Impact of Climatic Variables on the Prevalence of Measles in Wudil Local Government, Kano State, Nigeria

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Abstract- ***This research focused on the study of measles in relation to weather elements, in Wudil town. The data were obtained from both primary and secondary sources. Temperature and rainfall records from KUST Wudil meteorological station was collected alongside record of measles cases from Wudil General Hospital. The data was subjected to Multiple Linear Regression analysis where the impact of climatic factors on the frequency and occurrence of measles was tested. An interview was as well conducted for the purpose of having the responses from the public of their different perception on how the weather elements has impact on measles in Wudil town. Fifty respondents were interviewed across the three divisions. The research findings has shown that temperature and rainfall have a significant impact on the outbreak of diseases like measles. The analysis revealed that there is a statistically significant relationship between weather parameters (Temperature and Rainfall) and the occurrence of measles in the study area. This corresponds with the views of the respondents that the hot and dry season is the period with the most frequent occurrence of measles followed by the cold and dry season. The study further observed that outbreak of measles disease is all year round. The paper recommends that the Governments should plant more trees especially in the institutions and along the streets lines and improve Health sectors through re-construction and repairing clinics and hospitals, to provide all the medical facilities, and offer to give a proper attention to the infected and non-infected people.***

Indexed Terms- ***Infection, Measles, Rainfall, Temperature***

I. BACKGROUND

The amount of solar energy received by any region varies with time of the day, season and latitudes these difference are responsible for most of the temperature variation. Temperature also varies with difference in topographical surface and altitude. These temperature variations create forces that drive the atmosphere in it endless motion which in turn teleguide human activities and variables around them (Inoue et al. 1995). The variation of temperature may result in some heat- related disease such as measles meningitis, malaria and some other disease. This shows that temperature is most determinant for survival of living organism and their environment. The degree of seasonality in the climate of a region also appears to effect mortality rates. Armstrong in (2006) reported that countries with smaller seasonal temperature ranges exhibit steeper regression liner in temperature mortality correlation than countries which are found at below normal temperature, and in cooler countries similar temperature will produce no appreciable rise in mortality.

Measles is a highly contagious disease caused by measles virus with a prodromal illness characterized by fever, fatigue, coryza, and cough before the onset of rash. Its complications include immune suppression after measles virus infection. Measles is primarily and easily transmitted by direct contact or droplet exposure, and humans are the only natural host. Measles contributed to millions of deaths annually worldwide before the introduction of the measles vaccines (MVs). However, there were still 454 000 deaths resulting from measles following an intense international immunization campaign that has vaccinated over 200 million African children in 2004, (Weisberg SS. 2007) and measles caused an estimated 164 000 deaths worldwide in 2008 (CDC 2009). In recent years, many measles outbreaks

occurred all over the world including Nigeria.Antona D. et al. (2013).

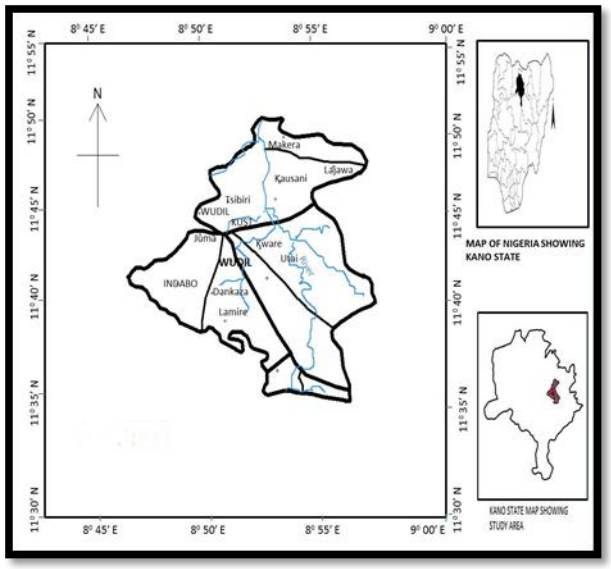
The morbidity of measles shows a seasonal variation. In temperate climates, measles outbreaks typically occur in the late winter and early spring every year, whereas in the tropics, measles outbreaks have irregular associations with rainy seasons,(Moss and Griffin 2012). Which suggests that climatic factors partly underlie the seasonality of measles virus infections. According to the world health organization (WHO 1999), measles is acute viral disease causes by paramyxovirus of the genus morbillivirus. It is spread by respiratory system contact with fluids from an infected persons nose and mouth by either droplet (coughing or sneezing) or gerosol transmission.

Measles, not just another viral exanthema is a highly communicable disease predominantly of the pre-school and early school- age children (2-5 year) it is one of the six killer disease of child hood caused by paramyxovirus commonly seen in the tropics (Knol M. et al. 2013). Disease cases in tropical area seem to vary from time to time like in other places in the world Willkie and Herbert (1998). Few studies are available on the effects of weather conditions on measles incidence regardless of frequent outbreaks of measles. The influence of temperature and rainfall on temporal variation of outbreak of measles in Wudil was therefore examined.

II. METHODOLOGY

2.1 Study Area

Geographically Wudil local government area is located between latitudes 11^o 37" N to Latitude 11^o 56" N and Longitude 8^o 45" E" to 8^0 57" E it boarded by Warawa local government to the north-west and Gaya to the east, Garko to the south-west and Albasu to the south-east, the Dawakin kudu local government area to the south west. It shears to the south and south – east by Garko L.G.A. Wudil town is the local government headquarters, Wudil which is strategically located on the river wudil it is also the gate way to the state capital Kano city from north-east as traffic is coming from Jigawa, Bauchi Yobe, Adamawa, Borno, Gombe, Taraba, and other neighboring countries like Niger, Chad, and Cameroon republics to Kano city are mostly passing through the Wudil town before reaching their destination.



Source: KUST GIS Lab. (2018)

The climate of the study area is tropical wet and dry type coded as AW by Koppen's classification of climate. Rainfall is very critical element in the area because of its seasonality the mean annual rainfall is about 850 mm, great temporal variation exist in the amount of rainfall as not two consecutive year with same amount and average calculated for any two year are usually not the same Olofin (1987).The temperature regime is warm to hot throughout the year with a slight cool period between November and February. The mean annual temperature is about 26^0c, but mean monthly values ranges between 21^0c, in the coolest month December- January and 31^0c in the hottest month April – May(Olofin, 2008).

It is believed that the landform of Wudil local government area is a product of interaction of geologic, geomorphic and climatic factors. The region fall within the area described by Udo (1970) as the high plain of Hausa land.

The soil of the region is sandy ferruginous type, while the zonal soils are also influenced by human manipulation to varying degrees (Olofin, 1987). Vegetation of the region was originally defined as undisturbed Sudan savanna and guinea savanna. The

normal vegetation has always been the dry Guinea in the southern fringe and the Sudan in the larger part of the region (Olofin, 2008). The vegetation has now been subjected to destruction through fuel wood extraction, urban encroachment and population pressure (Dakata and Yelwa, 2012) hence eventuated the formation of four vegetation zones in the region namely: Sudano-Sahelian Savanna, Sudan Savanna, Open Guinea Savanna and Protected Guinea Savanna (Dakata, 2012 in A. Mustapha et al. 2014).

The dominant drainage system in the area is river Wudil elsewhere recognized as river Hadejia which gets its water from river Chalawa and river kano and their tributaries and flows north east as river Hadejia and finally into the lake Chad, the river is important part of the Hadejia and the Jama'are river system (Natural resources Environment, 2010). The River Hadejia-jama'are basin occupies a total land area of about 22,410 sqkm and is part of the inland drainage system of the chad basin (Natural Environment, 2010). The river being located in the tropical savannah initially has wide alluvial channels with beds lower than the beds of the tributaries and gully channels draining into it and without a true flood plain (Olofin, 2005).

An important feature of human activities within the local government area is the settlement pattern. A settlement can be defined as a group of building with the people living inside. It sense farmstead, town, and metropolis. Conurbation or megalopolis. A settlement can also be Rural or Urban. However the classifications of any settlement in to any of the mentioned type depend on their size, spatial location and the function they perform. The settlement type within the area can broadly classified into Rural and Urban with the dominance of farmers group.

The major activities that pre dominate in the study area agricultural activities, local craft and local trading. Bulk of agricultural practice is for subsistence with surplus taken to nearby periodic market for sale. Prominent among these are market in Darki, Makole and Garko. Some of the people engage in local craft manufacturing producing traditional mats as major source of income for both men and women.

The 2006 population census put the population of the area at 185, 189 people. The 2006 census figure revealed a total number of 97,360 male and 87,826 female (FGN, 2007). The projected figure of 2012 was given as 231,116 (NPC, 2013). Hausa Fulani are the dominant inhabitants of the area. Other tribes are Yoruba, Igbo, Igala and Ibra.

2.2 Research Method

The data for the research have been collected from the meteorological station of Kano University of Science and Technology Wudil, on Temperature and Rainfall for the period of 10 years (2007-2016). Record from Wudil General Hospital on the disease had been collected for the corresponding years with the meteorological records.

Responses from the house hold members of the society with respect to their biodata, responses on seasonality of the diseases outbreak and climatic conditions were collected using a questionnaire. Stratified random sampling method was used where the study area is divided into Old town, New town and the G.R.A. A total of 50 respondents were selected from each of these areas at random.

The data collected was then subjected to descriptive statistics using Percentages and Means. The climatic data and the hospital record for the ten years were summarized and mean monthly values were calculated. The mean monthly values were then subjected to Multiple-linear Regression. This was used to test the impact of climatic factors on the frequency and occurrence of the outbreak. Multiple-linear Regression revealed the variability that exist between a dependent and independent variable (Shi et al 2011). It is used to form an explicit equation that explains the general variability in a data set with less complexity (Dominick et al 2012). The equation for MLR is:

$$Yi = \beta o + \beta 1 xIi + ... + \beta kxki + \varepsilon iEq(1)$$

Where $i = 1.....n$, $\beta 0$, $\beta 1$ and βk are regression coefficient, $x1$ and $xk$are independent variables and ε is error associated with the regression.

III. RESULTS AND DISCUSSION

3.1.1 Demographic characteristics of Respondents

The gender distribution is an important matter in the analysis of perception toward a given concentration in the area of research. This is because sometime what males perceive as a problem may not be the same as female.

Table 3.1 shows that males are the majority of the respondents and female are the least number, this happens because the Islamic religion does not allow female gender to move freely or to attend any occasion without their parents or husbands concern.

Table 3.1: Gender Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
	MALE	111	74.0	74.0	74.0
	FEMALE	39	26.0	26.0	100.0
	Total	150	100.0	100.0	

3.1.2 Age Distribution of the Respondent

Age distribution is an important aspect of the respondents; this is because different age groups may ascribe to different perception for certain phenomena.

Table 3.2 Represent the different age group of the respondents, which shows that 52% of the respondent interviewed fall between the age group of 18-30 years. Then followed by age between 31-40 which accounts for 22%, then age group of 41-50yrs with 14% the last 50 years and above constitutes 12%.This indicates that most of the respondents are youth.

Table 3.2: Age Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
	18-30	78	52.0	52.0	52.0
	31-40	33	22.0	22.0	74.0
	41-50	21	14.0	14.0	88.0
	51 AND ABOVE	18	12.0	12.0	100.0
	Total	150	100.0	100.0	

3.1.3 Occupational status

From what has been gathered, 52% of the respondents are self-employed in the study area, while 48% are civil servants. Table 3.3 shows the occupation distribution among the respondents in the study area.

Table 3.3: Occupational Status

		Frequency	Percent	Valid Percent	Cumulative Percent
	Civil Servant	72	48.0	48.0	48.0
	Self Employed	78	52.0	52.0	100.0
	Total	150	100.0	100.0	

3.1.4 Educational status

Table 3.4 shows the Educational level of the respondents. Most of them are secondary school attendants with 46%, then followed by those with Diploma/NCE at 26% and then those with Islamic education and Primary school at 10% each.

Table 3.4: Educational status

		Frequency	Percent	Valid Percent	Cumulative Percent
	Islamic Education	15	10.0	10.0	10.0
	Primary	15	10.0	10.0	20.0
	Secondary	69	46.0	46.0	66.0
	Diploma/NCE	39	26.0	26.0	92.0
	Degree	12	8.0	8.0	100.0
	Total	150	100.0	100.0	

3.1.5 Seasonal pattern of the Diseases outbreak

Table 3.5 shows respondents' view on seasons of diseases occurrence. The period of diseases occurrence is an important factor in epidemiological survey. This is why the research tries to look at the respondents' view. The research divided the period in to 2 seasons which is shown in the table below. 68% of the respondents believe that Dry and Hot Season (Bazara) has high rate of disease occurrence while 32% are of the belief that Dry and cool period (Kaka) has high rate of the disease occurrence.

Table 3.5: Seasonal pattern of the Diseases outbreak

SEASONS OF MEASLES OCCURRENCE					
		Frequency	Percent	Valid Percent	Cumulative Percent
	DRY AND HOT SEASON (BAZARA)	102	68.0	68.0	68.0
	DRY AND COOL SEASON (KAKA)	48	32.0	32.0	100.0
	Total	150	100.0	100.0	

3.1.6 Age vulnerability to Disease

In table 3.5, the respondents believes that children between the ages zero to five years are more vulnerable to the disease attack with 78%. And then followed by ages between six to eighteen years which have 22%

Table 3.6: Age vulnerability to Disease

MORE VULNERABLE TO DISEASES ATTACK					
		Frequency	Percent	Valid Percent	Cumulative Percent
	0-5	117	78.0	78.0	78.0
	6-18	33	22.0	22.0	100.0
	Total	150	100.0	100.0	

3.2 The impact of climatic element on measles outbreak

Table 3.7: Mean monthly pattern of climatic elements and measles

S/N	MONTHS	MEAN TEMPERATURE	MEAN RAINFALL	MEASLES OCCURRENCE
1	JANUARY	21.9^{O}C	0mm	3
2	FEBRUARY	26.67^{O}C	0mm	12
3	MARCH	28.67^{O}C	0.2mm	16
4	APRIL	32.67^{O}C	5.75mm	89
5	MAY	30.2 ^{O}C	33.6mm	88
6	JUNE	29.29 ^{O}C	146.75 mm	43
7	JULY	28.02 ^{O}C	96.2mm	17
8	AUGUST	26.8 ^{O}C	323.77 mm	99
9	SEPTEMBER	27.65 ^{O}C	141.82 mm	8
10	OCTOMBER	28.77 ^{O}C	32.05mm	4
11	NOVEMBER	27.47 ^{O}C	0mm	5
12	DECEMBER	21.1 ^{O}C	0mm	28
	TOTAL			412

- Multi linear Regression

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.814[a]	.663	.536	1.02018
a. Predictors: (Constant), MEASELES, RAINFALL, TEMPERETURE				

The results from the table above shows that the R-square value was 66.3% indicating that the variables included in the model could account for about 66.3% of the cerebrospinal meningitis.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.354	3	5.451	5.238	.027[b]
	Residual	8.326	8	1.041		

	Total	24.680	11			

The results from the table above shows that the F-statistic which measure the level of agreement among the independent variables was found to be significant at 5%. This indicated that the variables included in the model could jointly predict the output.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.349	.563		.619	.553
	TEMPERETURE	.000	.006	-.005	-.022	.010
	RAINFALL	-.001	.001	-.261	-1.235	.025
	MEASELES[a]	.035	.010	.734	3.435	.009
a. Dependent Variable: MEASLES						

From the results obtain from the table above it could be seen that temperature, rainfall and measles has all tested significant at 5%. The regression coefficients was found to be -0.005, -0.26 and 0.73 for temperature, rainfall and measles respectively. This implies that any increase in the temperature and rainfall by one unit, it will cause increase in measles by 0.734.

IV. CONCLUSION

The research findings has shown that temperature and rainfall have a significant impact on the outbreak of diseases like measles. The analysis revealed that there is a statistically significant relationship between weather parameters (Temperature and Rainfall) and the occurrence of measles in the study area. This corresponds with the views of the respondents that the hot and dry season is the period with the most frequent occurrence of measles followed by the cold and dry season. The study further observed that outbreak of measles disease is all year round as it is seen that there is no month without the occurrence of measles disease and the month of August recorded the highest cases of occurrence. The result obtained can be very useful for planning and policy making especially in the prevention and provision of health facilities. It can however be concluded that climatic variables alone cannot give an absolute description as to the spread and occurrence of measles.

V. RECOMMENDATION

1. An extensive and in-depth study should be undertaken for better understanding of the cause and pattern of the outbreak of infectious disease like measles among children.
2. Government should encourage immunization activities in order to prevent disease such as meningitis measles.
3. Communities' mobilization should be done in order to let people of the study area know their responsibility and importance of community participation in sanitation activities.
4. Government at all levels should focus on how the local and General hospital can be improved as to possess, all the necessary drugs and equipment for the treatment of those infected with the disease such as measles.
5. Health education should be adopted in order to let the community members have adequate awareness on the importance of having ventilation and its role on prevention of infectious diseases such as measles.

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