The Effects of Climate on the Occurrence of Diarrhoea in South-South Nigeria

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ABSTRACT

For years, studies have shown that climate affected man, especially in the spread of diseases. Diarrhoea is a known climate-sensitive disease. Hence, climate favours the occurrence of diarrhoea as changes in climatic variables causes pathogens, such as viruses, bacteria, etc., to mature faster. This study evaluated the effects of climate on the occurrence of diarrhoea in the south-south region of Nigeria. Archival yearly climate (rainfall, temperature, and humidity) and diarrhoea data were collected for 30 years (1992-2921). The diarrhoea data were collected from government hospitals and the Ministry of Health in the six state capitals of Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers states respectively. The climate data were down scaled at 5^{o} x 5^{o} gridded CRUTEM4 2019-12 grid boxes and Cruts_4. 04. The multiple regression analysis was employed, and the result for climatic factors showed a significant relationship F (3, 26) = 8.903, p (.000) < 0.05; the correlation coefficient R = .712, and the R-square (coefficient of determination) was .507. The study established a statistically significant relationship between climate factors and diarrhoea. The coefficient showed that rainfall, temperature, and humidity had significant effect on the occurrence of diarrhoea. This study incorporated socioeconomic factors and administered 30 questionnaires to 30 medical consultants in the region to ascertain whether socioeconomic factors act as catalyst in the spread of diarrhoea. This was done based on 6 medical consultants in each of the government hospitals located in the state capitals. The result for climate and socioeconomic factors showed a significant relationship F (11, 18) = 9.400, p (.000) < 0.05; the correlation coefficient R = .923, and the R-square = .852. This indicated that socioeconomic factors act as catalyst to the spread of diarrhoea The study highlighted the need for people in the region to be sensitised on the dangers of climate vagaries, especially on diarrhoea occurrence, and should be enlightened on the causes and prevention of diarrhoea. It suggested that personal hygiene should be encouraged, and health services provided, especially in remote areas.

Keywords: Climate, Disease, Diarrhoea, Pathogen, South-South of Nigeria.

INTRODUCTION

Climate plays a tremendous role in what happens generally in the environment and man's health [35], [10]. Increases in temperature and precipitation have led to heat waves, floods, and wildfires, including an increase in diseases, which in turn affect human health [8], [31], [7]. The main insidious implication of warming is the spread of diseases [20]. Climate affects the supply and quality of water [33], [34]. Also, an increase in temperature or rainfall can cause favourable conditions for the breeding of insects (vectors), a quickening of the life cycle, an increase in the biting rates of these insects, their mortality rate, enhanced pathogen-vector interactions, and increased virulence [9], [27], [28], and [25]. It was also stated that pathogens, such as viruses, bacteria, fungi, and parasitic worms, mature faster with increased temperature [27]. Although [19] believe that when this increase is excessive, the survival of some of these pathogens may be disrupted. Upon the above premise, there has been an increase in studies on climate impact on other diseases like malaria, coronavirus, etc. (see [8], [9], [35], [11], [14]) due to the relative neglect of diarrhoea in Nigeria.

It has been averred that changes in weather and climate (rainfall, temperature, and humidity) affect the incidence of diarrhoea [23, 6]. They added that weather and climate alone are not the only causes of diarrhoea. However, other factors, such as culture, human behaviour, human immunity, etc., could cause diarrhoea. [5] stated that there is a significant association between rainfall, temperature, and the incidence of diarrhoea. In addition, [20] stated that the degree and type of effects of climate depend on the region in question. Studies have shown that environmental, biological, and socioeconomic factors are the cause of diarrhoea (see [29]). However, while most studies have focused on the biological and socioeconomic aspects, little is done in the environmental aspect in Nigeria; even the few studies on the ecology of diarrhoea are located in other climes to the neglect of this area, (see [17], [3], [21], [18], [1], [6] and [32]). Also, while studies on diarrhoea are concentrated in the northwest, northeast, and south-western Nigeria (see [15], [22] and [30]), little or no studies are reported in south-south Nigeria, thus leading to a dearth of information in the region. Upon the above neglect and problem of climate on diarrhoea, this study evaluates the effects of climate on the occurrence of diarrhoea in the south-south region of Nigeria.

A. Theoretical Review

The theory of disease ecology explains why diseases are unevenly distributed on the earth's surface. It argues that disease distribution is due to three fundamental factors: genetics, environment, and behaviour. According to [29], genetics has to do with the biological makeup of individuals; the environment is the geographic location of the people, and behaviour is the people's way of life. The environment can be looked at from different angles: there is the physical environment, which includes the climate, water bodies, elevation, etc.; the social environment, which includes social groups and their interactions; socioeconomic aspects such as gender, income level, and education; and the built-up environment [29]. These different factors are not the same in all places, hence the difference in the distribution of diseases. Although viruses, bacteria, parasites, etc. cause diseases, socio-economic factors can act as catalysts for the occurrence of these diseases.

The theory of disease ecology makes it clear that although climate, which is part of the physical environment, can cause diseases, several other factors, such as biological and socio-economic factors, could be responsible for spreading the disease diarrhoea. These three factors bring about spatial variation in the occurrence of diseases in the environment [29]. [29] opined that instead of seeing the environment as the geochemistry or climate alone, the environment should be seen as the physical, social, economic, and other factors that are responsible for the occurrence and spread of disease.

B. Empirical Review

Diarrhoea is one of the significant challenges affecting people of the south-south states of Nigeria. The primary reason for this is the region's location and climatic factors. Several studies on diarrhoea disease attributed its occurrence to an increase in rainfall, and some attributed it to an increase in temperature. In contrast, some attributed the occurrence of diarrhoea to both. [5], in their study on diarrhoea in Nepal, shared the area into three Eco-development regions and stated in their findings that a 1% increase in temperature resulted in a 4.4% increase in the risk of diarrhoea occurrence and a 1cm increase in rainfall causes .028% risk of the occurrence of diarrhoea. Another study by [23], with a systematic review of journals, stated that climate has a significant relationship with diarrhoea but concluded that only climate could not bring about the occurrence of diarrhoea, that other factors such as human behaviour, socioeconomic factors, human immunity etc.

A study was done by [6] on diarrhoea in children in 51 countries from 2000 to 2019, and the findings reveal that in the tropical savanna, an abnormally dry period is associated with the occurrence of diarrhoea, while in the subtropical humid savanna, heavy rainfall is associated with diarrhoea occurrence. In addition, they

surveyed hygiene, access to clean water, feeding methods and immunisation status of the children. Their results revealed that there is an association between drought and diarrhoea in the tropical savanna and that children who do not have access to clean water, do not have good stool disposal methods, and do not have suitable feeding methods are more likely to be at risk than those children with potable water, good hygiene and who are immunised. Also, in the humid subtropical region, there was an association with severe wet anomalies and diarrhoea in children. There was a statistically significant association between children who used piped water and diarrheal disease when exposed to it. The opposite was the case for children who do not use piped water.

The concept of diarrhoea and climate are terms that we are used to, but for the purpose of this study, more clarification shall be given. Diarrhoea is sensitive to climate, and when there is an alteration in climate, it changes the disease occurrence. Alteration in climate means an alteration in rainfall, temperature, humidity, and other climatic variables apart from the ones listed in this study. According to [26], diarrhoea diseases are expected in the warm, humid part of Nigeria, where the south-south region lies. Diarrhoea has been known to be either waterborne or foodborne diseases—pathogens from contaminated water or food result in diarrhoea when consumed.

Climate is the synthesis of weather condition over a long period, typically, 30 years. Climate is made up of parameters as rainfall, temperature, humidity, sunshine, wind etc. According to [4] climate is the long-term weather patterns. Increase or decrease in this climate parameters can alter the environment and the health of man.

Fig. 1 below shows how climate can lead to the occurrence of diarrhoea.

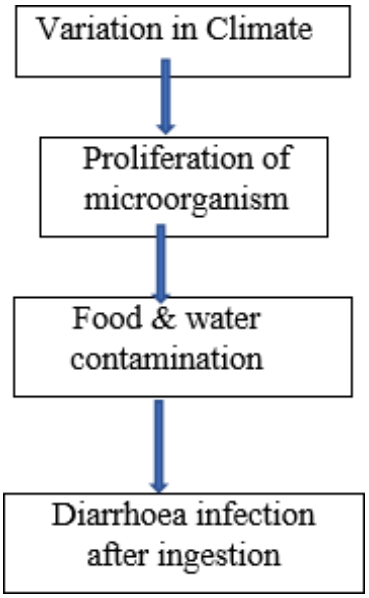

Fig. 1 Pattern of spread of diarrhoea**.**

C. Study Area

The South-South region is located within latitudes $4^0 2' 0'' N$ – $7^0 4' 0'' N$ and longitudes $5^0 0' 0'' E$ – $9^0 2' 0'' E$ of the Greenwich Meridian [2], [12]. It is bounded north by Abia, Ebonyi, Enugu, Imo, and Kogi States and in the south by the Atlantic Ocean. It is bounded in the east by Cameroun and on the west by Ondo State. The south-south geo-political zone comprises six states: Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers. It occupies about 85,303 square kilometres [13], [12]. This region lies within a tropical humid climate and rainfall almost yearly with double maxima. The annual mean temperature for this region is about 27.10°C, and the temperature range is between 3.2°C and 3.4°C. The area comprises coastal lowlands, creeks, and lagoons which drain the river Niger and eventually empties into the Atlantic Ocean.

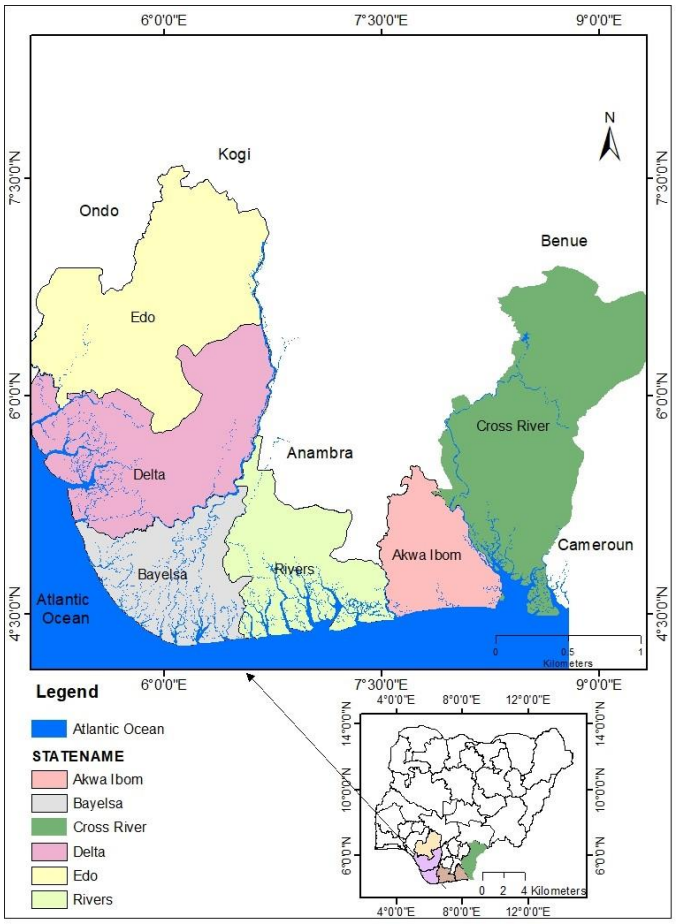

Fig. 2 South-South Zone of Nigeria Showing the States

D. Data Collection Techniques

The study adopted the ex post facto research where archival yearly climate (rainfall, temperature, and humidity) and diarrhoea data were collected. These data were obtained for 30 years from 1992-2021. The choice of thirty years was predicated on the fact that it forms the basis of climate normal discourse. The diarrhoea data were collected from government hospitals and the Ministry of Health in the six state capitals of Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers states respectively. The climate data were down scaled at 5^{o} x 5^{o} gridded CRUTEM4 2019-12 grid boxes and Cruts_4. 04. For the disease data, all clinically diagnosed in and outpatients, including young and old male and female patients, were all included in the data used for this study. The multiple regression analysis was used to determine the effect of rainfall, temperature, humidity, and socioeconomic factors on the occurrence of diarrhoea in the region; it was analyzed with the aid of the statistical package for the Social Sciences (SPSS) version 25. The techniques have been adopted by [8], [9], [35] and [12] in similar studies. To determine the effects of climate and socioeconomic factors on diarrhoea, thirty (30) questionnaires were served on 30 medical consultants in the region. This was done based on six (6) medical consultants in each of the government hospitals located in the state capitals of Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers states. This method has been employed by [12] on the comparative study of the distribution of diarrhoea in south southern Nigeria. The socioeconomic factors used in the questionnaires include lack of potable water, unclean environment, poor hygiene, contaminated food and water, low immunity, poor nutrition, maternal awareness, beliefs, rainfall, temperature, and humidity. Maternal awareness involves maternal education, partial breast feeding and predominant breast feeding.

1) Duration of Study: The study duration was from January 1992 to December 2021. That is, yearly data for rainfall, temperature, humidity, and diarrhoea were collected for a period of thirty years.

RESULT and DISCUSSION

A. Demographic Status

The diarrhoea data collected for the period of thirty years were for children, younger and older adults that were confirmed patients of diarrhoea at the hospital. Apart collating data for people of all ages, the study also gathered data for both male and female gender. The data was for the total confirmed cases of diarrhoea. For the six states (Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers) in the south-south region. Thirty questionnaires were administered to six (6) medical consultants in government hospitals in each state under study.

B. Descriptive Analysis

The SPSS version 25 was the software package used to analyse the statistical data and the statistical technique employed in the study was multiple regression analysis. For diarrhoea yearly data were collected from the six states of the south-south Nigeria (each state provided 30 years data). For the climatic data, 30 years data were collected for rainfall temperature, and humidity across the states. For socioeconomic factors, thirty (30) questionnaires were administered.

Table I. Annual Summary of Diarrhoea

	DIARRHOEA					
	Akwa Ibom	**Bayelsa**	**Cross River**	**Delta**	**Edo**	**Rivers**
1	26	2231	182	171	1609	84
2	6	2568	99	52	1389	39
3	5	1120	240	49	1247	26
4	5	1457	59	47	2429	113
5	9	1644	158	101	1992	20
6	12	1992	75	42	1939	80
7	5	1567	169	4	989	94
8	7	1401	114	45	385	89
9	18	2371	236	56	1363	89
10	5	2511	121	46	1320	99
11	11	945	168	47	2081	23
12	5	2060	145	4	1267	70
13	17	1551	192	130	499	59
14	2	1707	113	34	1989	23
15	28	1087	158	93	903	90
16	27	1356	218	30	2329	37
17	15	1962	119	61	1632	101
18	10	1148	91	93	2540	66
19	91	1713	69	45	1276	76
20	91	1137	117	151	948	33
21	119	1966	76	46	2451	31
22	489	729	109	120	2703	54

23	238	1174	173	19	1905	25
24	131	1205	50	15	505	53
25	51	1494	233	42	1988	70
26	47	2722	156	69	706	78
27	57	2648	177	80	1653	61
28	94	2585	52	50	903	71
29	46	572	98	87	2329	30
30	138	2115	28	68	1632	39

Source: Ministry of Health and Hospitals (Government)

Table I shows the diarrhoea occurrences for 30 years, where 1-30 represents 1992-2021 for the first column and columns Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers States.

It shows that the highest occurrence in Akwa Ibom state was in 2013, with a value of 489, and its lowest occurrence, with a value of 2, was in 2005. In Bayelsa, the highest value was 2722 in 2017, and the lowest was 572 in 2020. Cross River state had its highest value of 240 in 1994 and its lowest value of 28 in 2020. Delta State's highest value was 171 in 1992, and its lowest occurrence was 4 in 1998 and 2003. The highest occurrence in Edo state with a value of 2703 in 2013, and the lowest occurrence was 385 in 1999. While the highest occurrence of diarrhoea in Rivers State was 113 in 1995, and the lowest was 20 in 1996. However, table 2 revealed that Bayelsa had the highest number of diarrhoea cases (50738), while Akwa Ibom recorded 1805 cases, the lowest during this period. Other regional states have 46901, 3995, 1897 and 1823 for Edo, Cross River, Delta, and Rivers states respectively**.**

Table II Means of Diarrhoea Cases (1992-2021)

Akwa Ibom	**Bayelsa**	**Cross River**	**Delta**	**Edo**	**Rivers**
60	1691	133	63	1563	60

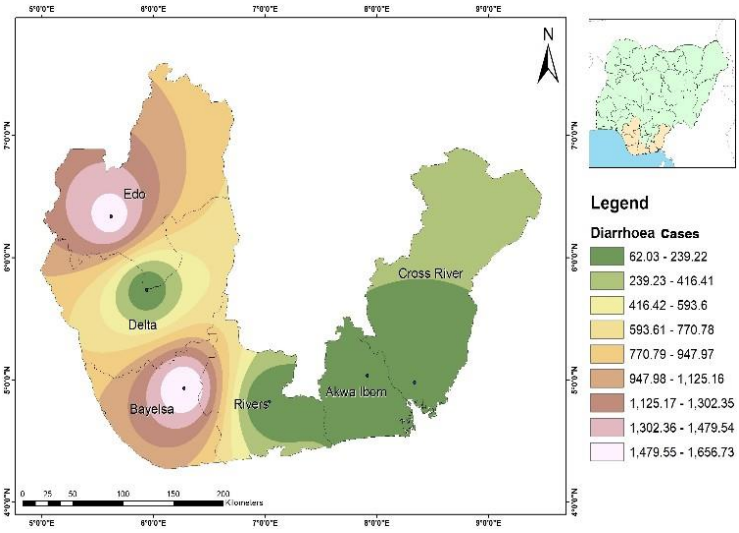

Fig. 3: Spatial Variation of Diarrhoea in South-South Nigeria

Figure 3 shows diarrhoea's spatial distribution in south-south Nigeria from 1992-2021. It shows that Bayelsa and Edo state have higher occurrences of diarrhoea than Akwa Ibom, Cross River, Delta, and Rivers states. For Bayelsa and Edo states, the diarrhoea mean occurrences are 1691 and 1563, while mean

occurrences for Akwa Ibom, Cross River, Delta and Rivers States are 60, 133, 63, and 61, respectively.

Table III Means of Rainfall, Temperature and Humidity (1992-2021**)**

	Akwa Ibom	Bayelsa	Cross River	Delta	Edo	Rivers
Rainfall in mm	209.7	211.7	212	180.5	177	202.8
Temp. In ℃	26.3	26.3	27.4	26.2	25.8	25.8
Humidity in %	87.1	87.8	88.2	88.1	87	87

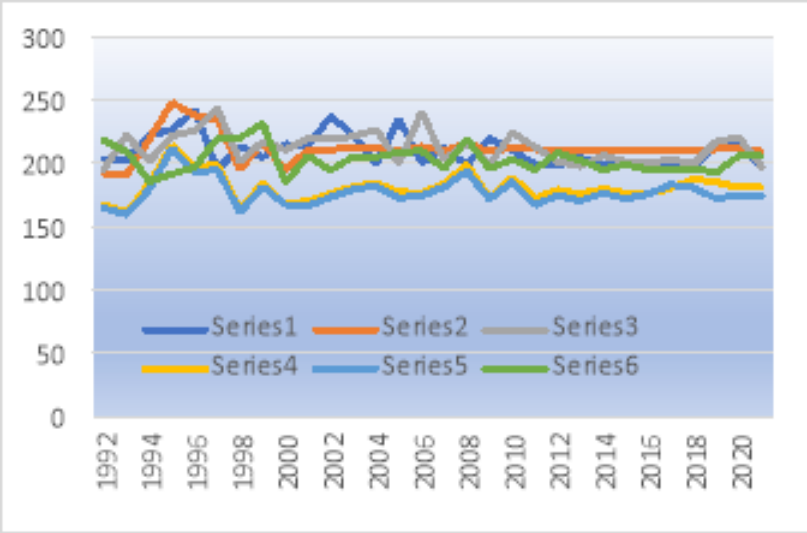

Fig. 4: Rainfall Line Chart

Figure 4 shows the annual rainfall distribution for the six states in the south-south region of Nigeria for thirty years (1992-2021). For each year, it displays the variation among the states in the region. Series 1 represents Akwa Ibom state, series 2 represents Bayelsa state, series 3 represents Cross River state, series 4 represents Delta state, series 5 represents Edo state and series 6 represents Rivers State.

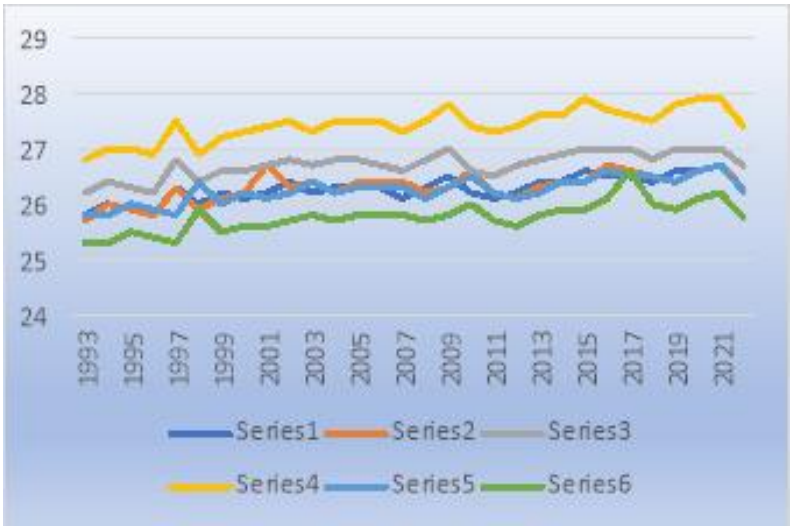

Fig. 5: Temperature Distribution

Figure 5 shows the temperature distribution for the six states in the south-south region of Nigeria for a period of thirty years (1992-2021). It depicts the temperature variation for the states each year. From the graph, it is observed that Delta state (series 4) had the highest temperature all through the year.

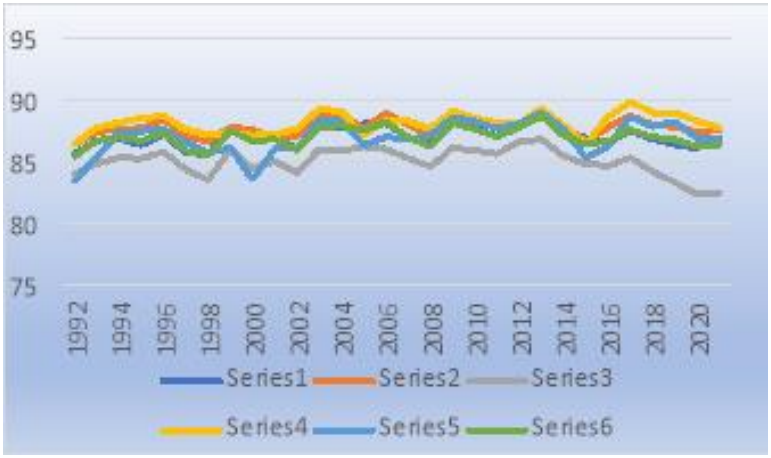

Fig. 6: Humidity Line Chart

Humidity is represented in Figure 6. It shows the distribution and humidity fluctuations for the six states throughout the thirty years of study. 1992 had the lowest relative humidity for all the states.

A. Inferential Analysis

Table IV Climate Factors Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	**.712 a**	**.507**	**.450**	**.47449**
a. Predictors: (Constant), Humidity, Rainfall, Temperature				

Table V Climate Factors ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	**6.013**	**3**	**2.004**	**8.903**	**.000[b]**
	Residual	**5.854**	**26**	**.225**		
	Total	**11.867**	**29**			
a. Dependent Variable: Diarrhoea						
b. Predictors: (Constant), Humidity, Rainfall, Temperature						

Table VI Climate Factors Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	**.968**	**.749**		**1.292**	**.007**
	Rainfall	**.348**	**.166**	**.371**	**2.093**	**.004**
	Temperature	**.102**	**.488**	**.091**	**.210**	**.005**
	Humidity	**.376**	**.517**	**.331**	**.729**	**.002**
a. Dependent Variable: Diarrhoea						

A multiple regression was conducted to show the effects of climate on the disease, diarrhoea. In table IV, the independent variable (rainfall, temperature, and humidity) was regressed over the dependent variable (diarrhoea) and, the value of the multiple correlation coefficient R was .712, R-square (coefficient of

determination) was .507, and this means that 50.7% of the variance of the disease- diarrhoea is explained by climatic factors (rainfall, temperature, and humidity). This means that other variables explain 49.3% of the outcome variables. This is in consonant with the theory of disease ecology that other factors apart from the natural environment affect the occurrence of disease (diarrhoea).

Table V is the ANOVA table showing whether the overall regression model fits the data well. From the table, it is seen that climate has a statistically significant relationship with the occurrence of diarrhoea, F (3, 26) = 8.903, p (.000) < 0.05. This means that the regression model is a good fit for the data.

From Table VI, it is observed that rainfall p (.004) < .05, temperature p (.005) < .05 and humidity p (.002) < .05 have significant relationship with the occurrence of diarrhoea in the south-south region of Nigeria. This means that rainfall, temperature and humidity are determinants of the occurrence of diarrhoea in south-south Nigeria. The equation to predict the occurrence of disease from rainfall, temperature, and humidity is, diarrhoea occurrence = .968 + .371 (rainfall) + .091 (temperature) + .331 (humidity). Also, from Table VI, it is observed that for any unit increase in rainfall, there is an increase of .371 for diarrhoea occurrence; for any unit increase in temperature, there is a .091 increase in diarrhoea occurrence, while a unit increase in humidity will cause .331 increase in diarrhoea occurrence.

Table VII Climate and Socioeconomic Factors Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	**.923[a]**	**.852**	**.761**	**.31265**

a. Predictors: (Constant), Humidity, Belief, Contaminated, Poor, Low, Maternal, Unclean, Rainfall, Temp, Inadequate, overall

Table VIII Climate and Socioeconomic Factors ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	**10.107**	**11**	**.919**	**9.400**	**.000[b]**
	Residual	**1.760**	**18**	**.098**		
	Total	**11.867**	**29**			

a. Dependent Variable: Diarrhoea

b. Predictors: (Constant), Humidity, Beliefs, Contaminated, Poor, Improper, Maternal, Unclean, Rainfall, Temp, Lack, Low

Table IX Climate and Socioeconomic Factors Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	**.208**	**.636**		**.327**	**.003**
	Lack of Portable Water	**.302**	**.397**	**.253**	**.761**	**.004**
	Unclean Environs	**.584**	**.430**	**.507**	**1.359**	**.001**
	Poor Hygiene	**.402**	**.177**	**.426**	**2.275**	**.005**
	Contaminated Food & Water	**.804**	**.164**	**.972**	**4.888**	**.000**
	Low Immunity	**2.724**	**.707**	**2.891**	**3.852**	**.001**
	Poor Nutrition	**-.287**	**.304**	**-.306**	**-.947**	**.003**
	Maternal Awareness	**.370**	**.268**	**.328**	**1.381**	**.018**

	Beliefs	**.246**	**.116**	**.346**	**2.121**	**.048**
	Rainfall	**2.100**	**.488**	**2.240**	**4.301**	**.000**
	Temp	**.123**	**.334**	**.109**	**.368**	**.006**
	Humidity	**.164**	**.369**	**.145**	**.445**	**.006**
a. Dependent Variable: Diarrhoea						

For the effects of climate and socioeconomic factors on the occurrence of diarrhoea, a multiple regression was conducted. In table VII, the independent variables (rainfall, temperature, humidity, lack of portable drinking water, unclean environment, poor hygiene, contaminated food and water, low immune system, poor nutrition, beliefs and maternal characteristics was regressed over the dependent variable (diarrhoea) and, the, value of R is .923, R-square (coefficient of determination) is .852 , and this means that 85.2% of the variance of the disease- diarrhoea is explained by climate and some socioeconomic factors. This means that other variables explain 14.8% of the outcome variables. This agrees with the theory of disease ecology that socioeconomic factors have effects the occurrence of disease (diarrhoea).

Table VIII is the ANOVA table showing whether the overall regression model fits the data well. From the table, it is seen that climate and the socioeconomic have a statistically significant relationship with the occurrence of diarrhoea, F (11, 18) = 9.400, p (.000) < 0.05. This means that the regression model is a good fit for the data.

From Table IX, it is observed that lack of portable water p (.004) < .05, unclean environs p (.001) < .05, poor hygiene p (.005) < .05, contaminated food and water p (.000) < .05, low immunity p (.001) < .05, poor nutrition p (.003) < .05, maternal awareness p (.018) < .05, beliefs p (.048) < .05, rainfall p (.000) < .05, temperature p (.006) < .05 and humidity p (.006) < .05 have significant relationship with the occurrence of diarrhoea in the south-south region of Nigeria. This means that lack of portable water, unclean environment, poor hygiene, contaminated food and water, poor hygiene, poor nutrition, maternal awareness, rainfall, temperature, and humidity are the determinants of the occurrence of diarrhoea in south-south Nigeria. The equation to predict the occurrence of disease from lack of portable water, unclean environment, poor hygiene, contaminated food and water, low immunity, poor hygiene, maternal awareness, beliefs, rainfall, temperature, and humidity is diarrhoea occurrence = **.**208 + **.**253 **+** .507 + .426 + .972 + 2.891 – .306 + .328 + .346 **+** 2.240 + .109 + .145.

Also, from table IX, it was observed that a one-unit shortage of portable water will result to .253 increase in diarrhoea, an increase in unclean environment by one unit, will result to .507 increase in diarrhoea, a unit increase in unhygienic lifestyle will result to .426 increase in diarrhoea. In addition, a unit increase in the consumption of contaminated food and water will result to .972 increase in the occurrence of diarrhoea, a unit decrease in a man's immune system will allow 2.891 occurrence of diarrhoea, when maternal awareness is lacking by one unit, it will result to .328 increase in the occurrence of diarrhoea, and a unit increase of people's beliefs and traditions (unhealthy ones) can result to .346 increase in diarrhoea. The table also showed that increase in rainfall by unit will result to 2.241 increase in the occurrence of diarrhoea, increase in temperature by one unit will bring about .109 increase in diarrhoea and a unit increase in humidity will result to .145 increase in the occurrence of diarrhoea. For poor nutrition, a unit increase in the consumption of food with poor nutritional value, there is a reduction in the occurrence diarrhoea.

D. Discussion of Result

In this study, "the effects of climate on the occurrence of diarrhoea" ascertained whether climate influences the occurrence of diarrhoea in south-south region of Nigeria. From the regression analysis conducted in Table IV, it was observed that the R value is .712 and the R-square value is .507, which is 50.7% of the outcome variable is explained by the predictable variables. This means that other variables explain 49.3% of

the outcome variables. Another analysis was conducted in tables VII-IX incorporating socioeconomic factors to ascertain whether socioeconomic factors have effects on the occurrence of diarrhoea, the outcome showed that R value was 92.3% and R square value (for climate and socioeconomic factors) was 85.2%. This is in consonant with the theory of disease ecology that other factors apart from the natural environment affect the occurrence of disease (diarrhoea).

Comparing the two analyses (climate only, and climate and socioeconomic factors), it can be observed that climate has effects on the occurrence of diarrhoea with R-square value of 50.7% but the socioeconomic factors act as catalyst in the spread of the disease diarrhoea.

CONCLUSION

This study evaluated the effects of climate on the occurrence of diarrhoea in the south-south region of Nigeria, and it re-affirmed the concept of ecology of disease by establishing that climate has a significant effect on the occurrence of diarrhoea in the south-south region of Nigeria but pointed out that although variation in climate may cause the increase in diarrhoea causing pathogens, the socioeconomic factors act as catalyst in the spread or occurrence of diarrhoea. Therefore, it was recommended that the people in the region be sensitised to the dangers of climate effects on diarrhoea. Personal hygiene should be an essential aspect of the sensitisation. Health care services should be provided, especially in remote areas (riverine communities).

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