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EFFECTS OF TUBERCULOSIS INFECTION ON AGRICULTURAL PRODUCTIVITY IN OKPOKWU LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

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ABSTRACT
The study was carried out to determine the effect of tuberculosis infection on agricultural productivity in Okpokwu Local Government Area of Benue State, Nigeria. Data was collected for the study from primary source by the use of a well-structured questionnaire; the data was analyzed using descriptive statistics and regression analysis. The result shows that majority of the farmers infected with tuberculosis are males, married and have attain secondary education, majority also have farming as their major occupation. Majority of the farmers (64.7%) fell between the ages of 21-40, (58.8%) of the farmers have household size of 4-6 persons. All the respondents (100.0%) have experience cases of tuberculosis in their family which lowers productivity in the study area. Tuberculosis however has a negative impact on agricultural productivity. Duration of infection and cost of treatment were significant 1% and 5% levels of significance, respectively, showing that unit increase in these variables lead to decrease in productivity of farmers in the study area. It was, therefore, recommended that government should make clinics and hospitals available, affordable and accessible to farmers in the rural areas and also organize tuberculosis campaign programs like that of HIV to educate rural farmers on issues of tuberculosis how to prevent and control tuberculosis, and compensate infected farmers on their loss of time and resources.

Keywords: Agricultural productivity, Farmers, Infection, Regression analysis, Tuberculosis.

INTRODUCTION
In Nigeria, agricultural production is dominated by peasant farmers most of whom reside in the rural communities; these people are responsible for a greater percentage of agricultural produce in Nigeria. Therefore it is of great importance that the health of these rural communities are improved or sustained, if they are to perform effectively, efficiently and also to sustain an appreciable level of agricultural productivity and economic development.

Among the major diseases that are common in Africa, tuberculosis is one of the greatest threats facing agricultural development in Africa today. Tuberculosis (TB) is a chronic infectious disease of man and animals characterized by the formation of granulomas in tissues and organs, more significantly in the lungs, lymph nodes, intestine and kidney among others (Shitaye *et al.* 2007). At present, all types of tuberculosis cases are found to be ranked 4th (4.3%) among the top 10 diseases, leading causes of admission in hospitals in 2003, also as the 2nd (11.5%) cause of death among the top 10 diseases in 2004 (Ministry of Health, 2004). However, the current level of the problem and its impact is not clearly estimated due to various constraints, most notably due to lack of health institutions and reliable data, in rural areas in particular.

Tuberculosis accounts for almost 20% of all deaths and 26% of all preventable deaths in the age group of 15 to 49 years. The shopping around for diagnosis, cost of privately

purchased drugs, money spent on travelling and care received in the private sector, by the farmer, further aggravate the problems of productivity. Health risk and particularly tuberculosis has some debilitating effects on the output and income of farmers through cost of health care, labour man days lost to tuberculosis medication and physical weakness. Tuberculosis leads to loss of agricultural labour due to illness and death, wastage of family members' time and energy in caring for tuberculosis patients and grieving for people killed by tuberculosis.

Despite the fact that 70% of the country's working population are employed in agricultural sector and mostly in the rural areas (Olomola, 2007), which account for a substantial amount of food production. They are continually faced with the problem of infectious diseases such as tuberculosis which is very common in the rural areas especially in those areas where access to health care facilities are not common.

It has been figured out that Tuberculosis places an extraordinary burden on those afflicted by the disease, their families and communities and on government budgets as a whole. The greatest burden of tuberculosis falls on the productive adults whom, once infected, are weakened and often unable to work. The burden of taking care of sick individuals usually falls to other family members and, in addition putting them at the greater risk of infection, which also lower their productivity (Russell, 2014). Besides loss of productivity, the cost of treating tuberculosis can also be significant on the farmers that are infected with the disease. The mean household spending on tuberculosis can account for as much as 8–20 percent of annual household income, varying from region to region (Russell, 2004).

A study by Kemp *et al.* (2007) also shows that despite the fact that anti-tuberculosis treatment is free in Nigeria; patients are likely to incur costs due to multiple visits during treatment. The economic costs can be an important barrier to tuberculosis patients' ability to utilize tuberculosis services and access and adhere to anti-tuberculosis treatment. Studies associated with the costs of anti-tuberculosis treatment have noted the direct costs borne by patients from fees, transport and food costs, along the pathway to care. The author further found that patients spend on average about US$13, equivalent to about 18 days' wages, during treatment, and that other indirect costs such as loss of man hours at work could be greater. Ukwaja *et al.* (2013) found that In an attempt to cope, many patients have been known to further weaken their coping strategies by selling or leasing off their assets or resorting to borrowing, as well as the receipt of vouchers to cover certain basic costs such as food, transportation and house rental.

Researchers such as Nwanta *et al.* (2011); Ukwaja *et al.* (2013); and Kemp *et al.* (2007) amongst others have worked on tuberculosis infection with varying focus and in different locations but little or no study have been carried out on the effect of tuberculosis on agricultural productivity in the study area.

The broad objective of the study was to determine the effect of tuberculosis infection on agricultural productivity in Okpokwu Local Government Area of Benue State. The specific objectives include to: describe the socio-economic characteristics of the farmers infected with tuberculosis in the study area; determine the level of its occurrence in the study area; examine the effect of tuberculosis infection on agricultural productivity in the study area; and determine the level of health care services that are available for farmers infected with tuberculosis in the study area.

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MATERIALS AND METHODS

The Study Area

The study was conducted in Okpokwu Local Government Area of Benue State. Okpokwu Local Government Area (LGA) was created in 1976 and takes its name from the Okpokwu stream. The LGA is made up of Okpoga, Edumoga and Ichama districts with Okpoga as the headquarters (Idom LGAs of Benue State, Olamaboro LGA of Kogi State and Isi-uzo LGA of Enugu State (Idoma Land Initiative, 2014).

Okpokwu Local Government Area lies between latitude $6^0$45'N, - $7^0$15'N, and $7^0$30'E, - $8^0$00'E, (Abah, 2000). The Local Government Area has an area of 731km/sq and population of 176,647 at 2006 census (NPC, 2006). The people of the area, speaks a dialect of Idoma and are predominantly farmers with about 80 to 90% engaged in the occupation. The major crops cultivated in the area include cassava, yam, maize, rice, and groundnut and tree crops such as citrus fruits, palm fruit and mango. Livestock such as cattle, goat, sheep, pig and local chicken, mostly on an extensive scale are also raised in the area (Idoma land initiative, 2014). The area has a typical tropical climate, which is marked by two predominant seasons, rainy season (April to October) and dry season (November to March). This area is constituted of gently undulating hills with high altitudes. The sloppy nature, increase the velocity of run of in the area. The area has an average temperature of 28^0 Celsius. The average relative humidity is highest in September and lowest in December or January with an average of 80%. The average annual rainfall in this area is 1650mm. The major type of soil is sandy loam with red color. It is very firm and friable, weak sub-angular blocks (Abah, 2000).

Sampling Techniques

Purposive sampling technique was used to select farmers from the three (3) districts in the study area which were Okpoga, Ichama and Edumoga. Also, 20 farmers infected with tuberculosis were selected purposely from Okpoga, 21 from Edumoga and 10 from Ichama making a total of 51 farmers from the three (3) districts. Data were collected from primary source. The primary data were collected from farmers through the use of a well structured questionnaire.

Analytical Techniques

Data for the study were analyzed using simple descriptive statistics and inferential statistics. Simple descriptive statistics such as percentages, frequencies, and mean, were used while inferential statistics such as multiple regression analysis was also employed in the data analysis.

Multiple regression analysis was used as a tool of analysis for this study. The regression models are expressed below:

The implicit function is given as:

$$Y = f(X_1, X_2, X_3, \text{----------}X_N) \quad \ldots (1)$$

Explicitly, the estimated function is given as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \quad \ldots (2)$$

where;

Y = Output of farmers
X_1 = Cost of medical charges
X_2 = Transport cost to medical checkup
X_3 = Cost of time lost in self medication
X_4 = Cost of time lost in taking care of sick relatives
e = error term

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RESULTS AND DISCUSSION

Socio-Economic Characteristics of Farmers Infected with Tuberculosis

Table 1 below presents the results of the analysis on the socio economic characteristics of farmers infected with tuberculosis. The result revealed that (64.7%) of the farmers were between the age 21-40 years, (27.5%) have their age ranging between 41-60 years while (7.8%) have their age to be 20 years or less. This result implies that majority of the farmers infected with tuberculosis in the study area were still in their productive stage (Geetharamani *et al.,* 2001). Therefore, in the absence of disease like tuberculosis they will produce in their maximum capacity. Majority of the farmers infected with tuberculosis in the study area are male (70.6%) while (29.4%) are female. This result implies that the males are more susceptible to the disease than female. Majority (70.6%) are married, (35.3%) are single while (5.9%) are widows. This means that majority of farmers in the study area are married thus infection of disease like tuberculosis will be detrimental to the whole family at large. The result shows that (5.9%) have no formal education, (27.5%) have primary education, (52%) have secondary education and (13.7%) have tertiary education. This implies that majority of the farmers are educated (can read and write). This means that, they can easily adopt measures to control tuberculosis if they are made available.

Majority of the respondents in the study area (94.1%) have farming as their major occupation, (3.9%) are traders while (2.0%) are civil servants. Implying that their major occupation is farming therefore if they are face with health challenges like tuberculosis, it will in turn affect agricultural productivity as whole. The result also shows that (58.8%) of the farmers have 4-6 people in their households, (9.8%) had 7-9 people in their households while (31.4%) have 3 people or less. This result implies that majority (58.8%) of farmers in the study area have large households size and as such many of them will be involve in agricultural activities. This result agrees with the finding of Abah and Tor (2012) that established that majority of the farmers are married with large household and this served as source of family labour. The result shows that (2.0%) of the farmers have farming experience of 20 years and above, (13.7%) have farming experience of 11-15 years, (15.7%) have farming experience of 16-20 years and (68.6%) have farming experience of less than 10 years. This result implies that each of the farmer in the study area have been in the farming business for at least eight (8) years and above, thus they are devoted and consistent in the farming activities. The result further revealed that (15.7%) of the farmers in the study area have farm size of 1.00 hectare or less, (60.8%) have farm size of between 1.00-2.00 hectares, (19.6%) have farm size of between 2.01-3.00 hectares while (3.9%) have farm size of 3.01 hectares and above. Meaning that on average, about (60.8%) of farmers in the study area has up to 2.0 hectares farm size which is a large farm size; this implies that farmer will be able to increase production. This finding is agreement with the finding of Abah and Tor (2012) who find out that 72% of the farmers in Nasarawa State have farmer land ranging from 0.5 to 3 hectares for farm operation.

The result indicates that (2.0%) of farmers in the study area earn ₦20000 or less annually, (23.5%) of the study area earn between ₦20001 - ₦40000, (43.1%) of the farmers in the study area, earn between ₦40001 - ₦60000 while (31.4%) of the farmers in the study area earn ₦60000 and above. This result implies that all the respondent in the study area earn within the range of ₦20000 and ₦60000 as their annual household income. This findings is in agreement with the findings of Nouman *et al.* (2013) who discovered that majority of the farmers earned within the range ₦20000 and above from their agricultural production. The result also indicated that (41.2%) of the respondent in the study area earn ₦10000 or less as their non-farm income annually, (47.1%)of the farmers in the study area earn between ₦10001-

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₦20000 as their non-farm income annually while (11.8%) of the farmers in the study area earn between ₦20001 - ₦30000 as their non-farm income annually. The result further indicated that (82.4%) of the farmers in the study area receives ₦10000 or less from their children and relatives annually (remittance), (15.7%) of the farmers in the study area receives ₦10001 - ₦20000 annually from their children and relatives (remittance) while only (2.0%) of the farmers in the study area receives ₦20001- ₦30000 from their children and relatives annually (remittance). This finding is in concord with the findings of Nouman *et al*. (2013) who established that majority of the farmers earned more than ₦10000 from other sources and served as a means of resources for purchasing inputs and labour.

Table 1: Socio-Economic characteristics of farmers infected with tuberculosis (n = 51)

Variables	Frequency	Percentage	Mean
Age			
<=20	4	7.8	
21-40	33	64.7	36.76
41-60	14	27.5	
Total	51	100	
Sex			
Female	15	29.4	
Male	36	70.6	
Total	51	100	
Marital Status			
Single	18	35.3	
Married	30	58.8	
Widow	3	5.9	
Total	51	100	
Level of Education			
No formal Education	3	5.9	
Primary Education	14	27.5	10.06
Secondary Education	27	52.9	
Tertiary Education	7	13.7	
Total	51	100	
Major Occupation			
Farming	48	94.1	
Trading	2	3.9	
Civil service	1	2.0	
Total	51	100	
Household Size			
<=3	16	31.4	
4-6	30	58.8	4.24
7-9	5	9.8	
Total	51	100	

Source: Field survey, 2016

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Table 1: Socio-Economic characteristics of farmers infected with tuberculosis **Cont'd.**

Variables	Frequency	Percentage	Mean
Farming Experience			
<=10	35	68.6	
11-15	7	13.7	11.27
16-20	8	15.7	
21+	1	2.0	
Total	51	100	
Farm Size			
<=1.00	8	15.7	
1.01	31	60.8	1.9843
2.01-3.00	10	19.6	
3.01+	2	3.9	
Total	51	100	
Annual Farm Income (₦)			
<=20000	1	2.0	
20001-40000	12	23.5	
40001-60000	22	43.1	57647.06
60001+	16	31.4	
Total	51	100	
Non-Farm Income (₦)			
<=10000	21	41	
10001-20000	24	47.1	15588.24
20001-30000	6	11.8	
Total	51	100	
Remittance			
<=10000	42	82.4	7705.88
10001-20000	8	15.7	
20001-30000	1	2.0	
Total	**51**	**100.0**	

Source: Field survey, 2016

Level of Occurrences of Tuberculosis

Table 2 presents the result of the analysis on the level of tuberculosis occurrences in the study area. The result revealed that the maximum duration of infection was 180 days while the minimum duration was 60 days, on the average the duration infection was 98.24. The maximum number of tuberculosis in the family were 2 persons while the minimum number was 1 person, on the average, the number of tuberculosis in the family was 1.04, meaning that at least one person is infected in the family. The maximum cost of treatment/drugs of tuberculosis infection in the study area was ₦60000 while the minimum cost was ₦5000, on the average the cost of treatment of tuberculosis/drugs was ₦26176.47, meaning that the farmers spend at least half of their resources in treating tuberculosis thus leading to low productivity. The table also shows that the maximum time the farmer visited the hospital for treatment was 3 times per month while the minimum time was 1 (once) per month, on the average the mean was 2.04. The result shows the maximum number of days, the farmers stay at home without going to the farm (number of days incapacitated) was 6 months, while the

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minimum number of days was 3 months, on the average the mean was 3.27, this implies that at least the farmers stay at home for three months or more without going to farm which also lowers productivity. This implies that man days will be affected and return limit agricultural activities.

The result further shows that the maximum numbers of days, farmers spend at home taking care of sick relatives were 30 days while the minimum numbers of days were 15 days, on the average the mean was 23.12. The result also revealed the level of occurrences of tuberculosis in the study area. According to the result (3.9%) of the farmers in the study area were taking care of their brothers who is infected with tuberculosis, (7.8%) farmers were taking care of their fathers, (3.9%) of the farmers were taking care of their friends, (15.7%) of the farmers were taking care of their husbands, (2.0%) of the farmers were taking care of their mothers, (60.8%) of the farmers were infected with tuberculosis, (2.0%) 0f the farmers were taking care of their sons, (2.0%) of the farmers were taking of their uncles, (2.0%) of the farmers were taking care of their wives. This result implies that (60.8%) of farmers in the study area, were infected with tuberculosis and in each of the 51 respondents (farmers) in the study area, at least one person was infected with tuberculosis from their family, and one or two (2) members of the family miss work due to care giving to tuberculosis infected patient thus affecting productivity in the study area.

Table 2: The Level of Tuberculosis Occurrences (n = 51)

Variables	Minimum	Maximum	Mean
Duration of infection	60	180	98.24
Number of TB in the family	1	2	1.04
Cost of treatment and drugs	5000	60000	26176.47
Cost of transportation	200	15000	1468.63
Number of hospital visits	1	3	2.04
Number of days incapacitated	2	6	3.27
Days taking care of the sick	15	30	23.12

Source: Field survey, 2016

Number of Family Members Infected with Tuberculosis

Table 3 presents the number of family members infected with tuberculosis. The result further shows that the maximum numbers of days, farmers spend at home taking care of sick relatives were 30 days while the minimum numbers of days were 15 days, on the average the mean was 23.12. Table 3 revealed the level of occurrences of tuberculosis in the study area. According to the results, 3.9% of the farmers in the study area were taking care of their brothers who were infected with tuberculosis; 7.8% farmers were taking care of their fathers; 3.9% of the farmers were taking care of their friends; 15.7% of the farmers were taking care of their husbands; the farmers were taking care of their mothers (2.0%); the farmers infected with tuberculosis (60.8%); farmers were taking care of their sons (2.0%); farmers who took care of their uncles (2.0%); and about 2.0% of the farmers were taking care of their wives. This result implies that 60.8% of farmers in the study area, were infected with tuberculosis and in each of the 51 respondents (farmers) in the study area, at least one (1) person was infected with tuberculosis from their family, and one or two (2) members of the family missed work due to care given to tuberculosis infected patient, thus, affecting productivity in the study area.

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Table 3: Number of Family Members Infected with Tuberculosis

Variables	Frequency	Percentage
Brother	2	3.9
Father	4	7.8
Friend	2	3.9
Husband	8	15.7
Mother	1	2.0
Myself	31	60.8
Son	1	2.0
Uncle	1	2.0
Wife	1	2.0
Total	**51**	**100.0**

Source: Field survey, 2016

Effect of Tuberculosis Infection on Agricultural Productivity

The effect of tuberculosis on agricultural productivity is presented in Table 4. The result shows that duration of infection was significant at 1% level of significance thus duration of infection affects agricultural productivity in the study area. The result also shows that cost of treatment/drugs of tuberculosis infection was significant at 5% level of significance. This shows that cost of treatment/drugs of tuberculosis affects agricultural productivity in the study area.

Table 4: Effect of tuberculosis infection on agricultural productivity (n = 51)

Variables	Linear function[a]	Semi log	Double log
Constant	6249.306	11441.406	14.902
	(4.612)	(1.918)	(3.482)
Duration of infection	-16.325	-1168.090	-741
(days)	(-3.270)*	(-1.955)	(-1.728)
Cost of treatment	-.034	-208.804	-263
and drugs (₦)	(-2.316)**	(-555)	(-973)
Cost of	.039	226.386	.086
Transportation (₦)	(.647)	(1.087)	(.574)
No of hospital visits	-480.331	-1544.575	-835
	(-1.370)	(-2.173)	(-1.637)
No of days taking care of the sick	-38.760	-948.577	-1.087
	(-1.179)	(-1.180)	(-1.883)
Labour man days	1.061	104.538	.439
	(.222)	(.232)	(1.360)
R^2	.260	.202	.191
F	2.583	1.858	1.730
Prob>F	.031[b]	.110[b]	.137[b]

Note: Values in parentheses represent t-ratio; *, ** = t- test significant at 1% and 5% levels, respectively. a = lead equation.
Source: Field survey, 2016

From the result, the negative sign associated with duration of infection implies that a unit increase in the duration of infection will lead to a decrease in agricultural productivity. The result also shows that the negative sign associated with cost of treatment/drugs of

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tuberculosis infection implies that a unit increase in the cost of treatment/drugs of tuberculosis infection will lead to a decrease in agricultural productivity.

Level of Health Care Services Available to Farmers Infected with Tuberculosis

The result of the level of health care services that are available to the farmers infected with tuberculosis presented in Table 5. The result revealed that (82.4%) of the farmers indicated that one doctor attend to them daily while (17.6%) of the farmers indicated that two doctors attend to them daily. This result implies that at least one doctor attend to majority of the farmers infected with tuberculosis every day in the study area. The result also shows that (11.8%) of the farmers indicated that three nurses attend to them every day while (88.2%) of the farmers indicated that four nurses do attend to them daily, meaning that four nurses attend to majority of farmers infected with tuberculosis in the study area. The result also shows that (72.5%) of the farmers indicated that full attention was given to them by the doctors and the nurses during medication while (27.5%) of the farmers indicated that more attention was given to them by the doctors and the nurses during medication in the study area.

Table 5: Available Health Care Services to Farmers Infected with Tuberculosis (n = 51)

Variables	Frequency	Percentage
No of Doctors		
One	42	82.4
Two	9	17.6
Total	51	100.0
No of Nurses		
Three	6	11.8
Four	45	88.2
Total	51	100.0
How much attention		
Full attention	37	72.5
More attention	14	27.5
Total	51	100.0

Source: Field survey, 2016

CONCLUSION AND RECOMMENDATIONS

The study concluded that tuberculosis has a negative effect on farmers' productivity in the study area and it was also discovered that tuberculosis affects the farmers more at their productive age. Also, cases of tuberculosis infection was found to be high in the study area while duration of infection and cost of treatment of tuberculosis were found to be the major variables that affects productivity of farmers infected in the study area. Based on the findings of the study, the following recommendations were made:

1. Government should improve the present condition of the health services in the study area and provide more health care services in rural areas, so that infected farmers will not need to travel far away for medication.
2. There should be an intervention in the form of campaign organization or programs to educate farmers especially youths on the effect of tuberculosis, measures taken to ensure effective prevention and control of tuberculosis.

3. Medications that reduces the days of incapacitation should be introduce and intensified and also made available to farmers at affordable prices as most of the farmers are poor, to improve their health and productivity.
4. Infected farmers with active tuberculosis disease are to be isolated before starting effective anti-tuberculosis therapy, so as to break the chain of transmission.

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