

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;

$FS = \delta_0 + \delta_1 TY + \delta_2 LnHshock + \delta_3 HHS + \delta_4 LE + \delta_5 PF + U_3$…….. (6)

The *a priori* expectation $\delta_1, \delta_4 > 0$; δ2, δ_3, $\delta_5 < 0$

2.1.4 Healthexpenditure model

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

$C_i = K_0 + K_1 TY + K_2 DESAV + K_3 ABOR + K_4 SAL + K_5 OTHER +$
$K_6 LE + K_7 HHS + K_8 SH + K_9 AH + U_2$..... (7)

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

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Ki = parameters to be estimated
Ui = random error term

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

Table 1 showed the socio-economic characteristics of respondents in the study areas (Benue, Nasarawa and Plateau States). Most (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 [9] 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 and average household size of 10 persons. This 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. However, the large household size in the study area has implications on food security of the households. According to [10], 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, [11] 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 most common owned household asset in the study area was radio and the least owned household asset was car. Overall, about 80% of the households had radio for the combined sample and 16% households had cars. The study revealed that farmers with Onchocercal skin disease (OSD) had an overall lower standard of living as indicated by their ownership of fewer personal wealth indicators such as motorcycles, motor-cars and cement plastered houses.

Most (45.2%) of the farmers in the study area have a farm size of between 0.5 – 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 ₦188, 541.45 for the 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 [12].More so, a mean household size of 10 persons indicates that household members in the study area live on ₦52.90 per day indicating a poor living condition of the households. However, households in the study area produce most of the 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)

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Variable	Benue n=206	Nasarawa n=217	Plateau n=133	Pooled n=556
Sex				
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)
Age (years)				
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
Marital Status				
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)
Education (years)				
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)
Household Size				

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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	
Farm Size (Ha)					
0.5-2.5	95(46.0)	96 (44.5)	60 (45.0)	251 (45.2)	
3.5-5.5	72(35.0)	73 (33.5.)	40 (30.0)	185 (33. 2)	
6.5.-8.5	26(12.5)	30 (14.0)	24 (18.0)	80 (14.4)	
9.5-11.5	9(4.5)	11 (5.0)	8 (6.0)	28 (5.1)	
12.5and above	4(2.0)	7 (3.0)	1 (1.0)	12 (2.2)	
Mean	3.9	4.1	4.1	4.0	
Farm Income (₦)					
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.

Effect of onchocerciasis illness on household food consumption Pattern

Onchocerciasis is alluded to affect households' food consumption patterns. This study investigated the number of meals that were consumed by households affected with onchocerciasis illness. Table 2 showed that the affected households ate fewer meals per day compared to past days of no onchocerciasis illness. On the average only 32.5% of the households in the study area had three meals per day during the period of onchocerciasis attack compared to

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67.5% before onchocerciasis attack. Affected households reduced consumption level as a coping strategy to health risk (Onchocerciasis attack). The households who could not have the normal 3 meals per day complained of insufficient food stock. The affected households indicated that reducing the number of meals per day andchanging the time of the first meal of the day were coping strategies adopted by the households in the face of food shortages occasioned by onchocerciasis attack.

Table 2: Number of Meals Eaten Per Day Before and During Onchocerciasis Attack (in Percentage)

No of meals/	Benue		Nasarawa		Plateau		Pooled	
day	Before	During	Before	During	After	During	Before	During
1	0.0	5.9	0.0	9.7	0.0	10.5	0.0	8.7
2	33.6	60.5	31.2	59.1	32.6	56.9	32.5	58.8
366.4	33.6	68.831.2	67.4	32.6	67.5	32.5		

Source: Survey Data, 2015.

Socio-economic variables influencing household food consumption

Table 3 showed the results of the feeding expenditure model. The R^2 of 0.61 suggested that about 61% variation in the dependent variable was explained by the independent variables. The total income (TY) of the household appeared with a positive sign, indicating a positive relationship with the feeding expenditure of the households. This implies that a 1% increase in the total income of the household will lead to about 1% increase in the feeding expenditure of the households.The health shock variable appeared with a negative sign, signifying an inverse relationship between the health shock and the feeding expenditure as well as feeding pattern of the households, and is statistically different from zero at 1% level of significance. 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 estimates of the model revealed that a one percent increase in the health shock would lead to a 0.07% reduction in the quantity of food consumed in the affected household. The household size (HS) appeared with a positive sign in line with the a priori expectation and were statistically significant at 1% level of significance. This implies that increase in the size of the household will 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 by one percent, the household feeding expenditure declined by 46%. 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 [13] who reported that the impact of ill-health on household consumption patterns are more significant in low income households of rural China.

Table 3: Socio-economic Factors Influencing Household Feeding Expenditure

Variable	Coefficient (β)	t-Statistics	Significance
Constant	44173.10	7.120***	0.000

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TY	0.05	2.578*	0.010
LnSHOCK	- 0.007	- 4.099***	0.000
LE	- 927.72	- 2.688 ***	0.001
HS	456.140	3.208***	0.001
PF	- 0.046	1.675 **	0.007
R^2 =0.61			
F-Statistic =8.938			

Source: Survey Data, 2015 *(P<0.05), ** (P<0.1) and *** (P<0.01).

TY = Total income of household
Ln SHOCK =Health shock
LE =Level of education of household head
HS =Household size,
PF=Prices of food item

Effects of onchocerciasis illness on households' health expenditure (Health consumption model).

The results of the health expenditure model (Table 4) revealed the R^2 of 0.66 implying that 66% of variation in the log of expenditure on health was accounted for by the predictor variables. The results showed a positive relationship between the amounts borrowed by households from friends, relatives, self-help groups, financial institutions and money lenders and the expenditure on health. This implies that increase in the health expenditure of households would lead to increase in the amount borrowed from such sources when faced with the health shocks.

The total income (TY) of the household had a positive relationship with the health expenditure and was statistically significant (P<0.05). A one percent increase in the income of the households would increase the expenditure on health by 1%. 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 head 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. The results showed that an additional household member is associated with ₦0.271 fewer spent on medical care (P<0.01).Similarly, a 1% increase in health expenditure of

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the household is associated with 20% decreased in education.
Although it has been revealed that ill-health increases medical care utilization and therefore increases medical expenditure [14], few studies have closely examined the impact of ill-health and medical expenditure on household consumption patterns, which could have immediate harm on household family members particularly in poor families where basic needs often go unmet [3]. Although medical services can help patients recover from ill-health, the excessive burden of medical expenditure crowd-out other goods and services, and therefore can have several potential negative impacts on productivity and human well-being, and thus would impact the overall economy and social development of a society. The findings from this study revealed that ill-health and medical expenditure reduces the household investment in human capital, physical capital for farm production, and other consumptions critical to human well-being. This findings agreed with the work of [14] who reported that expenditure on medical services occurs at the expense of food, education, investment in farming, and participation in social activities in China rural areas

Table 4: Effect of Onchocerciasis on Household Health Expenditure

Variable	Coefficient	t - Value	Significance
Constant	- 6.511	- 6.690	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*
LevelEDU	- 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: Survey Data, 2015*** (P<0.01), ** (P<0.1) and * (P<0.05)

TY = Total income of households,
DESAVING = Amount de-saved by households
BORROW = Amount borrowed by households
ASSETSALE = Sale of household assets and reserves
SEX = Sex of head of household
LevelEDU = Level of education of head of household
HHSIZE = Household Size
AGE = Age of the household head.

4.4.7 Effects of onchocerciasis illness shocks on households' education (Education expenditure model).
The results of education expenditure model (Table 5) showed the R^2 of 0.52 suggesting that 52%

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variation in the dependent variable was explained by the explanatory variables. 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 was observed to 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 by 5%. The level of education of the household head (LE) also agrees with a priori expectation and was statistically significant at 5% level.

Expenditures on education for children or adults are human capital investment that tend to increase productivity in the long run. 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 [14]. Thus, households forgo long-term benefits to meet immediate health needs, especially among poor families.

Table 5: Effect of Onchocerciasis on Household Education Expenditure

Variable	Coefficient (β)	t - Statistics	Significance
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			

Source: Survey Data, 2015
****** (P<0.01), ** (P<0.1),*(P<0.05)***

TY = Total income of households
LnSHOCK = Health Shock variable
LE = level of education of household head
HS = Household size

4.4.8 Effects of onchocerciasis illness shocks on households' housing expenditure

Table 6 showed the results of the housing expenditure model. The R^2 of 0.70 revealed that 70% of variation in the housing expenditure was explained by the explanatory variables of the model. The total income (TY) of the households showed a positive relationship with the housing expenditure and was statistically significant (P<0.1). This results agrees with the findings of [15] who reported that illness shocks have a negative and statistically significant effect on

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consumption or income.
The health shock variable has negative sign, implying an inverse relationship with housing expenditure but was statistically significant at 1% level. This suggests that increase in Onchocerciasis infection would lead to reduction in the household expenditure on housing items. The household size was positively related with the housing expenditure of households. This indicates that as the number of persons in the household increases, the expenditure on housing items would also increase.Prices of housing items has a positive 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.

Table 6: Effect of Onchocerciasis on Household Housing Expenditure

Variable	Coefficient (β)	t- statistics	Significance
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 = 10.33			

Source: Survey Data, 2015
*** (P<0.01), ** (P<0.1) * (P<0.05).

TY = Total income of households
LnSHOCK = Health Shock variable
LE = level of education of household head
HS = Household size
PF =Prices of food item

CONCLUSION AND RECOMMENDATIONS

The study has shown that onchocerciasis constitute considerable burden on food consumption pattern and the expenditures of the affected households. The result showed that only 32.5% of the affected households in the study area had three meals per day during onchocerciasis attack compared to 67.5% before onchocerciasis attack. The household expenditure models revealed a negative relationship between onchocerciasis illness and food expenditure (-0.007), education expenditure (-1.103) and housing expenditure (-0.170). The study revealed a positive relationship between health consumption of affected households and household income (0.052), sales of assets (0.059), borrowing (0.433) and de-saving(0.024).
There is need to realize how devastating the economic effect of onchocerciasis illness are on the expenditures of patients who suffer this illness. It is evident that most families do not have

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formal support, having to manage the high catastrophic cost burden that onchocerciasis illness place on them .The study recommends provision of Social security scheme so as to ameliorate the significant economic impacts of onchocerciasis illness on the expenditures of the households.

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