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IMPACT OF EBOLA ON FARM PRODUCTIVITY AS PERCEIVED BY FARMERS AND EXTENSION AGENTS IN SIERRA LEONE

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ABSTRACT
The Ebola epidemic outbreak that hit the three West African Countries (Guinea, Liberia, and Sierra Leone) is described as the largest outbreak in history. The epidemic caused devastating effects on human beings, economic activities and food security in these countries The magnitude and extent of these activities have been speculative especially that of food security. This paper reports study that investigated the magnitudes of the impact of Ebola scourge on farm productivity from farmers' and extension workers' perspectives. The study was conducted in two districts – Bo and Moyamba in the Southern Province of Sierra Leone. Stratified random sampling technique was used to select the two districts. Propulsive random sampling technique was adapted to select the farmers and extension workers in these districts. A questionnaire comprising four scales was employed to collect data from 160 (150 farmers and 10 extension workers) community members selected from 15 quarantined communities in these two districts. The findings of the research revealed that most of the farmers were in their socio-economically active age, ranging from 36 to 55 years. The study further showed that post–planting activities- fencing, hunting, bird scaring (28.8%) and crop harvesting (61.3%) were most severely affected by the Ebola outbreak in quarantined communities. These activities normally take place between the months of June and November, which coincided with peak of the Ebola epidemic in the country. Further still, it revealed that the disease outbreak to a very great extent decreased food affordability and financing (99.4%), food availability, storage and protection (98.1%), processing and preservation, marketing, and food accessibility (97.5%). The major recommendation based on the findings was that: Government and other donor bodies should consider the deteriorating trend of farmers' health and food security to give them priority in time of the after- Ebola rehabilitation.

KEY WORDS: Ebola, Impact, Farm productivity, Household Food security, Quarantine Community

INTRODUCTION
Ebola hemorrhagic fever is a fierce and extremely rapid killing viral disease which passes to other humans *via* blood and other body fluids, and causes death in 50-90% of clinically diagnosed cases (Leach, 2008). It leads to rapid onset of symptoms (initially high temperature, shivering, and aches). It advances to gastric problems and rashes on appropriately the third day, resulting to throat lesions by the eight day. This is often accompanied by spontaneous bleeding and renal failure, and then to extreme lethargy and hallucinations and usually death within two weeks (Leach, 2008). Ebola Virus Disease (EVD) outbreak in parts of Guinea, Liberia, and Sierra Leone has severely affected these countries and it is having acute repercussions on the food security of these affected countries (Welthungerhilfe, 2014). World Bank Report (2014) states that beyond the toll of human lives and suffering, the Ebola epidemic currently affecting West Africa is already having measurable economic impact in terms of forgone outputs. The report further intimated that Ebola outbreak has caused higher fiscal deficits and prices; lower real household incomes and greater poverty. United Nations Development Programme (UNDP) in 2014 also stated that these economic impacts include costs of health care and foregone productivity of those farmers directly affected. In Sierra Leone, the Ebola outbreak

reached an alarming state at the beginning of the rice and cocoa harvesting season (July/August), which is the time when business people reach out to farmers to exchange food and their items with cocoa (Ragozini and Maietta, 2014). The government declared a Public Health Emergency on the 14th August 2014, involving heightened control measures including limitations on internal movement, health inspections at borders, mobilization of all health and security/defense personnel, increased restrictions on both suspected cases and contacts undergoing tracing, and ban on movement of corpses (Biosurveillance Event Report, 2014). Restrictions on movement negatively impacted not only household income but also availability of food within households. For example, the closure of markets, especially the weekly markets –"Ndoways", because of fear of infection curtailed food trade and this caused supply shortages (West Africa, 2014). According to Glennerster and Suri (2014), at least 40% of the farmers in Kailahun District either abandoned their farms or moved to new safer locations or died, leaving the farms unattended to. The report also indicated that about 90 percent of the plots in the inland valley swamps were not cultivated. The major producers of staple food and to some extent even the cash crops in Sierra Leone are the smallholder farmers, who make up 80-85% of the rural population and depend on

farming for their livelihood (Statistics Sierra Leone, 2004). It was their economic activities that were halted; and their numbers suffered the highest death from the Ebola disease. Yet, the necessary data that would show the impact of Ebola on farm activities, farm productivities, household food security and economic security in farming communities is scanty. Also, there is a general perception that what is reported by government about the epidemic in the national and international media is not the true reflection of situation on the ground. Thus, interventions by the government, NGOs, and International Parties would not be well targeted. The purpose of this study therefore, to investigate the effect of Ebola on farm productivity from the farmers and extension workers perceptive. It is hoped that results of this study would forecast what the food security situation would be like after the Ebola crisis. The government and NGOs and the international organizations may find such data useful for after Ebola reconstruction planning. The main objectives were to identify the demographic and socioeconomic status of the selected farmers; identify the different farming activities that were severely affected by the Ebola outbreak; determine the extent of the impact of Ebola outbreak on farm productivity' and to determine the extent to which reduced farm productivity affected household food security within the study area.

METHODOLOGY
Research Design
The study design used was descriptive field survey design. Fraenkel and Wallen (1993) describe descriptive analysis as that method that involves asking a large group of people questions about a particular issue. Information is obtained from a sample rather than the entire population at one point in time which may range from one day to a few weeks. The design is considered appropriate because it focuses on the observation and the perception of an existing situation, describes and interprets what is concerned with issue; conditions and practices and relationship, views, belief, attitudes, process and trends which are developing concerning the issue of Impact of Ebola outbreak on food security in Sierra Leone. Also, any research undertaking involves lots of cost implications hence this design was deliberately selected for the study because it allows for quick data collection at a comparatively cheap cost (Grinnel, 1993).

Study Area
The study was conducted in Bo and Moyamba District in the Southern region of Sierra Leone. These are two out of the fourteen districts in Sierra Leone. Bo is one hundred and fifty two miles (152 miles) from the capital city, Freetown. It is bounded to the North by Tonkolili District, North–Northeast by Kenema District, to the South by Pujehun District, to the Southwest by Bonthe District, and to the West and West-north by Moyamba District. Bo district comprises of fifteen (15) administrative sections - chiefdoms and a total population of 463,668 people with as much land area as 1,500 km^2 (SSL, 2004). Moyamba District is about seventy five miles (120 kilometers) away from the capital city, Freetown. And it is bounded to the North by Tonkolili District; to the south by Bo District; to the southwest by Bonthe District and to the West and

North-West by the Mabam River. The entire district comprises fourteen (14) chiefdoms with a population of approximately 261, 000 (SSL2004). Muslims and Christians mutually live across the districts tolerating one another's beliefs. The main occupation of the people of these districts is farming. Crops usually grown include rice, maize, yam, cassava, cocoyam, melon, and vegetables under mixed cropping practices. Livestock reared in these two districts include goats, pigs, chickens and sheep, with few growing cattle.

Sampling Procedure and Sample Size
A multistage sampling procedure was used in selecting respondents for the study. In the first stage, two districts-Bo and Moyamba, out of four districts in the southern region of Sierra Leone were purposively selected. These two neighboring districts were purposively selected because they are one of the most important Ebola affected districts and share similar culture in the southern region. The second stage of the sampling procedure consisted of purposive selection of five chiefdoms – Boama, Kakua, Kori, Lower Banta and Tikonko where Ebola outbreak has actually occurred. The third stage was characterized by the purposive random sampling of sixteen quarantined communities from these chiefdoms. The lists of these communities were provided by the Ebola Task Force Team and MFS Officers in each of the chiefdoms. The fourth stage comprised of selection of household which were quarantined for Ebola outbreak. Here the lists were provided by local authorities, Ebola Task Force Team, Ministry of Health, and MSF Workers in the communities. The fifth stage involved a purposive selection of 150 farmers from 16 communities. The number of farmers per community was determined by the size and population of the community as follows: Forgbo (5), Boama (5), Bye-Largo (5), Moyamba Junction (20), and Gbangbatoke (20) in Moyamba District; Kailia (5), Negbema(5) Tikonko Town (20), Bumpeh Town(20), Bawomahun (20), Yakagie (5), Ngomahun (5), Farma (5), Gbembeh (5), and Bateima (5) villages in Bo District. In the last stage, 10 Extension workers were randomly sampled from the Bo (5) and Moyamba (5) districts. This gave a total of 160 respondents.

Instrument and Data Collection
Data for this study were collected from September 20th to 15th November 2014.The use of primary and secondary data was employed for this study. For the effectiveness of the primary data collection, 5 welled trained enumerators (able to communicate in English, Krio and the local dialects of the respective selected 16 communities/ villages) were engaged in data collection. Secondary data were the information obtained from literature, published and unpublished research works, books, academic journals, project reports, official documents, consultations, and library materials among others. Primary data were collected through the use of a structured and validated questionnaire consisting of open and closed-ended questions, and focus group discussions to elicit information from the target respondents the instrument consisted of four separate sections according to the purpose and objectives of the study. The first section was designed to collect data on the demographic and socioeconomic characteristics of quarantined farmers and

extension workers. The second section was designed to solicit data concerning farming activities that were affected by the Ebola outbreak, the third sections gathered data on the extent of the Ebola breakout on farm productivity. And the forth section collected information on the farmers perception on the impact of bola breakout on household food security. The responses of section three were categorized using three Point Likert-type scales: very great extent = 1, great extent = 2, some extent = 3, while those for section four were categorized using four point Likert-type scales: highly agreed = 1, disagreed = 2, highly disagreed= 3, and don't know = 4. The mean scores were used for later analysis. The instrument for data collection was subjected to pre-testing at Kaiyamba Chiefdom, which was not included in the sample, while validity and reliability tests were carried out. Validity testes included face validity and content validity.

i. **Face validit**

To determine the extent to which the instrument measures what it was designed to measure, the questionnaire was assessed by a panel of experts. The panel included Extension Education officers, Health officers, and Community Development workers, agricultural economists, and relevant specialists in tropical diseases. Each of these experts of the panel was asked to examine the instruments for content, clarity, wording, length, format, and overall appearance.

ii. Content validity

This was to measure the representativeness of sampling adequacy of the contents of rating scale. The reliability test was employed on 16 respondents with two different method of test-retest that is, administration of questionnaires to the same respondents (in the pretest) on two occasions at two weeks interval. The collected scores were subjected to Pearson Product Moment Correlation Test statistics. The second method was the split-half

method that gave measures of the internal consistency of the instrument. The administered questionnaire had its items divided into two on odd and even number basis. The relationship between the two halves was calculated using Pearson Correlation Test statistics. The value of 0.78 was obtained which makes the instrument reliable. The results of these tests were followed by the modification of the data collection instrument where necessary.

Data Analysis

Data collected were analyzed using computer software called Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics was used for the analysis of the data that was generated. The descriptive statistics included frequency counts and percentages which were used to describe the distribution of socioeconomic characteristics of the respondents and to measure other variables of interest in the study.

RESULTS

Personal characteristics of farmers

The result of the demographic data is detailed in Table 1. It showed that most of the Ebola quarantine farmers are males (59.4%), and most of them (56.3%) were between 36 and 55 years. Farmers between the age ranges of 15 to 35 years constituted 28.1%, while those at 56 years and above were 15.6%. Furthermore, Table 1 revealed that 61.3% of the farmers are married, 25.0% single, 12.5% are widowed/widowers, while 1.2% are divorced. Most of the farmers (37.5%) had adult literacy education. The data further revealed that most of the farmers have many years of practical experience in farming. For example, 50.6% had 11 to 20 years of farming experience, but most of them (56.9%) have small size farms –less than 1ha.There were more Muslims (52.5%) than Christians (43.1%). The rest were traditionalist (4.4%).

TABLE 1: Socio-economic characteristics of Ebola quarantined farmers by frequencies and percentages

Gender	Age	Marital Status	Educational level		Years of farming experience	Farm Size(ha
Male 95 (59.4)	13-36 years 45 (28.1)	Single 40 (25.0) Married 98	No formal education 45(28.1) Adult literacy Education 60 (37.5)		Less 10 years 63(39.4) 11- 20 years 83(50.6)	Less 1 91 (56.9) 1–1.5 32(20.0)
Female 65 (40.6)	36–55years 90 (56.3)	(61.3) Divorced 2(1.2)	Primary Education 10(6.3) Secondary education 16(10.0)		31–40 Years 7(5.6) 41-50Years 2(2.5)	1.6 -2.0 16(10.0) 2.1 -2.5 9 (5.6)
	Above 56 years 25 (15.6)	Widower 20 (12.5)	Tec. Voc. Education 5(93.1) Tertiary Education 20(12.5) Quranic Education 4(2.5)		Above 51years 1(0.6)	2.6 -3.0 7 (4.4) 3.1 -3.5 4 (2.5) Above 3. 61(0.6)

Table two contains results of the aspects of farming activities that were severely affected by the Ebola outbreak. It shows that Ebola outbreak did not affect any of the pre-planting activities in study the area. The disease outbreak did not also affect most early post-planting activities, but greatly affected bird scaring (28.8%), harvesting (61.3%), while hunting (5.6%) and fencing (4.4%) were the least affected of the post-planting activities. The data further indicates that processing and marketing of harvested crops, (35.6%) each were equally affected by the disease outbreak, while transportation of these crops was affected by 28.8%. Table 3, contains results of factors that affect major limited farming activities in the study area. It showed that farmers not able to harvest their crops severely reduced farm productivity

as 93.8% of farmers did not harvest their crops. Loss of love ones and closure of weekly periodic markets (92.5% each), is second in causing severe drop in farm productivity. Farmers fear of harassments by police and soldiers (87.5%), closure of roads linking communities, trauma of quarantined village, and restricted movement of farmers, making the farmers afraid of attending hospitals (75.0% each) to a very great extent impacted farm productivity. Lack of treatment for the disease, and reduced available labour for work, (62.0% each) accordingly impacted farm productivity to a very great extent. Pest control on farms (56.3%) was the way in which farm productivity was very greatly affected by the Ebola outbreak in the study area.

TABLE 2: Different farming activities as severely affected by the Ebola outbreak

Farm Activities severely affected	Frequency	Percentage (%)
(a) Pre-planting Activities (n = 160)		
Brushing	0	-
Felling trees	0	-
Burning	0	-
Clearing debris	0	-
Ploughing	0	-
(b) Post-planting Activities (n =160)		
Weeding	0	-
Disease	0	-
Pest control		
Fencing	7	4.4
Hunting	9	5.6
Bird scaring	46	28.8
Harvesting	98	61.3
(c) Post Harvest Activities (n =160)		
Transporting harvested crop	46	28.8
Processing harvested crops	57	35.6
Marketing of harvested crops	57	35.6

TABLE 3: The extent of the impact of Ebola outbreak on farm productivity

Impacts of Ebola Outbreak	Extent of Impact on Farm Productivity		
	Very Great Extent	Great Extent	Some Extent
Farmers who did not harvest their farms	150(93.8%)	10(6.3%)	-
Families lost their loved ones	148(92.5%)	12(7.5 %)	12(7.5%)
Farmers who could not sell their products	148(92.5%)	12(7.5%)	-
Some police and soldiers harassed farmers	140(87.5 %)	20(12.5%)	-
Most roads linking communities were closed down	120(75.0%)	40(25.0%)	-
Farmers whose movement were restricted	120(75.0%)	20(12.5%)	10(6.3%)
Available labour for farm work is reduced	100(62.5%)	35(21.9%)	25 (15.6%)
Pest population has Increased	90(56.3 %)	60 (37.5)	-

The impact of Ebola outbreak on household food security

Majority of the Farmers (99.4%), (98.8%), (98.1%), (97.5%), (96.3%), (93.8%) and (91.3%) claimed that the Ebola outbreak has decreased food storage and protection, processing and preservation, food financing, affordability, availability and accessibility respectively in their community.

TABLE 4: The impact of Ebola outbreak on household food security

Food Security Indicators	Highly agreed	Disagreed	Highly disagreed	Don't Know
Food storage and protection decreased	159(99.4)	0(0.0)	0(-)	1(0.6)
Food processing and preservation	158(98.8)	0(0.0)	0(-)	2(1.3)
Food financing severely decreased	157(98.1)	0(0.0)	0(-)	3(1.9)
Food affordability greatly decreased	156(97.5)	0(0.0)	0(-)	4(2.5)
Marketing of food severely decreased	154(96.3)	0(0.0)	0(-)	6(3.8)
Availability of food severely decreased	150(93.8)	2(1.3)	0(-)	8(5.0)
Accessibility to food greatly decreased	147(91.9)	5(3.1)	0(-)	8(5.0)

DISCUSSION

According to the research findings, farmers in the Ebola quarantined communities share common socioeconomic characteristic; the Ebola outbreak severely obstructed few post-planted and more post- harvest activities; to the extent that it negatively impacted farm productivity; and caused decrease in food security.

1. Socio-economic characteristics of Ebola quarantine farmers

The study revealed that there are more males than females farmers. This subscribes to the findings of Ravi and Gauldin (2014), who found out that gender disparity exist across care providers and Ebola patients. The difference between male and female- farmers shown in Table 1 could have arisen from the random sampling procedure adopted by this study; which gave every respondent equal chance irrespective of sex.

2. The extent of impact of Ebola outbreak on farm productivity
The study reveals that the Ebola breakout severely affected pest control and harvesting activities in quarantined communities. All three means of pest control, hunting, fencing and bird scaring were not performed in farms during the Ebola outbreak. This accelerated pest buildup, especially rodents and birds which get easy access to farms without fences, if they are not hunted, or scared away. This study therefore endorses Boones et al.'s (2004) and Boone and Coughenour's (2001) findings that fencing can be useful in controlling access either by humans or animals, protecting gardens and landscaping. Rodents destroy the crops in its vegetative growing age, while birds do so during flowering stage. It is therefore very evident from this study that fencing can improve agricultural production of farms in upland farming .When farms are not harvested the result is loss of food in the home. Both lack of pest control and non-harvesting of farms create food insecurity, hunger and poverty and low standard of life. The implication of this is that there will be pressure on government and donor partners for post Ebola rehabilitations. The findings further reveal that the Ebola outbreak to a large extent negatively impacted farm productivity. In the first instance, it showed that most farmers did not harvest their farms. This finding is in line with the findings of FAO (2014) that most of the farms in Kailahun were abandoned and not harvested due to the Ebola outbreak in May that year. The implication of this is that there would be inadequate food for the people, making them susceptible to diseases. Poor health conditions affect agricultural production. Illness impairs the farmers' ability to innovate, experiment, and implement changes, and to acquire technical information available through extension activities. Households with sick members are less able to adopt labour-intensive techniques. According to the FAO Report (2014), which stated that in an effort to control Ebola the government of Sierra Leone imposed restrictions on the movement of people, and closed down markets and border crossings in the country. The closure of markets and the imposition of internal travel restrictions disrupted the marketing of agricultural produce and curtailed food trade. While the farmers find it difficult to take their produce to markets, buying agents who usually provide support to farmers and function as contact points between traders and their products refused to enter certain operational areas for fear of Ebola.

3: The impact of Ebola outbreak on household food security
According to the findings, the Ebola outbreak caused decreased food availability, accessibility, affordability, due to low or virtually lack of processing and preservation, marketing, financing, and storage and food protection undertakings. The findings revealed decrease in food storage and protection within the quarantine communities. This confirms the findings of Fewsnet, 2014) which stated that when farm yield are low, food storage and perseveration is impossible, as food itself is not available. This is due to the fact that most of the farmers abandoned their farms and crops at the mercy of pests for destruction. Where farmers abandon farms or are prevented from attending to their farms as a result of quarantine or restriction of their movement, there would be nothing for storage or preservation. The implication of this is food insecurity in the community leading to increased malnutrition and poverty.

CONCLUSION
The revealed Ebola outbreak did not only destroy human lives of medical personnel in the Ebola outbreak in Sierra Leone, but the disease affected all facets of the economy, especially agriculture being the primary industry of majority of Sierra Leoneans. The disease has also led to food insecurity, malnutrition and poverty. This may have great impact on future development plans of the country. These findings are important for development planners and Non-government organization for action plans for post Ebola rehabilitations. An effective strategy to prevent the spread of the disease in all rural areas of the country will help in solving the problem of Ebola. Such strategy should include understanding the socio-cultural characteristics of the farmers. This would help the farmers trust the government and its institutions and also enable them to participate in the prevention activities of the disease. Government and international donors should consider the deteriorating trend of farmer's health and food security to give them priority in time of after Ebola rehabilitation. Also, during the first year of the after Ebola rehabilitation, government should import more food, especially rice into the rural communities till they settle down as temporary measure and plan and implement a sustainable food production Programme. The markets closed should not only be reopened but farmers and traders should be allowed to freely move within the communities without harassment from police and soldiers. If this is not done, the level of availability of food and income of farmers in the communities will continue to fall beyond a point un-bearable. This high food insecurity will make farmers susceptible to other neglected diseases like diarrhea, malaria, etc. which may lead to unrest. This is what Maiderman showed as a concern that food insecurity will lead to unrest and threaten stability in the West African Region. This study specifically looked farm productivity in terms of crop production. There is a need, however, to further investigate the impact of Ebola on livestock production and other socioeconomic activities in the quarantine communities.

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