

**Analysis of the Effectiveness of Community Adaptation Strategies to Climate Change in  
relation to Diseases in Kano State, Nigeria**

By

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**Abstract**

Climate change has become one of the major issues in the world due to its various effects on the physical, chemical and biological system of the universe. The present research analyses effectiveness of community adaptation strategies to climate change in relation to disease in Kano State. The study utilized 784 questionnaires as an instrument for data collection, this was done through systematic sampling technique. The obtained data inform of Likert scale were analyses using percentages and weighted mean. Results showed that majority (78.6%) of the respondents slept in open space during hot condition, 73.8% slept indoor during cold condition, 67.9% use water storage facility during dry season and 64.7% plant trees, while majority (60.8%) of the respondents do not practice distance sleeping even during hot condition as climate change adaptation strategies against outbreak of disease. The study also revealed that sleeping indoors during cold condition with mean value of 3.87 is the most effective adaptation strategy to climate related diseases in the study area, this was followed by planting of trees with 3.73 while sleeping with distances between people with the mean value of 2.87 is not an adaptation strategy in the study area. The study concluded that people in the study area practice climate change adaptation strategies in relation to diseases. Therefore, the study recommended planting of trees as one of the most effective climate change adaptation strategies in relation to disease.

**Keywords: - Climate change, Disease, Community, Adaptation, Strategies**

**INTRODUCTION**

Climate change had become one of the major challenges to man and his environment. Asante and Amuakwa (2014) reported that climate change becomes one of the global issues as it affects the physical and biological systems of the universe. Maini et al. (2017) reported the impacts of climate change to have been more on health and climate – sensitive disasters. These impacts on public health happen to be either direct or indirect. The extreme climate related hazards such as storms, droughts, heat waves and floods were link to the direct impacts while the indirect are links with effect of climate change on secondary factors such as agricultural production which in turn, result in health problems (WHO, 2014 and Watts et al., 2018). Disease as define by Scarpelli and Burrows (2017) is any harmful deviation from the normal structural or functional state of an organism, associated with certain symptoms and signs differing in nature from

physical injury. Occurrence of disease and their transmission is related to many factors such as socioeconomic activities, vaccination and natural factors like changes on the climatic elements like temperature, relative humidity and rainfall.

According to Farmer and Murray (2015), although it is known that microscopic living microbes cause disease, the method of transmission is not always obvious. This therefore shows the importance of people perceptions on the linkages between climate change and outbreak of disease in their area and how effective are their adaption strategies. Greenwood et al. (1984) uses correlation analysis to investigate linkage between meningitis and some weather parameters (temperature, rainfall, humidity and harmattan dust) in Nigeria. Result of the study indicated peak of meningitis in the country to has been correlated significantly with highest temperature and inversely with absolute humidity and rainfall. Similarly, Omonijo et al. (2012) in Ondo State, studied the effect of thermal environment on the temporal, spatial and seasonal occurrence of measles in the State. Abdussalam (2014) in northwest of Nigeria also analyses the influence of climatic elements on the inter-annual variability of cholera and meningitis incidence in the region using Multiple Linear Regressions (MLR) and Generalized Linear Model (GLM) approaches. In Kano State Akinbobola and Hamisu (2018) also employed some weather variables to predicted measles occurrence in Kano metropolis using Autoregressive Moving Average Model (ARIMA). Despite the fact that, understanding previous and current environmental condition especially from the knowledge of experts and the community concern led to effective communication, mitigation and adaptation strategies to climate related diseases. And comprehensive approach to public health and outbreak of diseases is a function of various factors which include adaptation strategies related to the outbreak of diseases. Previous researchers in the study area paid less interest and attention to that. This implies further attention toward assessing community adaptation strategies to the impact of climate change on the occurrence of diseases in Kano State. This study employed Microsoft excel to analysis the effectiveness of community adaptation strategies to climate change in relation to the occurrence of diseases in the study area.

## **MATERIALS AND METHODS**

Kano State consists of 44 Local Government Areas (LGAs), out of which 36 are found in the rural area and 8 in the metropolitan area. The State bounded by Jigawa State to the Northern and North-East part, by the North West it was Katsina State, Bauchi State to the South-East, and Kaduna State to the South-West. The State extends from Latitude  $10^{\circ} 3' N$  to  $12^{\circ} 3' N$  and Longitude  $7^{\circ} 35' E$  to  $9^{\circ} 20' E$  (Figure: 1), and covers a total land mass of about 20,760sq km (Research and Documentation Directorate Kano, 2009). The climate characteristics of the State has been tropical continental with alternating wet and dry seasons classified as Aw, according to Koppen's classification scheme. The predominant period of maximum rainfall in the State begins in June to early September; and almost 40% falls in the month of August (Zakari et al., 2018). Source of water varies with the community, the metropolitan community relied mostly on open well and bore hole while the rural community relied upon open wells, dams and rivers. This

source of water was affected by climate change which leads to the scarcity and contamination of the water and consequently resulted to the outbreak of diseases.

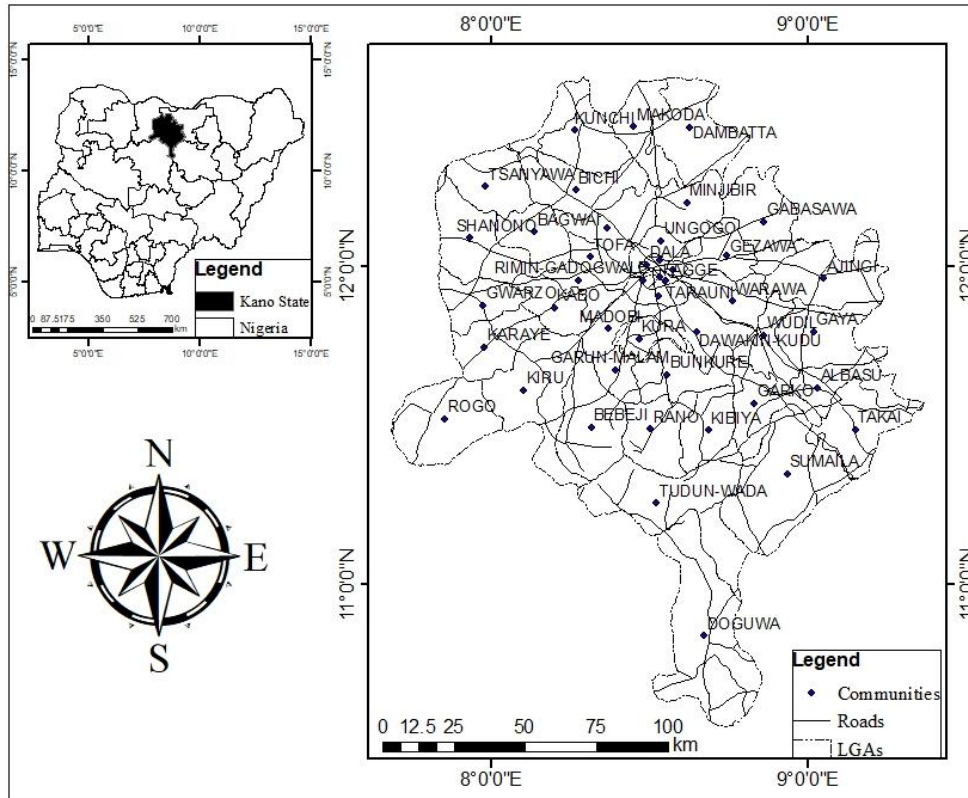


Figure 1: Study Area Map  
Source: Kano State Ministry of Land and Physical Planning

### DATA COLLECTION

The study employed the use of questionnaire for data collection. The questionnaire was informed of Likert scale in a range of 1 to 5, that is 5 = strongly agree, 4 = agree, 3 = uncertain, 2 = disagree and 1= strongly disagree. The population of Kano State which stood as 5,810,470 people with annual growth rate as 2.6% (National Population Commission, 1991) was projected to 2023 population figure for sampling technique. This was done using Newman’s (2001) method of population projection as given in equation 1:

$$P_n = P_0 + \left(\frac{1+R}{100} \times P_0\right)n \dots\dots\dots \text{Equation 1}$$

This gives a projected population of 12,713,308. To obtain the sample population Krejcie and Morgan’s (1970), which stated that, where a population ranges between 10,000,000 and 100,000,000, the sample size to use is 784 was adopted. Therefore, the sample size of 784 was used. A multi-stage sampling technique was adapted to arrive at sample size as presented in Table 1.

**Table 1: Sampled Size in the Study Area**

<b>Senatorial Zones</b>	<b>Selected LGAs</b>	<b>Sampled Wards</b>	<b>1991 Population</b>	<b>2023 Pop. Projection</b>	<b>Number of Respondents</b>	
Kano North	Dawakin Tofa	Dawaki west	16, 235	35,522	62	
		Marke	4,521	9,892	17	
	Kunchi	Kunchi	7,427	16,250	28	
		Shuwaki	2707	5,923	10	
Kano Central	Garun malam	Garun malam	10,142	22,191	39	
		Yalwan yada	3,217	7,039	12	
	Kumbotso	Chiranchi	19,614	42,915	75	
		Challawa	4,261	9,323	16	
	Nassarawa	Gama	40,147	87,842	153	
		Kaura goje	15,317	33,514	58	
Kano South	Bunkure	Bunkure	13,285	29,068	51	
		Gafan	2,847	6,229	11	
	Karaye	Karaye	9,617	21,042	37	
		Turawa	2,728	5,969	10	
	Rogo	Sabon Gari	16,085	35,194	61	
		Gwangwan	4,162	9,106	16	
	Wudil	Wudil	29, 969	65,572	114	
		Kausani	3,518	7,697	14	
	<b>Total</b>			<b>205,799</b>	<b>419,956</b>	<b>784</b>

**DATA ANALYSIS**

The researchers make used of descriptive statistics for the analyses and the results were presented in tables as used by WHO Regional Office for Europe (2018) in their study on the public health and climate change adaptation policies. This was done using the Likert scale points as 5 = strongly agreed, 4 = agreed, 3 = undecided, 2 = disagreed and 1 = strongly disagreed to assess the availability of adaptation strategies in the area was examine using percentage. After which, the effectiveness of the strategies was assess using the Likert scale points as 5 = highly effective, 4 = moderately effective, 3 = low effective, 2 = not effective, 1 = uncertain and the formular on equation 2. The results were finally determined based on the significant level, when the weighted mean is greater than or equal to 3 as significantly effective but, less than 3 as insignificantly effective.

$$W\bar{X} = \frac{\sum X_2 \times W_2 + X_2 \times W_2 \dots\dots\dots X_n \times W_n}{\sum X} \dots\dots\dots \text{Equation 2}$$

Where:

X - Stands for the frequency of the respondents for each of the Likert scale point

W - Represents the weight for each of the Likert scale points

ΣX - Stands for the total frequency

## RESULTS AND DISCUSSION

This section presents the results of the analysis conducted

### Availability of Community Adaptation Strategies in the Study Area

The results of the community adaptation strategies on climate change related to diseases in the study area are presented in Table 2. The Table shows that 36.6% of respondents disagreed and 24.2% strongly disagreed that they practice distances during sleeping, on the other hand, 16.1% agreed and 6.3% strongly agreed that they practice it, while 16.8% were undecided on this. This result therefore, indicates that many people in Kano State don't practice distancing during sleeping in order to protect themselves against diseases. This could be due to the high population density especially in the metropolis. The implication of this is that people might be easily infected by diseases this is more especially communicable diseases. This finding is in line with that of Baker et al (2013) who observed that in New Zealand approximately 10% of hospital admissions per year were linked with crowding in their households. Finding of this study also conform to the findings of Alemayehu et al. (2017) who attributed meningitis with crowds in Ethiopia.

**Table 2: Availability of the Community Adaptation Strategies in the Study Area**

<b>Adaptation Strategies</b>	<b>SA (%)</b>	<b>A (%)</b>	<b>U (%)</b>	<b>D (%)</b>	<b>SD (%)</b>
Distances during sleeping	6.3	16.1	16.8	36.6	24.2
Staying indoors	44.4	29.4	16.7	5.7	3.8
Sleeping in open space	42.2	36.4	13.1	2.8	5.5
Modification of dwelling environment	45.3	39.3	7.4	3.9	4.1
Provision of water storage facilities	30.8	37.1	17.5	10.7	3.9
Planting of vegetation resources such as trees	33.8	30.9	13.1	14.2	8.0

SA = Strongly agreed, A = Agreed, U = Undecided, D = Disagreed, SD = Strongly disagreed

Table 2 also indicated that, majority (44.4%) of the respondents strongly agreed and 29.4% agreed to the statement that, people in their locality stayed indoors as climate change adaptation strategy related to disease, while 3.8% strongly disagreed to that. This implied that people in Kano State employed the strategy of staying indoors when there is change in climatic condition such as cold weather. This conforms with the statement of Pachauri (2014) that changing weather patterns underline the importance of housing providing protection from cold, heat and extreme weather events necessitating people to think of proper adaptation strategies such as sleeping inside or outside rooms. During cold season majority of people in Kano State especially among low-income earners closed their doors and windows and slept under curtain to protect them against the negative impact of the situation.

Table 2 also revealed that 42.2% strongly agreed and 36.4% agreed with the statement that people sleep in open space as a climate adaptation strategy while 2.8% disagreed to that. Majority of people especially the low-income earners in the metropolitan area do sleep outside during hot season because rooms become very hot and there is epileptic power supply for use. People choose to sleep outside their rooms with mosquito net than sleeping in the rooms in order to protect their lives and also have peaceful night. This finding therefore, indicated that sleeping inside rooms during hot season is not proper; hence, people choose to sleep in open space as adaptation strategy to climate impacts. This result is in line with the Vital Statistic of Japan (2014) which established that in Japan heatstroke most often occurs to people who always stayed at home during warm/wet. The finding is also in line with that of Baker et al. (2007) who stated that people who spend most of their time indoors without air conditioning are exposed to an increased risk of diseases related with high indoor temperatures.

Modification of dwelling environment such as changing roofing materials and provision of appliances were considered as a climate change adaptation strategy. Respondents in the present study were asked if this system is applicable in their areas and majority (45.3%) of the respondents strongly agreed and 39.3% agreed to its applicability while 4.1% strongly disagreed to that and 7.4% were undecided. This implied that in the study area people modified their houses through provision of materials, restructuring their building and so forth in order to control the spread of diseases within their vicinity. This result is in line with the statement made by German Red Cross (2019) that some of the possible measures against the impact of climate change and disease transmission include providing cooling centers and buses, retrofitting houses in informal settlements such as shading roof installations, and procuring climate-friendly cooling systems.

This study also sought to know if people in the study area are using water storage facilities as adaptation strategies to climate change. The result as presented in Table 2 showed that majority (37.1%) of respondents agreed to the statement, followed by 30.8% who were strongly agreed to it, while the lowest percentage of 3.9% strongly disagreed to it. This result therefore implied that people in Kano State are still using water storage facilities in their houses. In the traditional Hausa communities some people especially, old women use water pot (Tulu) for safe keeping of drinking water. The importance attached to this is to have an access to cold water especially during hot weather conditions. Similarly, water storage facilities are being used by people in the study area in order to have qualitative and quantitative water especially during dry season. The climate of Kano State is very hot to the extent that during hot/dry season, water becomes hot, which makes some people in rural areas to use pot (Tulu) to store water for drinking purpose. Similarly, during dry season wells in the State become drier before another rainy season which necessitates the use of water storage facilities to store water. It was reported by Yalwa (2014) that rivers serve as the common source of water supply for the people of Kano north while open wells serve as the common water source for the people of Kano south and Kano central. This implied that there is need to provide means of water storage not even for its availability but in order to have access to clean water. This finding supports Guenther and Jarvis (2014) who reported that community requires proper water storage facilities into its water supply system, during water supply crisis as a key element for quality healthcare delivery.

Furthermore, the Table 2 showed that majority (33.8%) of the respondents strongly agreed and 30.9% agreed that people in their area do plant trees as a means of climate change adaptation

strategies related to the occurrence of diseases, while lowest percentage of 8% strongly disagreed to this. This implied that people of Kano State are aware of the important of planting trees. The implication of this awareness and practice is that many people may avoid indiscriminate felling of trees. In Kano city especially Government Reserved Areas (GRA), religious centers and institutions one can find many planted trees that help in stabilizing the weather condition of the places. This agrees with the statement of Gay et al. (2014) that people are aware of how ecosystem destruction which include indiscriminate felling of trees influence movement of micro-organisms which may consequently result to greater risk of disease outbreaks. This is also in line with the view of Bonnefoy (2007) that healthy housing relies on the immediate surrounding environment which include green space, protection from waste, pollution and the effects of disaster, whether natural or man-made.

### **Effectiveness of the Community Adaptation Strategies to Climate Change in the Study Area**

The result in Table 3 presents the results on the effectiveness of people adaptation strategies to climate change in relation to diseases. The finding in Table 3 showed that majority (37%) of respondents considered practicing distances during sleeping as not effective; this was followed by 23.3% low effective while 9.3% were uncertain. In view of these responses, the practice scored a weighted mean value of 2.87 and the lowest rank of 6 which implied that its effectiveness has been insignificant. This implied that majority of people in the study area do not regard crowd reduction as an effective strategy towards prevention the spread of diseases.

**Table 3: Effectiveness of the Community Adaptation Strategies to Climate Change**

<b>Adaptation Strategies</b>	<b>HE (%)</b>	<b>ME (%)</b>	<b>LE (%)</b>	<b>NE (%)</b>	<b>U (%)</b>	<b>W <math>\bar{X}</math> Mean</b>	<b>Rank</b>
Distances during sleeping	11.9	18.5	23.3	37.0	9.3	2.87	6
Staying indoors	32.3	40.9	12.1	11.3	3.4	3.87	1
Sleeping in open space	30.7	34.6	15.5	12.3	6.9	3.55	5
Modification of dwelling environment	33.8	30.1	14.8	11.1	10.2	3.7	3
Provision of water storage facilities	32.6	23.9	18.2	16.3	9.0	3.66	4
Planting of vegetation resources	37.8	28.1	13.9	9.7	10.5	3.73	2

HE = Highly effective, ME = Moderately effective, LE = Low effective, NE = Not effective and U – Uncertain

This result is not in agreement with the statement of Braconi (2001) that avoiding crowded areas is an effective adaptation strategy that supports good health outcomes. This variation may be due to the fact that the culture and attitudes of many people in Kano State is that, they are prepared to own a house no matter the size, provided that, it will accommodate their families. Moreover, the nature of business activities in the area doesn't permit distancing; hence people in the State disregard distances as a solution to disease infection. Therefore, majority of people in Kano State do not consider distance as a means of controlling diseases spread that is why even with the outbreak of Corona Virus (COVID – 19) government of Kano State and Nigeria at large found it difficult to stop people of Kano from going out.

Pertaining, the effectiveness of staying indoors, majority (40.9%) of respondents as presented in Table 3 considered the practice as moderately effective; while 32.3% consider it as highly

effective and 3.4% were uncertain. This practice scored the highest weighted mean value of 3.87 with ranking value of 1 which implied that the practice of staying indoors as an adaptation strategy to climate change that influences diseases in the study area have been highly effective. This result further means that majority of the respondents perceive staying indoor as an effective coping strategy toward the influence of climate change on public health in Kano State. People in Kano State adopt staying indoors and closing of doors and windows during cold/dry season in order to protect themselves against the changing weather. Although respondents in the study area consider staying indoors as an adaptation strategy to climate harshness during cold/dry, in temperate areas such as European countries in addition to staying indoors more heating is used. This supports Saeki et al. (2014) who reported that excess winter temperature in temperate regions of the world could be prevented not only by sleeping indoor but by improving the housing thermal environment.

On the effectiveness of the sleeping in open spaces, majority (34.6%) of the respondents as presented in Table 3 consider it as moderately effective, followed by those who considered it highly effective constituting 30.7% while the lowest response of 6.9% were those who were uncertain. The result further indicated that this activity scored a weighted mean value of 3.55 which means that its effectiveness has been significant. It is very effective in the sense that the weather of Kano State is very hot especially during hot/dry season therefore; sleeping in the rooms resulted to the occurrence of various diseases. This result is in agreement with that of WHO Regional office for Europe(2018) which showed that in developed countries during summer season people make use of air conditioner, insulation, certain building materials, wall thickness, shading from direct sunlight, natural ventilation, and increased air motion to cool indoor temperatures as an adaptation to climate change related diseases. However, in developing countries such as Nigeria people who are low-income earners find it difficult to own these facilities, that is why they make use of one of the options listed by WHO (natural ventilation) thereby sleeping in open space. This result is also in agreement with that of Howden-Chapman and Chapman (2012) who observed that for those who cannot sleep in open space during excessive heat, they can stay in door with the additional appliances such as improving thermal insulation, weatherization and ventilation, and installing energy efficient heating apparatus.

On the effectiveness of modification of dwelling environment such as changing roofing materials and provision of appliances, majority (33.8%) of the respondents as indicated in Table 3 said it is highly effective and 30.1% see it as moderately effective while 10.2% were uncertain. Based on the given responses, the modification of dwelling environment scored the weighted mean value of 3.7 with ranking order of 3 which implied that the practice have been significantly effective. Many people in Kano State believed that their home and its surrounding environment require frequent maintenance which includes changing the damaged paints. This result is in agreement with that of Dengel et al. (2016) which showed that improved ventilation and provision of house appliances such as air conditioner were very effective toward the decreasing the occurrence of climate change related diseases.

Responses on the effectiveness of the provision of water storage facilities are presented in Table 3. The result revealed that majority (32.6%) of the respondents considered it as highly effective, followed by those who considered it as moderately effective constituting 23.9% while the lowest response of 9% were uncertain. The finding indicated that this activity scored a weighted mean value of 3.66 with a ranking of 4 which implied that this system's effectiveness has been



significant. It is the attitude of households in Kano State to provide water storage facilities to their families. It has gone even to the extent that during wedding, the parents of the bride will purchase water storage facilities for their daughter. People in the study area considered this adaptation strategy as very effective because it serves as a means of getting clean water especially during dry season when water in the area becomes scarce and of poor quality. Furthermore, the low-income earners especially among rural communities keep water in pots during hot season so as to get cold water for drinking. This supports IPCC (2014) that people are at risks from the incidence of climate change that include flood risk due to extreme precipitation, and water scarcity during dry season or when precipitation becomes low. Therefore, integrating water storage system into adaptation strategies to climate change related diseases according to World Bank Group (2017) will strengthen community health and health sector as a whole by ensuring access to sustainable, safe and clean water to the people; so, these agree with the result of this research.

The Table 3 indicated that majority (37.8%) of the respondents were of the view that planting of vegetation has always been an effective adaptation strategy to climate-related diseases. This was followed by 28.1% who see it as moderately effective while lowest percentage of 10.5% was uncertain about that. The result also revealed that this practice scored weighted mean of 3.73 which gives it a ranking position of number 2 implying that its effectiveness is significant. This agrees with Loughnan et al. (2014) that availability of urban green infrastructure renders the community especially socioeconomically disadvantaged community less vulnerable to climate-related diseases. This result is also in agreement with the observation of Jacobs et al. (2015) who reported that some green housing elements that are typically included in standard building structures are associated with good health outcomes. The finding also corresponds with the report of Vital Statistic of Japan (2014) that building materials and house orientation, window shades and green spaces were some of the coping strategies associated with occurrence of climate related diseases.

## **CONCLUSION AND RECOMMENDATIONS**

Detail information about how people adapt to the changes in climatic condition is highly essential for sustainable development and protection against outbreak of diseases. The study utilized the use of questionnaire survey to solicited information on adaptation strategies to climate related diseases in Kano State. The study concluded that staying indoors, planting of vegetation resources, and modification of dwelling environment were the most effective adaptation strategies employed by the peoples of the study area. The study recommended that Kano State Ministry of Health should collaborate with the Ministry of Environment to develop special programs that integrate climate with the environment and diseases surveillance in the State.

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