

ANALYSIS OF EBOLA OUTBREAK IN SIERRA LEONE AND ITS IMPACT ON HEALTH FACILITIES IN MOYAMBA DISTRICT IN SOUTHERN PROVINCE

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ABSTRACT- In Sierra Leone, the outbreak of Ebola virus began slowly and silently, gradually building up a burst of cases in late May in 2014 and early June 2014. Cases then increased exponentially in the last quarter of the year, with November seeing the most dramatic jump (WHO, Jan, 2015). Considerable groundwork also reflected lessons learned earlier: listen to the community, well-known religious and traditional leaders were consulted to get a sense of community concerns and expectations. Well-known entertainment personalities were recruited to communicate messages emphasizing how early detection and treatment greatly improved the prospects of survival. The aim of this research is to analyse Ebola outbreak in Sierra Leone and its impact on Moyamba district in Southern province. The study was both a retrospective (quantitative), a rapid literature review was undertaken using internet searching to identify published and unpublished studies examining the evidence base on Ebola outbreak in Sierra Leone. 1147 (One thousand one hundred and forty seven) household members below age five years were affected by Ebola virus in Sierra Leone. 606 of the household members were male and 514 were females respectively. (1 November 2014–15 April 2015), burial teams recorded 1874 deaths in Moyamba (for which age was recorded in 1861 cases) of which 496 (27%) were under the age of 1 year, 786 (42%) were under the age of 5 years and 1282 (69%) were aged under 50 years of age. Ebola Virus Disease (EVD) preparedness and response plans for Moyamba should include social mobilisation activities targeting Ebola/knowledge attitudes practice during funeral attendance, to avoid contact with suspected cases and to increase awareness on EVD symptoms.

Keywords: Ebola Virus, Confirmed Cases, Suspected Cases, Death Cases

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I owe depth of gratitude to God almighty through Jesus for given me knowledge, wisdom and understanding through out my academic pursuit. My sincere thanks go to Professor Bob Kandeh and Professor Andrew Baimba for their lead and quality supervisions for the entire work. I am particularly grateful to my wife for her architectural role in my academic activities. Thanks and appreciation to my mother and late father, they nurtured me to the level I am today

INTRODUCTION

The Ebola Virus Disease (EVD) epidemic in Sierra Leone was the longest, largest, deadliest and the most complex and challenging

Ebola outbreak in history. It was unprecedented in terms of its duration, number of infections, fatality, geographical spread and social and humanitarian damage, accompanied by severe economic consequences. It remarkably reduced the impressive gains made in economic growth by Sierra Leone over the years.

The first person reported infected in the spread to Sierra Leone was a tribal healer. She had treated one or more infected people and died on 26 May. According to tribal tradition, her body was washed for burial and this appears to have led to infections in women from neighbouring towns. On 11 June, Sierra Leone shut its borders for trade with Guinea and Liberia and closed some schools in an attempt to slow the spread of the virus. The Ebola Virus Disease outbreak occurred with substantial differences between districts with someone even not affected. To monitor a community-based surveillance system was set up collecting data into the Viral Haemorrhagic Fever(VHF) data.

Ebola is characterised by initial flu-like symptoms including sudden onset of fever, fatigue, muscle pain, headache and sore throat. This then rapidly progresses to vomiting, rash, symptoms of impaired kidney and liver function, and in some cases, both external and internal bleeding. Most infected persons die within 10 days after their initial infection (80%-90% mortality). Since the discovery of the viruses in 1976 when outbreaks occurred in Sudan and the Democratic Republic of Congo (then called Zaire), Ebola virus disease has been confined to areas in Central Africa, where it is endemic. With the current outbreak, it was initially thought that a new species endemic to Guinea might be the cause, rather than being imported from central to West Africa. However, further studies have shown that the current outbreak is likely caused by an Ebola virus lineage that has spread from Central Africa into West Africa, with the first viral transfer to humans in Guinea.

Of June 7, 2015 Sierra Leone had reported more than 12,900 cases of Ebola Virus Diseases(EVD), and over 3,900 deaths since the outbreak began. Use of maternal health care services increased-the share of households reporting birth in hospital or clinics increased from 64% in January and February 2015 to 89% in may. (World Bank, 2015, Understanding Poverty Poverty).

STATEMENT OF THE PROBLEM

The initial response to the outbreak was characterized by confusion, chaos and denial. While a country can be overwhelmed by a serious outbreak, a situation in which WHO fails to mobilize the assistance needed to help a national government take control of an epidemic is unusual. The rest of the international community was, meanwhile, slow to rally. The window of opportunity to contain the outbreak through conventional control approaches closed, and the outbreak became a humanitarian crisis. The 2015 Peripheral Health Centre report revealed that a national total of 13,575 persons contracted the virus. Port Loko reported the highest number of infected individual cases at 3,594 (26.5 per cent), followed by Kailahun with 1,727 (12.8 per cent). With regard to the rural/urban divide, there were 7,263 (53.5 per cent) reported rural cases as against 6,312 (46.5 per cent) urban cases. The findings revealed that the largest number of infected persons were within the ages of 25–29 followed by the ages of 15–19. This shows that youths, who are more active, were more infected by the virus and there were more deaths among youths within the age bracket of 25–29 (Sierra Leone 2015 Population and Housing Census Thematic Report on socio-economic impact of the Ebola Virus Disease, Statistics Sierra Leone, 2017).

SIGNIFICANCE OF THE STUDY

The findings will inform the government on how to improve on our future mobilization campaigns and sensitization programs. The rationale or significance of this research is to provide data that can greatly enhance a better understanding of Ebola outbreak in Sierra Leone and its effect on health facilities in Moyamba district. The findings of the study therefore should be of use to the ministry of

Health and Sanitation, Central Board of Health, District Health Management Teams and other stakeholders such as Non Governmental Organizations (NGOs) in designing and implementing child health intervention and projects and policies.

AIM: To analyse outbreak of Ebola Virus Disease in Sierra Leone and its Impact on Moyamba District

OBJECTIVE:

- Identify household members infected with EVD in Sierra Leone
- Analysed cases of EVD in Sierra Leone
- Assess the impact of EVD outbreak in Moyamba district
- Use hypothesis to test reported cases of EVD

STUDY AREA

This research was conducted in Sierra Leone, a country founded on the West Coast of Africa. Sierra Leone is bounded on the North-East by the Republic of Guinea, the South and South-East by Liberia and on the West by the Atlantic Ocean. The area of Sierra Leone is About 27,000 square miles with a population. A careful observation of the principle of research was followed to ensure that the data collected reveal the realistic situation of the mathematical models to study the outbreak of Ebola in Sierra Leone and its impact on health facilities in Moyamba district.

RESEARCH POPULATION

The targeted population for the study was fixed and the population was mixed homogeneously and every district of the country that experience Ebola outbreak was targeted

SAMPLE PROCEDURE AND DATA COLLECTION

The study was both a retrospective (quantitative), a rapid literature review was undertaken using internet searching to identify published and unpublished studies examining the evidence base on Ebola outbreak in Sierra Leone. The data source is from the 2015 Population and Housing Census that was conducted nationwide from 5 to 18 December 2015 on Ebola

DATA ANALYSIS

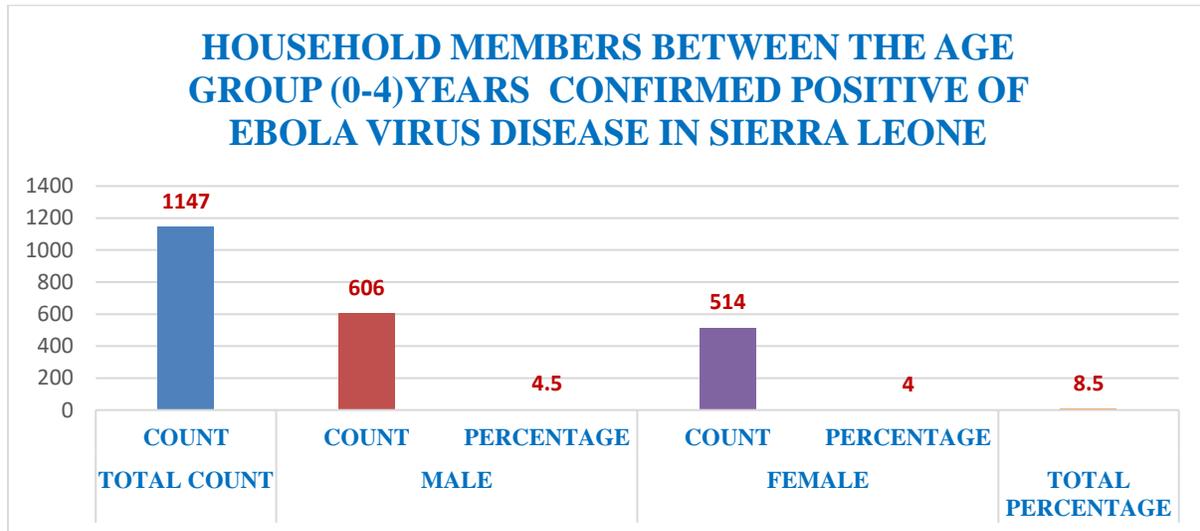
In the analysis of data collected, statistical tool such as Stat Graphic 18 and Excel were the key instruments used for the study.

DISCUSSION OF FINDINGS

ANALYSIS OF EBOLA OUTBREAK IN SIERRA LEONE AND ITS IMPACT ON MOYAMBA DISTRICT

Since the out-break of Ebola virus disease in 2014-2015, it has diverse effect on Sierra Leone as a nation. This aspect of the research gives analysis of the outbreak of Ebola in Sierra Leone and its Impact on Moyamba district

Fig1: Household Members the Age Group (0-4) Years Confirmed Positive of Ebola Virus disease in Sierra Leone

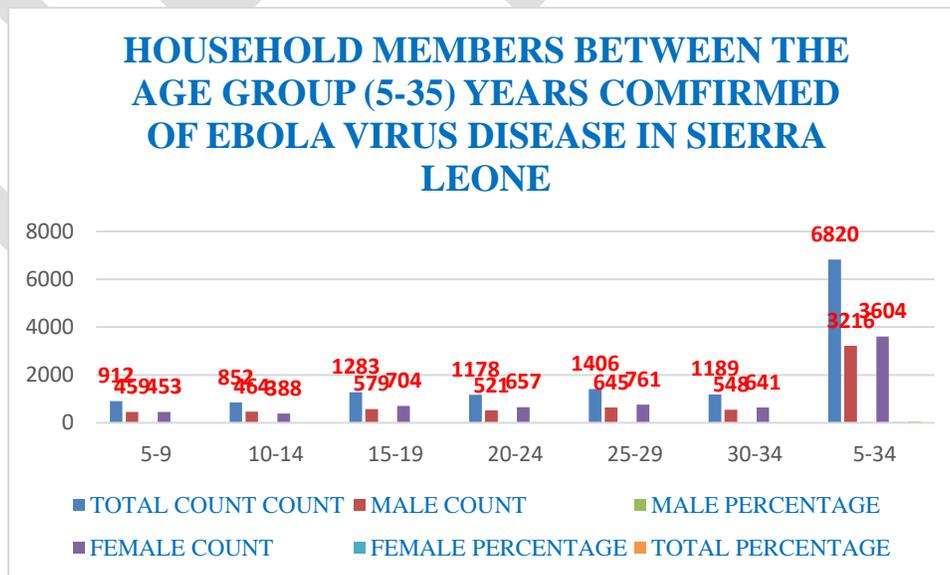


DATA SOURCE: STATISTICS SIERRA LEONE

HOUSEHOLD MEMBERS THE AGE GROUP (0-4) YEARS CONFIRMED POSITIVE OF EBOLA VIRUS DISEASE IN SIERRA LEONE

1147(One thousand one hundred and forty-seven) household members below age five years were affected by Ebola virus in Sierra Leone. 606 of the house members were male and 514 were females respectively and this represents 4.5% males and 4% of female household members below the age of five that were affected respectively during the outbreak of Ebola in Sierra Leone(May,2014-Aug.2015). 8.5% of the total house members in Sierra Leone with age below five years were affected by Ebola virus disease.

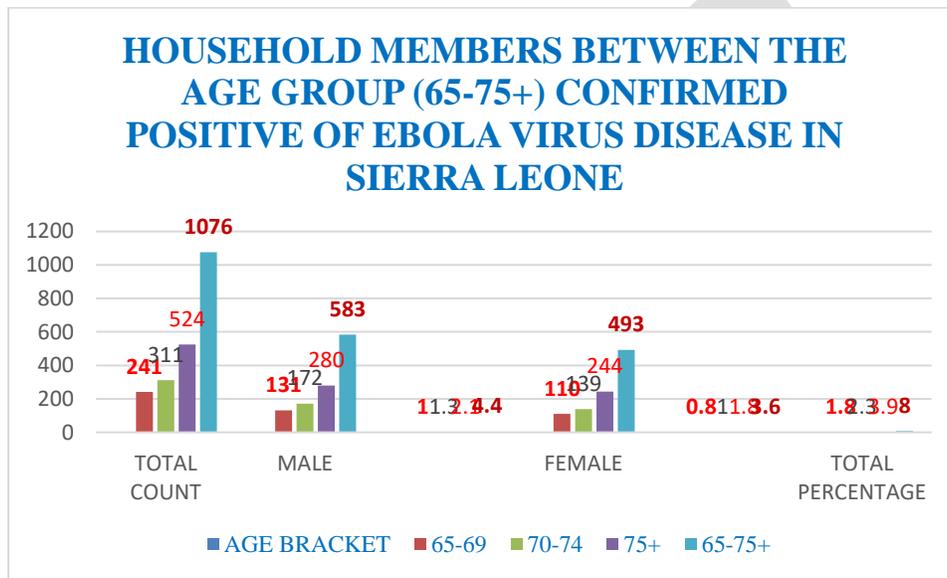
Fig 2: Household Members between the Ages Group (5-35) Years Confirmed Positive of Ebola Virus Disease in Sierra Leone



HOUSEHOLD MEMBERS BETWEEN THE AGES GROUP (5-35) YEARS CONFIRMED POSITIVE OF EBOLA VIRUS DISEASE IN SIERRA LEONE

6820(six thousand eight hundred twenty) household members of age between (5-35) years were confirmed positive of Ebola virus disease in Sierra Leone, this represents 50.2% of total household in Sierra Leone. Of this age bracket, 23.7% of them were male and 26.5% of them are females respectively. This age bracket has the highest age category affected by Ebola virus disease in Sierra Leone.

Fig3: Household Members between the Age Group (65-75+) Years Positive of Ebola Virus Disease in Sierra Leone

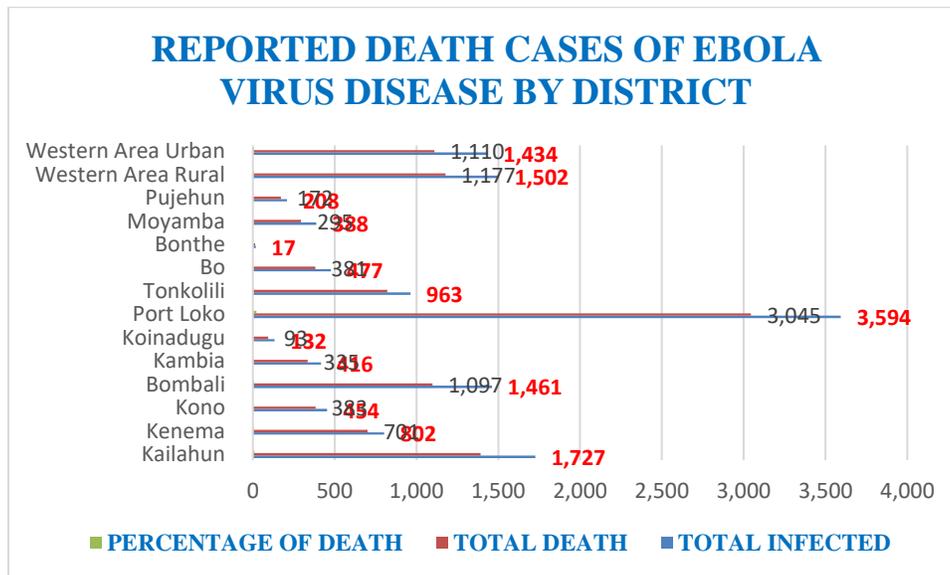


DATA SOURCE: STATISTICS SIERRA LEONE

HOUSEHOLD MEMBERS BETWEEN THE AGE GROUP (65-75+) YEARS POSITIVE OF EBOLA VIRUS DISEASE IN SIERRA LEONE

1076(One thousand and seventy six) household members between the age bracket (65-75+) years were confirmed positive of Ebola virus disease from 2014- 2014, of which 483 were male and 493 females respectively. This represents 4.4% of male and for female 3.6%, and 8% of the total household members were confirmed of Ebola virus disease in Sierra Leone

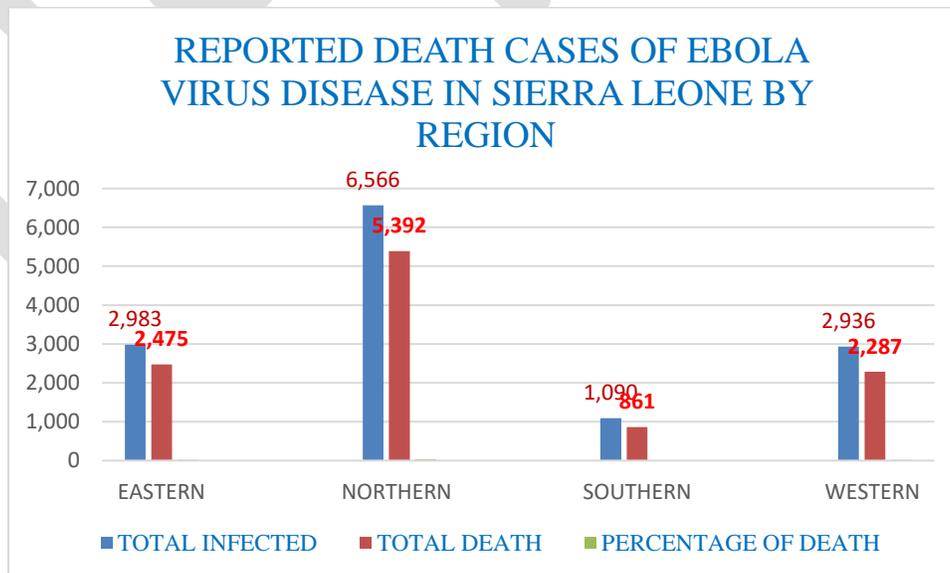
Fig 4: Reported Death Cases of Ebola Virus Disease by District in Sierra Leone



REPORTED DEATH CASES OF EBOLA VIRUS DISEASE BY DISTRICT IN SIERRA LEONE

Moyamba district had 477(four hundred and forty four) infected cases and 381(three hundred and eighty one) death cases. Port Loko district had the highest number of infected cases of 3,594 and the highest number of death cases of 3,045, this represents 22.4% of the death cases of Ebola virus disease in Sierra Leone. Kailahun district has the second highest number of infected cases in Sierra Leone with 1,727 cases and 1,391 reported death cases, this represents 10.2% of the number the number of reported death cases in Sierra Leone. Bothe district has the least number of infected cases of 17 with 13 deaths, this represents 0.1% of the number deaths in Sierra Leone followed by koinadugu with 132 infected cases and 93 deaths and this represents 0.7% of the number of deaths in Sierra Leone.

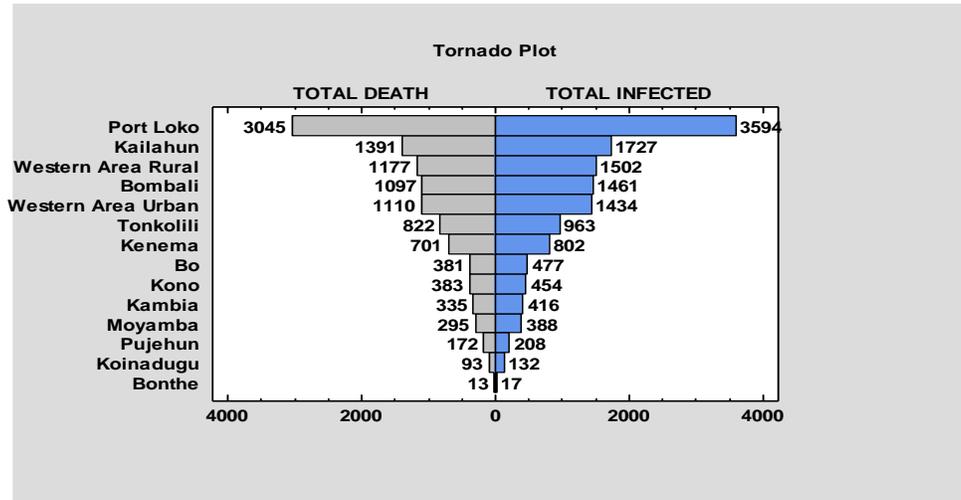
Fig5: Reported Death and Infected Cases by Region



REPORTED DEATH AND INFECTED CASES BY REGION

Northern region had the highest cases of death and infection, followed by Eastern region then Western area and finally Southern region, the region Moyamba district belongs. Total number of deaths are almost proportional to the total number of infections

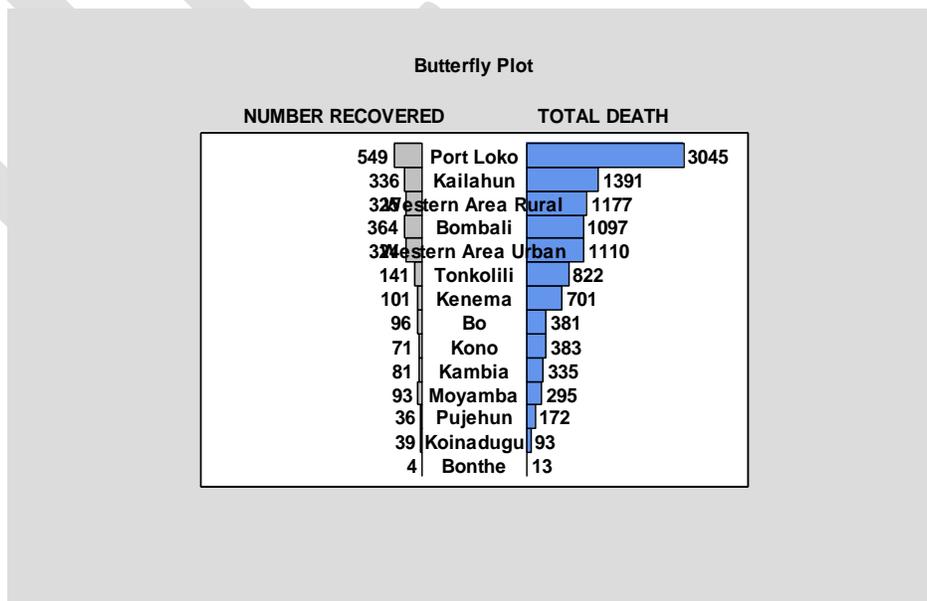
Fig6: Tornado Plot of Total infected and Death



TORNADO PLOT OF TOTAL INFECTED AND DEATH

This tornado plot highlights differences between total death and total infected by displaying bars with length proportional to the data values for each of the 14 levels of district. Moyamba district had 295(two hundred and ninety five) total death and 388 (three hundred and eighty eight) infected cases. Portloko had the highest number of total death and total infected followed by Kailahun district. Bonthe district had the least with 13(thirteen) death and 17(seventeen) infected.

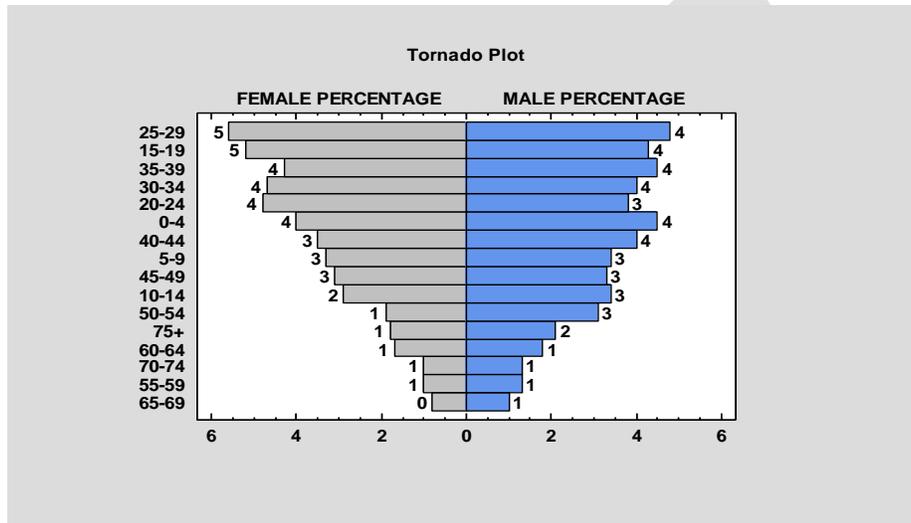
Fig7: Butterfly Plot of Total Death and total Recovery



BUTTERFLY PLOT OF TOTAL INFECTED AND TOTAL RECOVERY

This butterfly plot above highlights differences between number recovered and total death by displaying bars with length proportional to the data values for each of the 14 levels of district. Moyamba district had 295(two hundred and ninety five) death cases and 93(ninety-three) recovery cases. Portloko district had the highest number of death with highest recovery followed also by kailahun district. Bonthe district had the least total death with the least recovery of 4(four)

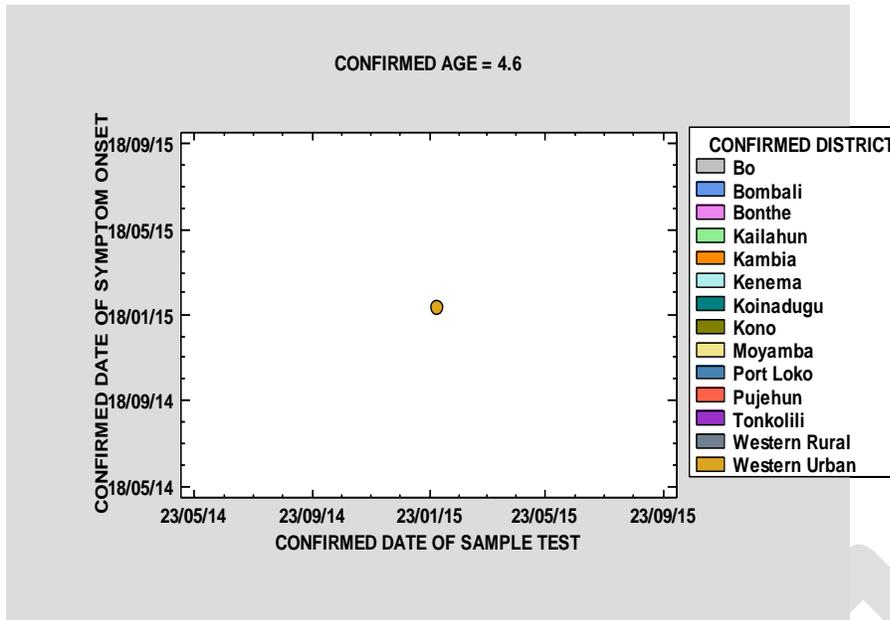
Fig8: Tornado plot of Female and Male Percentages Infected with Ebola virus Disease



TORNADO PLOT OF FEMALE AND MALE PERCENTAGES INFECTED WITH EBOLA VIRUS DISEASE

This tornado plot highlights differences between female percentage and male percentage by displaying bars with length proportional to the data values for each of the 16 levels of age group. (25-29) year’s bracket has the highest percentage of 5.6% for female and 4.8% for male respectively. (0-4) year’s bracket had 4% of the female infected with Ebola virus disease and 4.5% male. More males were infected at under five age than females.65-69 age bracket had 0.8 % females infected and 1% males infected.

Fig9 Confirmed Age Less Than five Years

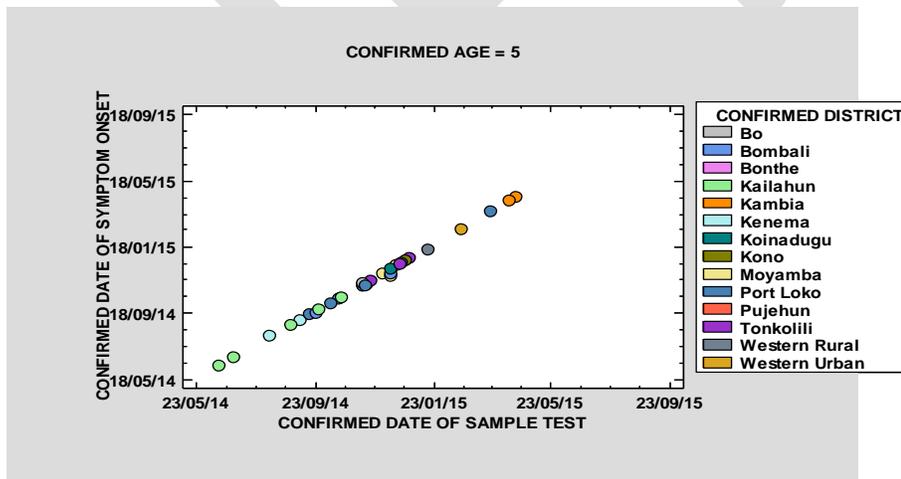


MINISTRY OF HEALTH AND SANITATION SIERRA LEONE

CONFIRMED AGE LESS THAN FIVE YEARS

During the outbreak of Ebola virus disease in Sierra Leone, 2014, western urban experienced the highest confirmed date of sample test and confirmed date of symptom onset at age below five years than any other district in Sierra Leone as indicated by the figure above

Fig10: Confirmed at Age of Five



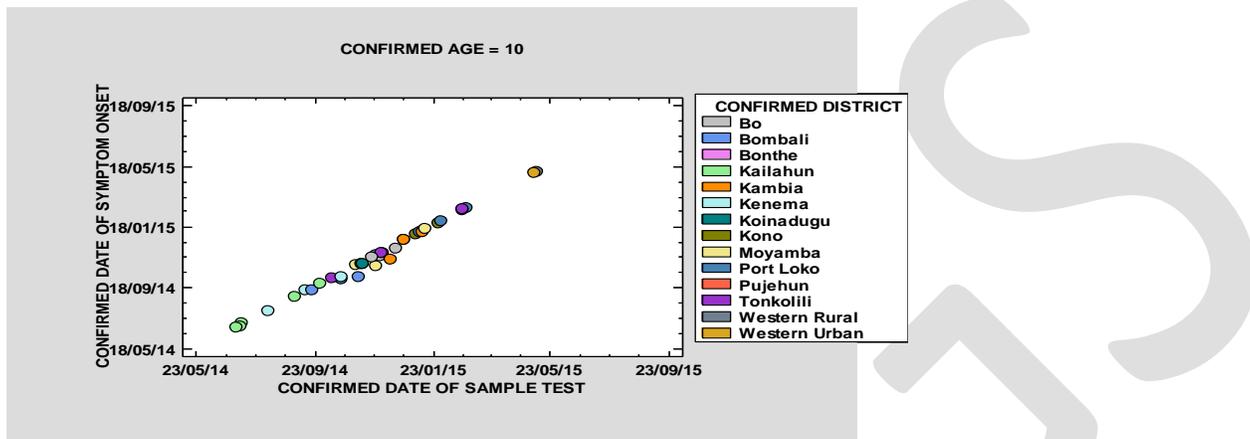
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CONFIRMED AT AGE OF FIVE

Confirmed date of sample test and confirmed date of symptom onset for children at the age of five appeared in all the district in Sierra Leone during the outbreak of Ebola Virus

Disease in 2014 but the highest frequency occurred in Kailahun district

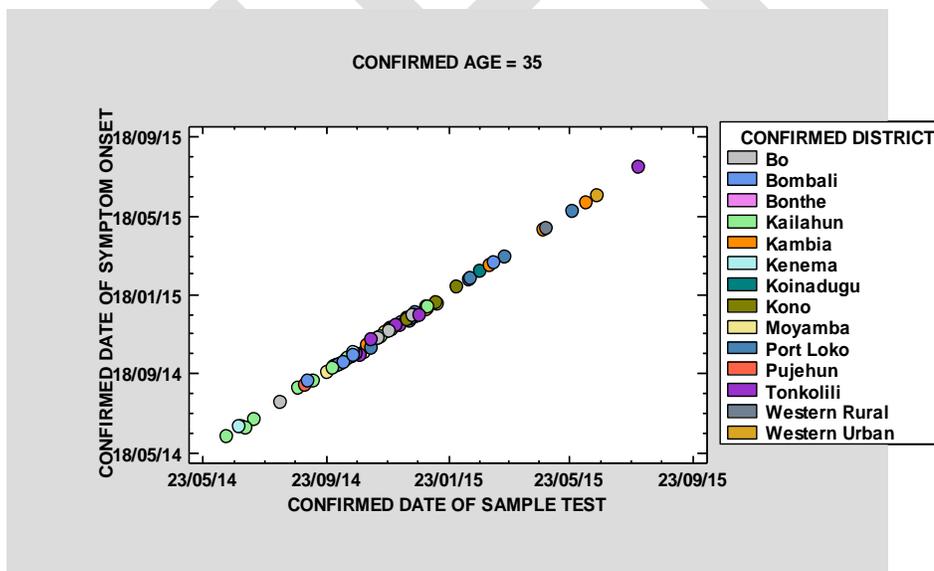
Fig 11: Confirmed at Age of Ten



CONFIRMED AT AGE OF TEN

Confirmed date of sample test and confirmed date of symptom onset for children at the age of ten appeared in all of the district in Sierra Leone during the outbreak of Ebola Virus Disease in 2014 and all district almost have the same frequency occurrence.

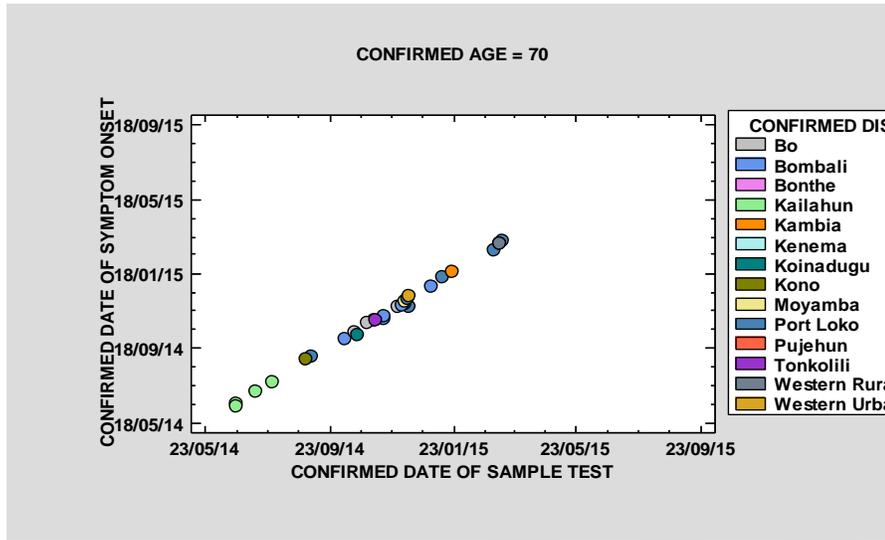
Fig12: Confirmed at Age of Thirty-Five



CONFIRMED AT AGE OF THIRTY-FIVE

Confirmed date of sample test and confirmed date of symptom onset for age thirty- five appeared in all of the district in Sierra Leone during the outbreak of Ebola Virus Disease in 2014 and all district almost have the same frequency occurrence.

Fig 13: Confirmed at Age of Seventy



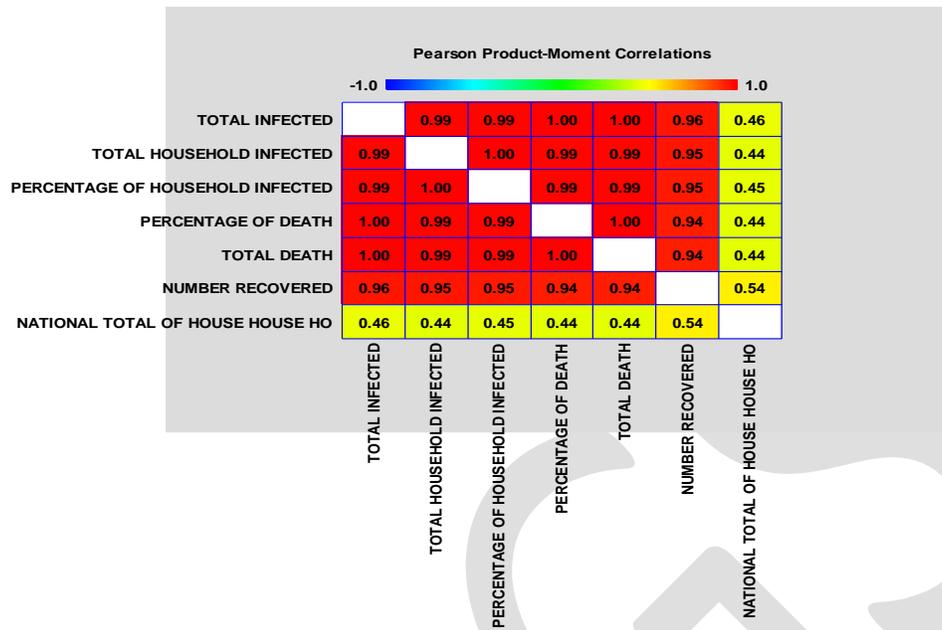
CONFIRMED AT AGE OF SEVENTY

Confirmed date of sample test and confirmed date of symptom onset for age thirty- five appeared in all all of the district in Sierra Leone during the outbreak of Ebola Virus Disease in 2014 but Kailahun and Bo experienced confirmed cases with symptom onset at age 70 than all other districts.

PEARSON PRODUCT MOMENT CORRELATION

This table shows Pearson product moment correlations between each pair of variables. These correlation coefficients range between - 1 and +1 and measure the strength of the linear relationship between the variables. Also shown in parentheses is the number of pairs of data values used to compute each coefficient.

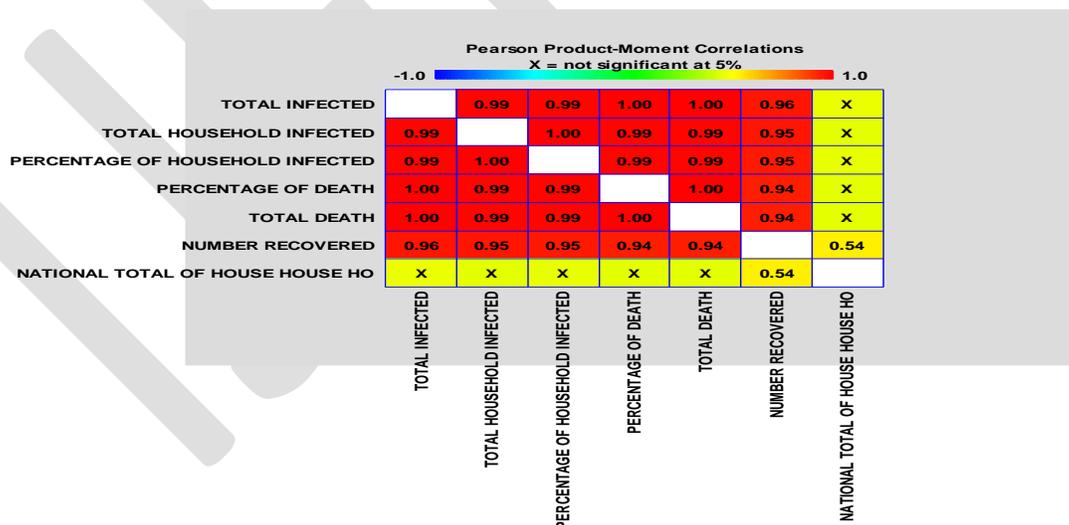
Fig14: Pearson Product Moment Correlation



PEARSON PRODUCT MOMENT CORRELATIONS

The red portions of the above figure show a strong positive correlation between the variables, while the yellow portions show weak correlations. There is a strong positive correlation between total infected and number recovered, death, percentage death, percentage infected and total household infected but weak correlation between the total infected and national total household.

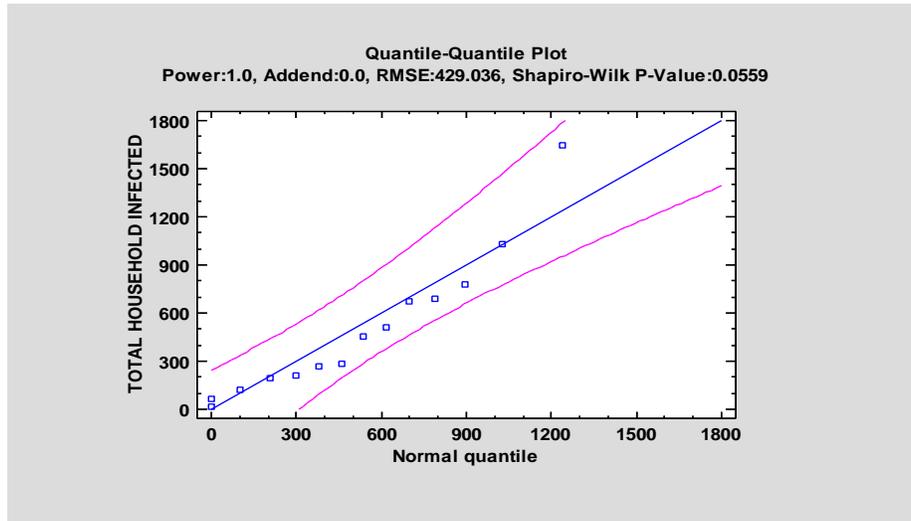
Fig15: Test of Significant



TEST OF SIGNIFICANT

The figure above shows a P-value, which tests the statistical significance of the estimated correlations. P-values below 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. Column marked X are statistically not significant.

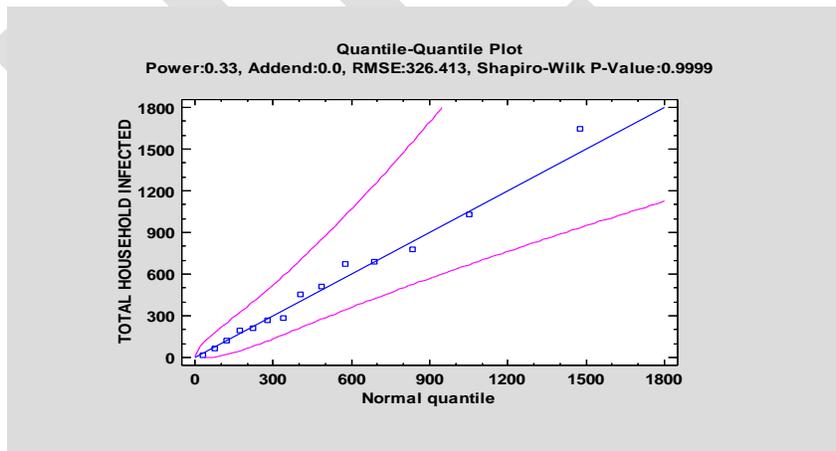
Fig16: Quantile – Quantile Plot



QUANTILE – QUANTILE PLOT

The plot above shows the total household infected and proves if the data is normal. With power at 1.0, the Shapiro-Wilk p-value = 0.0559, proves that the data is not normal as the points failed to follow the diagonal straight line.

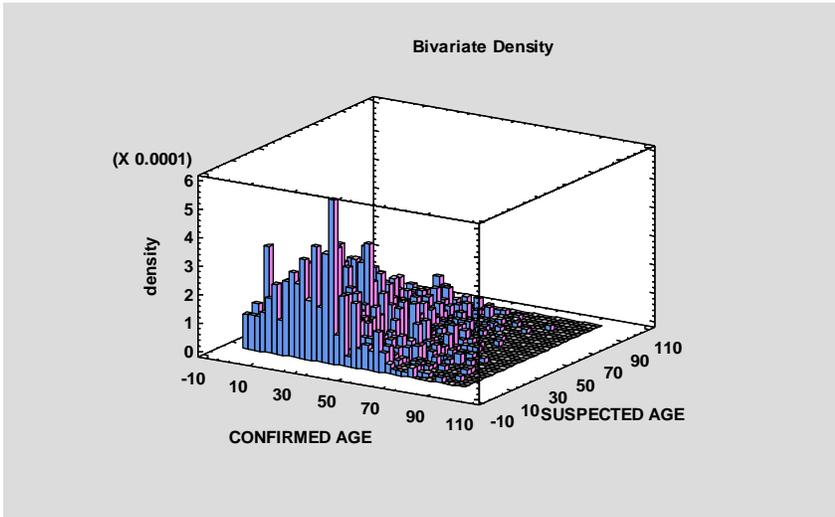
Fig 17: Quantile – Quantile Plot with Increase in Power Transformation



QUANTILE – QUANTILE PLOT WITH INCREASE IN POWER TRANSFORMATION

When there is increase in power transformation to 0.33, the point will tend to move close to the line, only few refused to come closer to the line and Shapiro-Wilk p-value increased to 0.9999, which shows that the data is now normal.

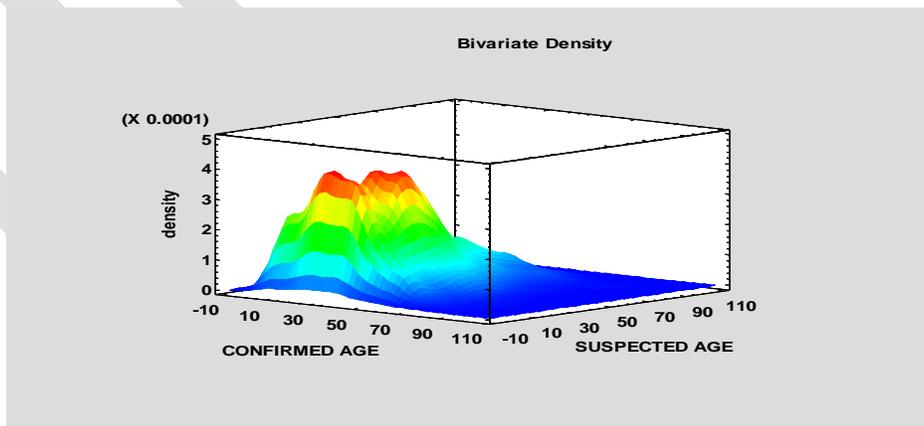
Fig 18: Bivariate Density Analysis between Confirmed Age Cases and Suspected Cases



BIVARIATE DENSITY ANALYSIS BETWEEN CONFIRMED AGE CASES AND SUSPECTED CASES

There is a negative correlation between the confirmed age group category and suspected age category during the outbreak of Ebola Virus Disease in Sierra Leone as illustrated in the above figure. As the age bracket between (30-50) years increase for confirmed cases we have less suspected cases between the age bracket (50-70) years.

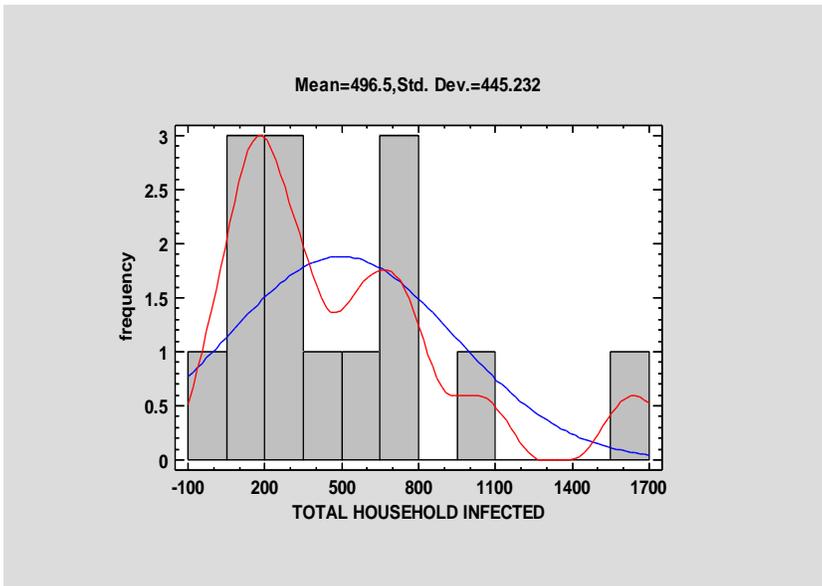
Fig19: Non-Parametric Density Function between Confirmed Age Category and Suspected Age Category



NON-PARAMETRIC DENSITY FUNCTION BETWEEN CONFIRMED AGE CATEGORY AND SUSPECTED AGE CATEGORY

The above graph clearly clarifies that the nonparametric density is bimodal and skewed towards the confirmed age cases on the left instead of suspected age cases on the right.

Fig20: Interactive Histogram



INTERACTIVE HISTOGRAM

With the mean of 496.5 standard deviation 445.23 and normal distribution curve (blue), the additive density estimate curve with 28% can give clear display of the number of household infected

SCHEMATIC DIAGRAM (NEURAL NETWORK BAYESIAN CLASSIFIER)

District members were classified perfectly and 100% correct. This procedure uses a Probabilistic Neural Network (PNN) to classify cases into different districts, based on 7 input variables of the 14 cases in the training set, 100.0% were correctly classified by the network.

Classification factor: District

Input factors:

National total household

Total household infected

Percentage household infected

Total infected

Total death

Percentage of death

Number recovered

Prior probabilities: non-informative

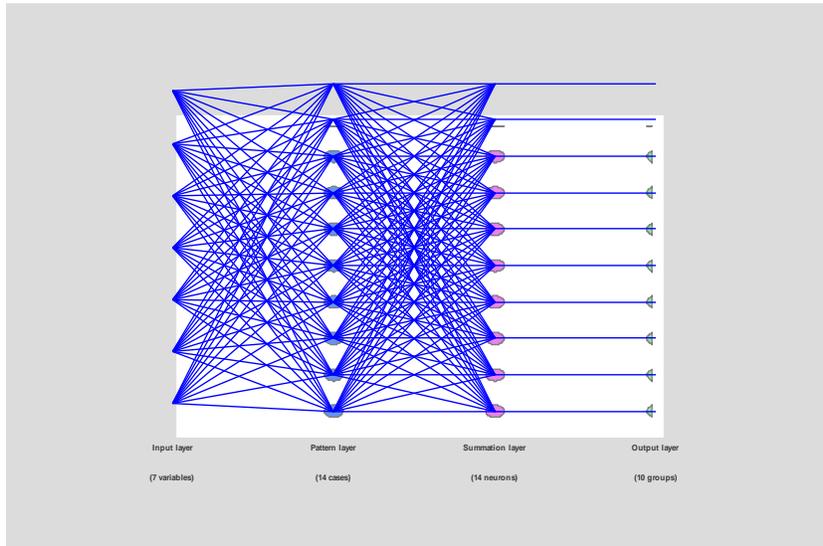
Error costs: equal for all classes

Number of cases in training set: 14

Number of cases in validation set: 0

Spacing parameter used: 0.0 (optimized by jack-knifing during training)

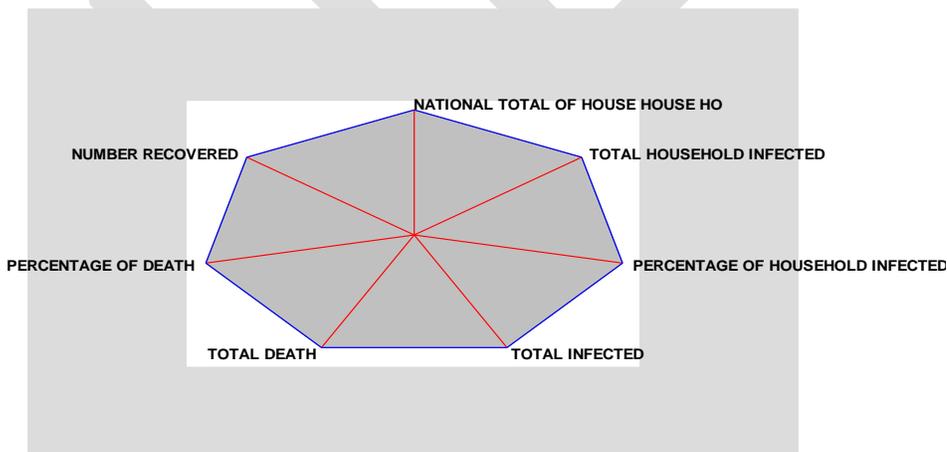
Fig 21: Classification Plot



CLASSIFICATION PLOT

It figures out district with two classification, total household infected and national total household with all other variables held constant with the mean values shaded portions would be allocated as colours in the keys

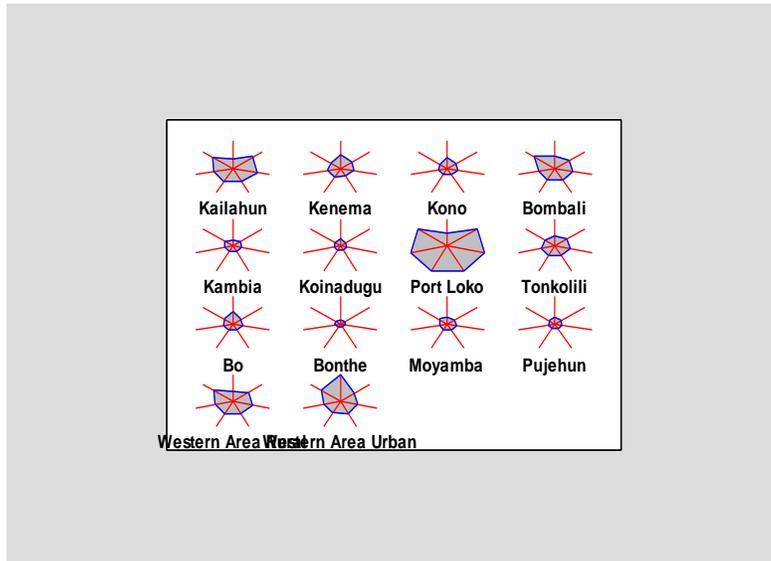
Fig23: Star Glyphs



STAR GLYPHS

Is a graphical representation of multivariate data, it looks at variables one at a time and gives the numeric values on district by district basis per 7 variables, National total household will have the maximum value on one particular distance.

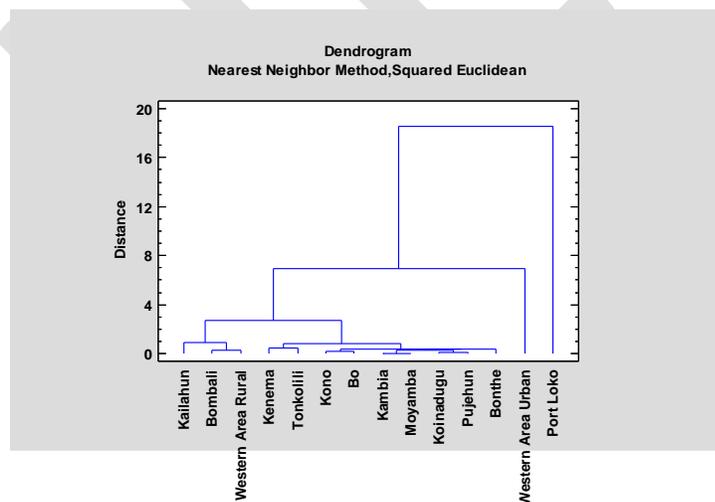
FIG24: Star Glyphs and Sunray Plots



STAR GLYPHS AND SUNRAY PLOTS

The graph above tries to identify districts that are identical to each other by looking at the star’s glyphs and sunray plots that are similar. By considering the seven variables in the star glyphs, Moyamba, Kambia, Bonthe and Pujehun districts have similar characters. Portloko, Kailahun and western area urban are similar characteristic districts.

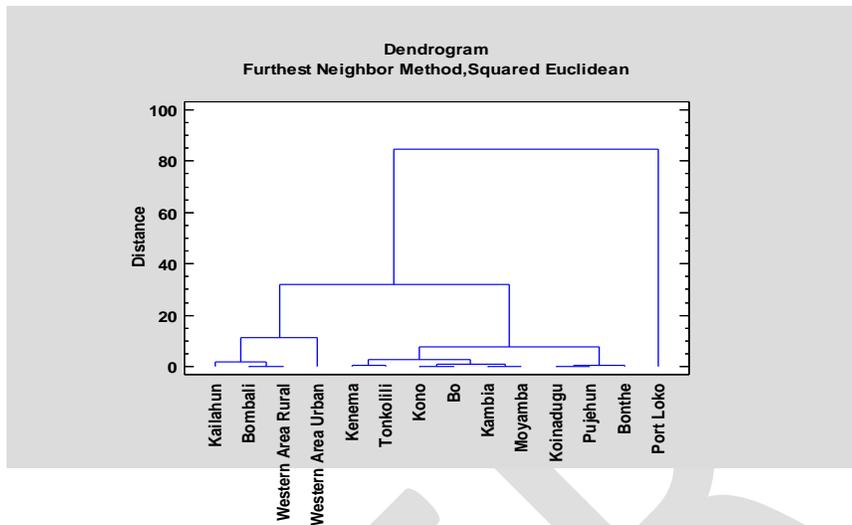
Fig25: Dendrogram for Nearest Neighbour



DENDROGRAM FOR NEAREST NEIGHBOUR

The above figure shows district between district with nearest neighbours. It shows distances between points when they are placed in the same group nearest neighbours apart. Distances between Bombali and western area rural are slightly above zero and the two districts are the nearest neighbours, the same thing goes for Kenema and Tonkolili, Kono and Bo, Kambia and Moyamba, Koinadugu and Pujehun they all slightly above zero and are nearest neighbours as paired. Kono and Bo, Kambia and Moyamba, Koinadugu and Pujehun can be placed again in another hierarchy of category base on their nearest neighbours'

Fig 26: Dendrogram for Farther Neighbours



DENDROGRAM FOR FARTHER NEIGHBOURS

The above figure shows district between districts with farthest neighbours. It shows distances between points when they are placed in the same group but far distances apart. Distances between Bombali and western area rural are slightly above zero and the two districts are the furthest neighbours, the same thing goes for Kenema and Tonkolili, Kono and Bo, Kambia and Moyamba, Koinadugu and Pujehun they all slightly above zero and are furthest neighbours as paired. Kono and Bo, Kambia and Moyamba, can be placed again in another hierarchy of category base on their nearest neighbours

PAIRED SAMPLES - TOTAL HOUSEHOLD INFECTED AND TOTAL DEATH

This procedure was designed to test for significant differences between two data samples where the data were collected as pairs. It will calculate various statistics and graphs for the differences between the paired data. Also included in the procedure are tests designed to determine whether the mean difference is equal to zero. Data variable: Total household infected –Total death

Fig 27: Stem-and-Leaf Display for TOTAL: unit = 100.0 1|2 represents 1200.0

LO|-1402.0

1 -1|

1 -1|
1 -1|
1 -0|
1 -0|
3 -0|44
7 -0|3332
7 -0|111000
1 0|0

STEM –AND- LEAF FOR TOTAL

This display shows a frequency tabulation for total household infected –total death. The range of the data has been divided into 9 intervals (called stems), each represented by a row of the table. The stems are labelled using one or more leading digits for the data values falling within that interval. On each row, a digit (called a leaf) represents the individual data values to the right of the vertical line. This results in a histogram of the data from which you can recover at least two significant digits for each data value. If there are any points lying far away from most of the others (called outside points), they are placed on separate high and low stems. In this case, there is one outside point. The leftmost column of numbers are depths, which give cumulative counts from the top and bottom of the table, stopping at the row, which contains the median.

HYPOTHESIS TEST FOR TOTAL HOUSEHOLD INFECTED – TOTAL DEATHS

Sample mean = -290.286

Sample median = -192.0

Sample standard deviation = 354.825

T-Test

The t-test tests the null hypothesis that the mean total household infected – total death equals 0.0 versus the alternative hypothesis that the mean Total Household Infected – Total death is not equal to 0.0.

Null hypothesis (H_0): mean = 0

Alternative (H_1): not equal

Computed t statistic = -3.06108

P-Value = 0.00910402

Reject the null hypothesis for alpha = 0.05.

Conclusion: Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level and accept Mean not equal to zero

SIGN TEST

The sign test tests the null hypothesis that the median equals 0.0 versus the alternative hypothesis that the median total household infected – total death is not equal to 0.0. It is based on counting the number of values above and below the hypothesized median

Null hypothesis (H_0): median = 0

Alternative (H_1): not equal

Number of values below hypothesized median: 13

Number of values above hypothesized median: 1

Large sample test statistic = 2.93987 (continuity correction applied)

P-Value = 0.00328359

Reject the null hypothesis for alpha = 0.05

Conclusion: Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level and accept median not to zero.

SIGNED RANK TEST

The signed rank test tests the null hypothesis that the median total household infected – total death equals 0.0 versus the alternative hypothesis that the median total household infected – total death is not equal to 0.0. It is based on comparing the average ranks of values above and below the hypothesized median. The sign and signed rank tests are less sensitive to the presence of outliers but are somewhat less powerful than the t-test if the data all come from a single normal distribution

Null hypothesis (H_0): median = 0

Alternative (H_1): not equal

Average rank of values below hypothesized median: 8.0

Average rank of values above hypothesized median: 1.0

Large sample test statistic = 3.2016 (continuity correction applied)

P-Value = 0.00136679

Reject the null hypothesis for alpha = 0.05.

Conclusion: Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level accept median not equal to zero

CHI- SQUARE TEST

The chi-square test tests the null hypothesis that the standard deviation of total household infected – total death equals 1.0 versus the alternative hypothesis that the standard deviation of total household infected – total death is not equal to 1.0.

Null hypothesis (H_0): $\sigma = 1.0$

Alternative (H_1): not equal

Computed chi-square statistic = 1.63671E6

P-Value = 0

Reject the null hypothesis for $\alpha = 0.05$.

Conclusion: Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level accept sigma not equal to 1.0

MULTIPLE SAMPLE COMPARISON

This procedure compares the data in 7 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. With the worried about the presence of outliers, Kruskal-Wallis Test will compare medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.

Sample variables:

Sample 1: National total household

Sample 2: Total household infected

Sample 3: Percentage of household infected

Sample 4: Total infected

Sample 5: total death

Sample 6: Percentage of death

Sample 7: Number recovered

This procedure compares the data in 7 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.

Table 1: ANOVA Table

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	9.71739E10	6	1.61956E10	50.70	0.0000
Within groups	2.90667E10	91	3.19414E8		
Total (Corr.)	1.26241E11	97			

ANOVA Table

The F-test in the ANOVA table tests whether there are any significant differences amongst the means. The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 50.7042, is a ratio of the between-group estimate to the within-group estimate.

Null hypothesis (H_0): There is a statistically significant difference between the means of the 7 variables at the 5% significance level.

Alternative (H_0): There is a statistically no significant difference between the means of the 7 variables at the 5% significance level.

Decision: P-value of the F-test is less than 0.05,

Conclusion: Accept null hypothesis i.e. there is a statistically significant difference between the means of the 7 variables at the 5% significance level.

MULTIPLE RANGE TEST

The Multiple Range Tests tells you which means are significantly different from others.

Hypothesis:

Null hypothesis (H_0): Means are statistically different from each other

Alternative (H_0): Means are not statistically different from each other

Calculations:

Table2: Percentage LSD (Least Significant Difference)

	<i>Count</i>	<i>Mean</i>	<i>Homogeneous Groups</i>
PERCENTAGE OF DEATH	14	5.80714	X
PERCENTAGE OF HOUSEHOLD INFECTED	14	7.14286	X
NUMBER RECOVERED	14	182.857	X
TOTAL HOUSEHOLD INFECTED	14	496.5	X
TOTAL DEATH	14	786.786	X
TOTAL INFECTED	14	969.643	X
NATIONAL TOTAL OF HOUSE HOUSE HO	14	90390.6	X

PERCENTAGE LSD(LEAST SIGNIFICANT DIFFERENCE)

At the table above, 2 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which may or may not be statistically significant. The method currently used to discriminate among the means is Fisher's least significant difference (LSD) procedure.

Decision and Conclusion

Within each column, the levels containing X's form a group of means within which there are no statistically significant differences.

Table 3: Differences and Limits

<i>Sig.</i>	<i>Difference</i>	<i>+/- Limits</i>
*	89894.1	13418.1
*	90383.4	13418.1
*	89420.9	13418.1
*	89603.8	13418.1

*	90384.8	13418.1
*	90207.7	13418.1
	489.357	13418.1
	-473.143	13418.1
	-290.286	13418.1
	490.693	13418.1
	313.643	13418.1
	-962.5	13418.1
	-779.643	13418.1
	1.33571	13418.1
	-175.714	13418.1
	182.857	13418.1
	963.836	13418.1
	786.786	13418.1
	780.979	13418.1
	603.929	13418.1
	-177.05	13418.1

* denotes a statistically significant difference.

DIFFERENCES AND LIMITS

This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 6 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

MOOD’S MEDIAN TEST

Mood's median test tests the hypothesis that the medians of all 7 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 275.0.

Table: Total n = 98 Grand median = 275.0

Table 4: Mood’s median Table

<i>Sample</i>	<i>Sample Size</i>	<i>n<=</i>	<i>n></i>	<i>Median</i>	<i>95.0% lower CL</i>
NATIONAL TOTAL OF HOUSEHOLD	14	0	14	86119.0	78827.9
TOTAL HOUSEHOLD INFECTED	14	6	8	453.0	268.227
PERCENTAGE OF HOUSEHOLD INFECTED	14	14	0	6.5	3.90088
TOTAL INFECTED	14	3	11	802.0	447.694
TOTAL DEATH	14	3	11	701.0	375.035
PERCENTAGE OF DEATH	14	14	0	5.2	2.75022
NUMBER RECOVERED	14	9	5	101.0	79.3407

Test statistic = 52.5714 P-Value = 1.43114E-9

Decision

If P-value for the chi-square test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Conclusion

Since the P-value for the chi-square test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Table 5: Table of Means with 95.0 percent LSD intervals

			<i>Std. error</i>		
	<i>Count</i>	<i>Mean</i>	<i>(pooled s)</i>	<i>Lower limit</i>	<i>Upper limit</i>
NATIONAL TOTAL OF HOUSE HOUSE HOLD	14	90390.6	4776.54	83681.5	97099.6
TOTAL HOUSEHOLD INFECTED	14	496.5	4776.54	-6212.55	7205.55
PERCENTAGE OF HOUSEHOLD INFECTED	14	7.14286	4776.54	-6701.9	6716.19
TOTAL INFECTED	14	969.643	4776.54	-5739.4	7678.69
TOTAL DEATH	14	786.786	4776.54	-5922.26	7495.83
PERCENTAGE OF DEATH	14	5.80714	4776.54	-6703.24	6714.85
NUMBER RECOVERED	14	182.857	4776.54	-6526.19	6891.9
Total	98	13262.8			

TABLE OF MEANS WITH 95.0 PERCENT LSD INTERVALS

This table shows the mean for each column of data. It also shows the standard error of each mean, which is a measure of its sampling variability. The standard error was formed by dividing the pooled standard deviation by the square root of the number of observations at each level. The table also displays an interval around each mean. The intervals currently displayed are based on Fisher's least significant difference (LSD) procedure. They are constructed in such a way that if two means are the same, their intervals will overlap 95.0% of the time. In the Multiple Range Tests, these intervals are used to determine which means are significantly different from which others.

Table 6: Comparism of Alternative Distribution

<i>Distribution</i>	<i>Est. Parameters</i>	<i>Log Likelihood</i>	<i>KS D</i>
Weibull	2	-100.794	0.0989555
Gamma	2	-100.83	0.0995373
Exponential	1	-100.906	0.115934
Loglogistic	2	-101.986	0.106217
Lognormal	2	-102.296	0.153903
Largest Extreme Value	2	-102.446	0.167584
Birbaum-Saunders	2	-102.901	0.258285
Uniform	2	-103.54	0.386916
Logistic	2	-104.334	0.164991
Inverse Gaussian	2	-104.717	0.292394
Normal	2	-104.745	0.185017
Laplace	2	-104.888	0.171257
Smallest Extreme Value	2	-107.993	0.223602
Pareto	1	-118.333	0.44717

COMPARISM OF ALTERNATIVE DISTRIBUTION

This table compares the goodness-of-fit when various distributions are fit to total household infected. According to the log likelihood statistic, the best fitting distribution is the Weibull distribution.

IMPACT OF EBOLA VIRUS DISEASE ON FREE HEALTH CARE INITIATIVE IN MOYAMBA DISTRICT

The EVD outbreak in Moyamba District occurred between 23 July 2014 and 17 March 2015, with 211 cases across 10 chiefdoms, and 126 EVD-related deaths, including five health care staff. Four chiefdoms reported more than 20 cases each.

(1 November 2014–15 April 2015), burial teams recorded 1874 deaths in Moyamba (for which age was recorded in 1861 cases) of which 496 (27%) were under the age of 1 year, 786 (42%) were under the age of 5 years and 1282 (69%) were aged under 50 years of

age. Ebola was confirmed post-mortem in 38 (2.0%) cases during this period. The number of deaths recorded by the burial teams was over 3.4 times greater than the average number of deaths registered during the same period (November to mid-April) from the previous 4 years (mean 556 of deaths for years 2010–13).

The mean number of monthly Antenatal Natal Care(ANC) visits remained stable over time, except for the subset of care provided via outreach visits where, compared with before the outbreak (n = 390), ANC1 visits declined during (n = 331, P = 0.002) and after the outbreak (n = 342, P = 0.03). Most (>97%) deliveries occurred in health facilities, assisted by maternal and child health aides (>80%). During the outbreak, the mean number of community-based deliveries per month declined from 31 to 21 (P = 0.03), and the mean number of deliveries performed by midwives increased from 49 to 78 (P < 0.001) compared with before the outbreak. The live births before, during and after Ebola, were 1134, 1110 and 1162 respectively.

Wider impact of the Ebola outbreak many adverse social consequences were reported, however, in particular it was widely perceived that since schools had closed sexual activity particularly involving young girls and older men had increased. This was evidenced by the findings of increase in teenage pregnancy in Moyamba in 2014 compared with 2013 with a mean of 137.6 (95% CI 96.4–178.9) teenage pregnancies recorded per Chiefdom in 2013 and mean of 173.1 (117.1–229.2) in 2014. (Journal of Public Health | Vol. 38, No. 4, pp. 673–678 October 27, 2015)

UNICEF reported reductions in utilization of peripheral health facilities from May to September 2014 with 10% reduction in fourth antenatal care attendance and 16% reduction in births reported for Moyamba

CONCLUSION

- 1147(One thousand one hundred and forty-seven) household members below age five years were affected by Ebola virus in Sierra Leone.
- This represents 4.5% males and 4% of female household members below the age of five that were affected respectively during the outbreak of Ebola in Sierra.
- 8.5% of the total house members in Sierra Leone with age below five years were affected by Ebola virus disease.
- 6820(six thousand eight hundred twenty) household members of age between (5-35) years were confirmed positive of Ebola virus disease in Sierra Leone.
- 6820(six thousand eight hundred twenty) household members of age between (5-35) years were confirmed positive of Ebola virus disease in Sierra Leone.
- Moyamba district had 477(four hundred and forty four) infected cases and 381(three hundred and eighty one) death cases.
- Port Loko district had the highest number of infected cases of 3,594 and the highest number of death cases of 3,045,
- Kailahun district has the second highest number of infected cases in Sierra Leone with 1,727 cases and 1,391 reported death cases,
- Bothe district has the least number of infected cases of 17 with 13 deaths, this represents 0.1% of the number deaths in Sierra Leone followed by koinadugu with 132 infected cases and 93 deaths and this represents 0.7% of the number of deaths in Sierra Leone.
- Northern region had the highest cases of death and infection, followed by Eastern region then Western area and finally Southern region, the region Moyamba district belongs. Total number of deaths are almost proportional to the total number of infections.

- There is a negative correlation between the confirmed age group category and suspected age category during the outbreak of Ebola Virus Disease in Sierra Leone
- Medians of the samples are significantly different at the 95.0% confidence level.
- The number of deaths recorded by the burial teams in Moyamba district was over 3.4 times greater than the average number of deaths registered during the same period (November to mid-April) from the previous 4 years (mean 556 of deaths for years 2010–13).
- The mean number of monthly Antenatal Natal Care(ANC) visits in Moyamba district remained stable over time, except for the subset of care provided via outreach visits where, compared with before the outbreak (n = 390), ANC1 visits declined during (n = 331, P = 0.002) and after the outbreak (n = 342, P = 0.03).
- Most (>97%) deliveries occurred in health facilities, assisted by maternal and child health aides (>80%) in Moyamba district. During the outbreak, the mean number of community-based deliveries per month declined from 31 to 21 (P = 0.03), and the mean number of deliveries performed by midwives increased from 49 to 78 (P < 0.001) compared with before the outbreak.
- The live births in Moyamaba district before, during and after Ebola, were 1134, 1110 and 1162 respectively.
- This was evidenced by the findings of increase in teenage pregnancy in Moyamba in 2014 compared with 2013 with a mean of 137.6 (95% CI 96.4–178.9) teenage pregnancies recorded per Chiefdom in 2013 and mean of 173.1 (117.1–229.2) in 2014.

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