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Sokoto Journal of Geographical Studies (SJGS) is a double-blind peer reviewed journal that is being published in **July** and **December** annually, by the Department of Geography Sokoto State University, Sokoto-Nigeria. The Journal provides a platform for researchers and academicians around the world in order to promote healthy intellectual discourse concerning research, preservation and dissemination of academic knowledge. The journal adopts a multidisciplinary approach to scholarship in all areas of Geographical Studies.

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ASSESSMENT OF CLIMATE CHANGE EFFECTS ON HUMAN HEALTH IN SOKOTO STATE, NIGERIA

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Abstract

Nigeria is one of the countries expected to be most affected by the impact of climate change on health aspect through sea level rise, extreme temperature, changes in precipitations and pattern of wind, flooding, disasters and general health effect that has now becomes a common sight. Changes in climate variability in Nigeria has direct and indirect impact on aspect of human environment, which in turns affected aspect of human health and development of some diseases such as lung diseases, cancer, cardiovascular diseases, stroke, and water borne diseases among others. the paper aimed at assessing the impact of climate variability and climate change on human health, examining the adaptation strategies as well as major diseases associated with them. A total number of 220 medical and Para-medical staffs were interviewed in Sokoto state using a combination of snowball and purposive sampling techniques concerning the impact of climate change and changes of climate variability on human health. The result shows that the major diseases caused by the climatic change in Nigeria are lung diseases, allergies disorder, eye diseases, respiratory disorder, water borne diseases and skin rashes accounted for 74%. The paper recommended some mitigations and adaptation strategies by Reduction of greenhouse gas emission from burning of fossil fuels, cutting down of tress, bush burning, emissions from transportation and other anthropogenic activities; Plantation of trees to maintain the global circle by removing carbon dioxide (co₂) from the atmosphere and store it as plant biomass and produce oxygen for human consumption and Improvement of cultivation methods will increase agricultural efficiency, reduce the loss of natural resources and overcome hunger and malnutrition induced by climate change impact. The paper also recommended the creating of adequate public awareness on climate change and its effects on human health so that individual, group and community will understand and get well prepared, response to any effects induced by climate change and manage it accordingly.

Keywords: *Climate Change, Mitigations, Adaptations and Human Health.*

Introduction

Climate change refers to a long-term significant change in the average weather element that is being experienced by any given region of the world. The element includes temperature, precipitation and wind pattern and the changes in these elements over years ranging from decades to millions of years (Ayoade, 2003 and Efe, 2009). However, these changes can be identified by using statistical test as it was carried out by IPCC, 2007. The climate change is one of the greatest health challenges affecting numerous people in Nigeria, for example, risen of sea level, changes in precipitation per annum, resulting in flooding and drought, heat waves, more intense hurricane and storms and degraded air quality, seriously affected human health directly or indirectly. The inter-governmental panel on climate change IPCC, 2001 and 2007 declares that natural and human induced environmental changes is one of the most serious risks and damage potentials to human existence. About 2500 years ago, Hippocrates noted his observations about the influence of climate on public health, especially on the incidence and severity of various

infectious diseases (Falagas, Bliziotis, Kosmidis & Daikos 2010). However, the future health outcomes may result from yet unknown climatic conditions, which in conjunction with other environmental changes, may also increase the likelihood of unfamiliar health outcomes, including the emergence of “new” infectious disease agents (Patz, Epstein, Burke & Balbus 1996).

Climate change is an emerging global issue that is critically affecting the development of many sectors in the world and is considered to be one of the most serious global threats to sustainable development. Internationally, an unprecedented increase in greenhouse emissions has led to increased climate change impacts across the world (Ozor and Nnaji, 2011). Many scholars believed that climate change will affect all nations especially the developing countries of Africa. The Intergovernmental Panel on Climate Change (IPCC) had predicted that Africa is the most vulnerable to climate change impacts (IPCC, 2007).

Climate change is a significant threat to the health people globally. It is the result of the build-up of greenhouse gases in the atmosphere, primarily from the burning of fossil fuels, such as oil and gasoline, for energy and other human activities. These gases, such as carbon dioxide and methane, warm and alter the global climate. Temperatures and the frequency of heavy rain and snow have been increasing in many countries of the world. The changes in temperature and precipitation, as well as other changes, such as more intense severe weather and rising sea levels, all have effects on people’s environments that can in turn harm their health and well-being.

Pest and diseases are implicated in climate change. Significant climatic condition such as temperature, precipitation, sunshine and wind can affect and accelerate their dispersion and their increase. Pest and diseases can adversely affect animal husbandry, it also causes human illness such as malaria, cholera, typhoid fever, among others which in turn affects the effectiveness and productivity of Nigerians (Ayoade 2003). The IPCC (2007) assessment reports clearly indicated that climate is changing and global warming is having major impacts on the earth, including melting of polar ice, sea level rise, and coastal inundation and flooding with threats to critical health situation among the populace.

However, it is saddening to note that Africa contributes less than 4% of the greenhouse gas emissions that contribute to climate change and yet it is most vulnerable to the impacts of the change. The adverse effects on poor people and poor countries in the continent are particularly severe because these people and countries depend more directly on natural resources and are less able to adapt to climate variations and extreme weather. Poor people in developing countries especially in Sub-Saharan Africa are affected by environmental change because they are much more exposed to existential risks such as disease, hunger, low income and most importantly poor adaptive capacities German Advisory Council on Global Change (WBGU, 2005).

According to United State National Institutes of Health NIH (2016) Climate change is a global process, it has both local and regional impacts that profoundly affect communities. Some of these effects are relatively direct, as when heat waves or intense hurricanes cause injury and illness, and even death. Some health effects of climate change are indirect and involve changes in our environment that in turn can affect human health and diseases. For example, changes in temperatures and rainfall can have a strong effect on the lifecycles of insects and other species that transmit diseases; rising sea levels can worsen the flooding from hurricanes in coastal areas, leading to human exposures to water and areas contaminated by industrial pollutants and hazardous wastes. In all cases, the effects of climate change occur in combination with other well-known health stressors, such as poverty, social disadvantage, impaired language ability, and others social determinants of health.

However, climate change endangered human health and affect all sector of the society domestically and globally. Many evidences show that the environmental consequences of climate change both already observed and those anticipating have debilitating effect on human health (WHO, 2005). According to Rocque, Beaudoin, Ndjaboue, *et al.* (2021), climate change is impacting on health of Nigerians in many ways such as respiratory allergies, airways and water borne diseases as well as development of pathogens and vectored microorganism, but many are unaware and hardly trace their health changes as a result of climate change. Likewise, Abiodun (2007), maintain that harmattan coming from Sahara Desert had direct bearing on climate change and the health impact on the people. He stressed that as soil become hot, malaria organism rise up and fined human body convenient for its survival.

Climate change is caused by the change in each component of the climate system such as atmosphere, hydrosphere, biosphere and lithosphere or by complicated interactions among those components. The causes of climate change are largely divided into natural causes and artificial causes. Natural causes include the change in solar activity, volcanic eruption, sea water temperature, ice cap distribution, westerly waves and atmospheric waves. On the other hand, artificial causes include carbon dioxide emission from industry and agricultural production activities, deforestation, acid rain and the destruction of the ozone layer by Freon gas, with global warming by the increase of greenhouse gases as the representative (Presidential Advisory Council on Education, Science & Technology: PACEST, 2007).

Climate change will affect all economic sectors of Africa and will therefore present unprecedented challenges for the continent, particularly in terms of meeting its sustainable development objectives, including the millennium development goals (MDGs). Indeed, climate change is already eroding decades of hard-won national and international development gains, thus the need for concerted and coherent efforts in urgently tackling the development challenge. This challenge has further exacerbated poverty in Africa as rising temperature and sea level results in undue flooding, droughts, and salinization in low lying areas. The consequences of climate change are therefore at a degree that requires exigency not only to the efforts to avert further change, but similarly significant efforts to adapt to the impacts already taking place (Oladipo, 2010).

According to National Institute for Health (NIH, 2016), the most vulnerable people affected by climate change on health as a result of environmental and socio-demographic factors are as follows, low-income group, occupational group; indigenous people, children and pregnant women; people with disability and people with chronic medical condition. Climate change refers to changes beyond the average atmospheric condition that are caused both by natural factors such as the orbit of earth's revolution, volcanic activities and crustal movements and by artificial factors such as the increase in the concentration of greenhouse gases and aerosol. In June 1992 about 150 countries signed in support of the United Nations framework Convention on climate change in Rio de Janeiro indicating the widespread recognition that climate change is potentially a major threat to the world's environment and economic development, and in line with the obviously obvious raising of the global temperature leading to the global warming as results of atmospheric changes occurred due to human activities over the environment. Meanwhile, the impact of climate variability and climate change on health is certain, health outcomes are known to be associated with weather and climate these include illnesses and death associated with extreme in temperature and precipitation, air pollution, water contamination, survival of pathogens in the environments.

Climate change will affect all economic sectors of Africa and will therefore present unprecedented challenges for the continent, particularly in terms of meeting its sustainable development objectives, including the millennium development goals (MDGs). Indeed, climate change is already eroding decades of hard-won national and international development gains, thus the need for concerted and coherent efforts in urgently tackling the development challenge. This challenge has further exacerbated poverty in Africa as rising temperature and sea level results in undue flooding, droughts, and salinization in low lying areas. The consequences of climate change are therefore at a degree that requires exigency not only to the efforts to avert further change, but similarly significant efforts to adapt to the impacts already taking place (Oladipo, 2010).

Rapid global effect of climate change necessitated the United Nations organized series of conferences in order to provide long-lasting solutions to the embodiment of climate change. For example, the previous COP 26, COP 27 which took place in Glasgow held to called for climate action and also demanded for a greater say in negotiation by the world leaders including the Nigerian presidents.

Some studies have documented the multiple health impacts of climate change, including an increase in infectious diseases, respiratory disorders, heat- related morbidity and mortality, under nutrition due to food insecurity, and adverse health outcomes ensuing from increased socio-political tension and conflicts (Patz, Fruniking and Holloway 2014 and Roque, Beaudoin, Ndjaboue et al. 2021). Impact, the most recent Lancet Countdown report, which investigates 43 indicators of the relationship between climate change and human health, arrived at their most worrisome findings since the beginning of their on- going annual work. Some scholars believed that, climate change endangered human health and affect all sector of the society domestically and globally. It is against this background that this study Seeks to analyze the impact of climate variability and climate change on human health.

Aim and Objectives of the Study

The aim of this study is to analyze the impact of climate change on human health. The specific objectives of the study are to:

- i.** to examine the major diseases associated with the effect of climate change on human health in the study area
- ii.** to assess the most vulnerable people to the effect of climate change on human health in the study area.

The Study Area

Sokoto State is located in the North-west geo-political zone between latitudes 12^o 00'N and 13^o58' and between longitudes 4^o8'E and 6^o54'E. By its location, it shares boundaries with the Republic of Niger to the North, Kebbi State to the West and South-West, and Zamfara State to the East. The state covers a total land area of about 32,000km² and has a population of 4,903,095 2017 projection, distributed across 23 local government areas (NPC, 2006). The state faced some changes as a result of creation of Kebbi and Zamfara States in 1991 and 1996 respectively. The state has twenty-three (23) local government areas with three senatorial districts namely Sokoto East, Sokoto North and Sokoto South senatorial districts (Figure 1). However, the state has 120 health districts and 244 political wards (MBEP, 2012). The current health status indices are poor and among the worst in the country as indicated by Nigeria Demographic and Health Survey (NDHS, 2008) among other studies. Crude Birth Rate is 41.7 per 1000, Infant Mortality Rate is

100 per 1,000 live births, Under Five Mortality Rate is 166/1000 live births and Maternal Mortality Rate 850/100,000. Current use of contraception, any method is 2.1%, with any modern method as 1.9% (NDHS, 2008, SSMOH, 2009). Other maternal health indicators in the State include 13.8% receiving Antenatal care (ANC) from a health professional, 6.8% percentage of pregnant women whose last live birth was protected against number needed to treats (NNT), percentage delivered by a health professional is 5.1%; and percentage delivered in a health facility is 4.4%. In general, malaria, diarrhea, pneumonia, measles, Human Immune Deficiency Virus (HIV) and Tuberculosis (TB) still constitute the major burden of prevailing diseases in the general population within the state (SSMOH, 2009).

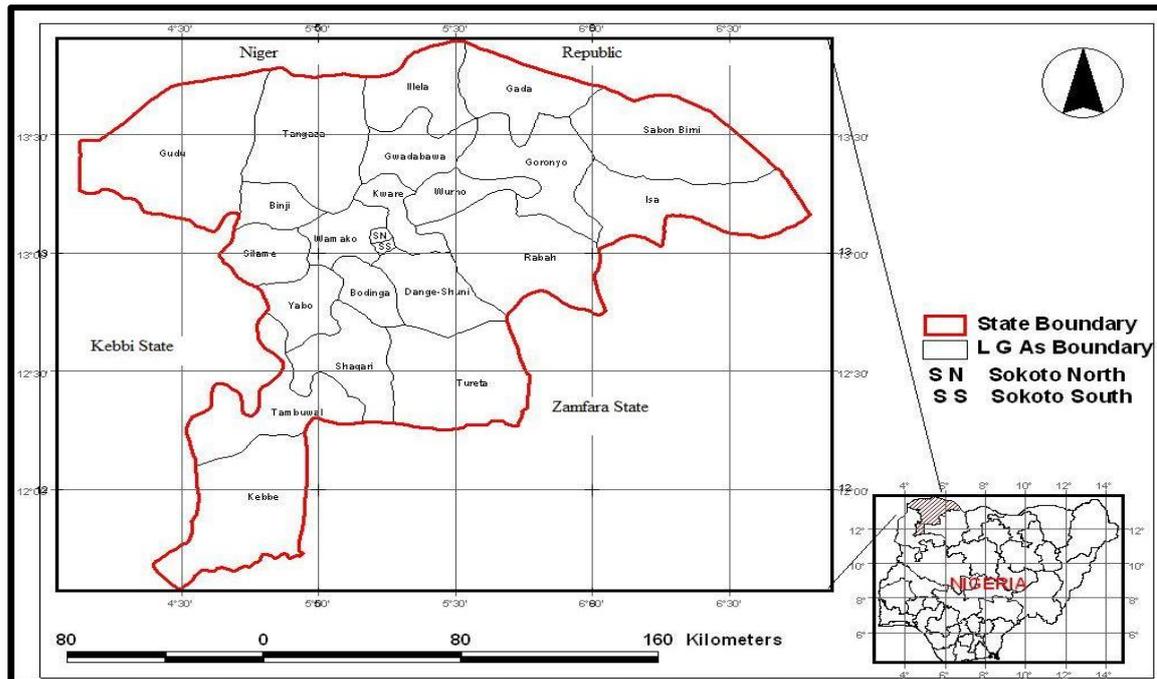


Figure 1: Nigeria Showing Sokoto State with 23 Local Government Areas

Source: Authors (2023)

Research Method

In this research study, mixed methods were employed where both qualitative and quantitative data were used (popularly known as triangulation) in order to describe and explain the impact of Climate variability and climate change in Sokoto state. The population of this study consist of Medical, Para-medical personnel, geographers and environmentalist. Meanwhile, the choice of quantitative data types for the study is because the research involves direct measurements of Climate variability data in the state. Moreover, qualitative data were obtained by administering structured questionnaires and in-depth interview with the medical Para medical staff, Geographers and environmentalist.

Types and Sources of Data

In order to achieve the set objectives for this study, relevant data and information were collected from primary sources. Primary data were collected by administering a structured questionnaire and interview checklist to population under study. Similarly, coordinates of some areas from the selected local government areas were collected using the Global Positional System (GPS) in order to identify their location in the state.

Sampling Techniques and Procedures

In order to have a truly representative sample and minimize sampling error for profound general statement, multi-stage sampling techniques was used, to select respondent from State ministry of health, ministry of environment and Association of Nigerian Geographers and Non-Governmental organization working on climate change issues, such as Go green, climate action group, climate change initiative and eco African climate change action group. Meanwhile, two, (2) referral healthcare facilities were selected to represent the healthcare facilities in the state, i.e. Usmanu Danfodiyo university teaching hospital Sokoto UDUTH and Specialist Hospital Sokoto (SHS) using purposive sampling techniques. Two 2 NGOs working on climate change issues and members of these NGOs were selected using a combination of purposive and snowballing sampling techniques, As can be seen from Table 1 below. However, from each of the selected ministry healthcare facilities association of Nigerian geographers ANG and NGOs ten (10) questionnaires were distributed to the respondent selected using purposive sampling. Moreover, from each category some members were also selected for interview such as directors, head of association. The reason for sampling respondents using purposive sampling techniques is to select respondents based on their basic knowledge and experience based on the topic of discussions, while for snowballing techniques is for the respondent to link us with resourceful person who can shared his knowledge and experience pertaining the topic of discussion.

Table 1: Sample of Population of the Study

Selected Places	Sample of Respondents
1. Ministry of Health, Sokoto State	13 Respondents
2. Ministry of Environment, Sokoto State	12 Respondents
3. Referral healthcare facilities (HCF)	
1. UDUTH	10 Respondents
2. Specialist Hospital	08 Respondents
4. Association of Nigerian geographers ANG	14 Respondents
5. NGOs	
1. Go Green Foundation	07 Respondents
2, Green Habital Initiative	06 Respondents
Total	70 Respondents

Source: Authors (2023)

Method of Data Analysis and Presentation

The data obtained from administered primary sources through questionnaires were analyzed and presented using both descriptive and inferential statistics accordingly. The secondary data collected were analyzed and mapped. Descriptive statistics were used to present frequency distribution, tables, graphs and charts using Microsoft Excel. The reason is that Microsoft Excel is one of the best, comprehensive and flexible statistical and management packages for synthesizing and analyzing data.

Results and Discussion

This segment analyses and presents results of the investigations conducted as explained above. The segment is divided into two sections A and B: Section A deals with the profile of the respondents while section B deals with the effect of climate change on human health.

Section A: Profile of Respondents

Age Distribution

Figure 2 shows the age group of the respondents. The result shows that the 31% of respondents fall in between 31-40 years, and 25% between 20-30 years and only 6% are 61 years and above of age group. This shows the demographic feature of professionals in the state in which the greater proportion of the respondents fall within the productive age of 31 to 50 years after which it starts to decline.

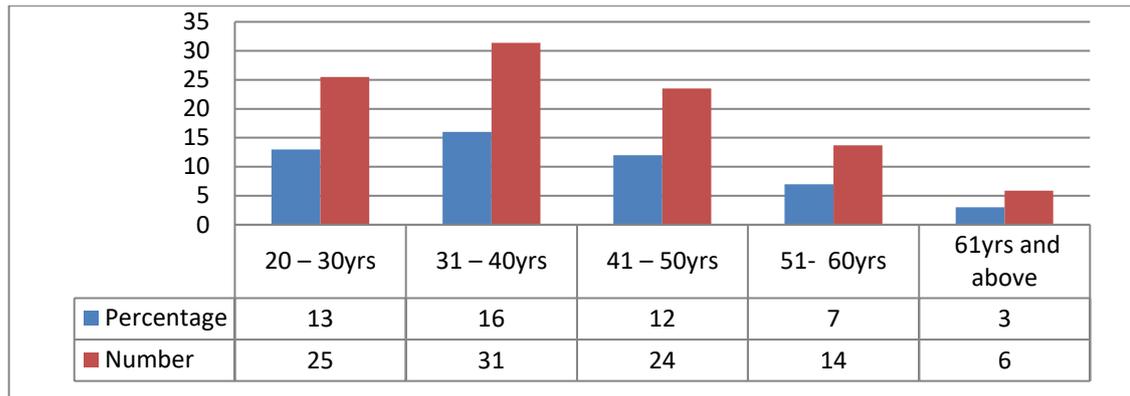


Figure 2: Age of the Respondents
Source: Authors (2023)

Gender of the Respondents

Figure 3 presents responses on the sex of the respondents in which 84% are male and only 16 are female. This shows that most of the respondents in Sokoto metropolis are male. This is attached to socio-cultural setting of the area, whereby men dominate most of the socio-economic activities including the white color job.

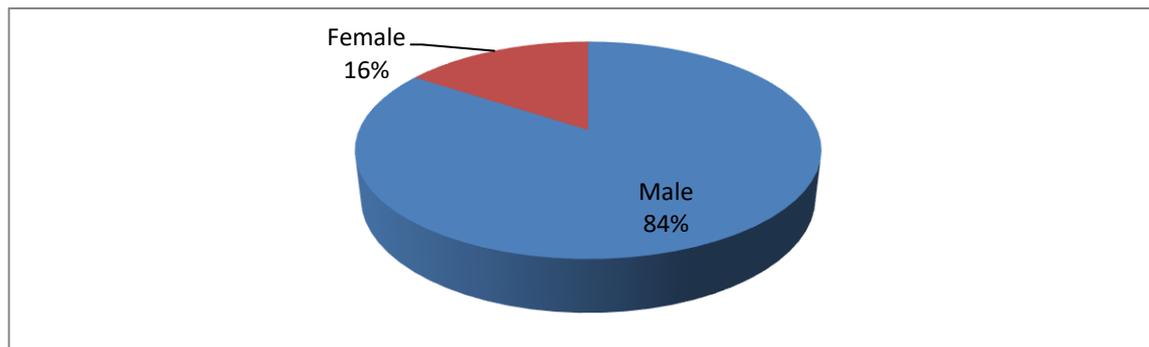


Figure 3: Gender of the Respondents
Source: Authors (2023)

Profession of the Respondents

Figure 4, shows that 37% and 24% are geographer/environmentalist and medical doctors respectively, while nurses accounted for 16%. Laboratory scientist and health information management scored 10% each, while pharmacist represents 2%. This indicated that the high level of self-reliance of the respondents who engage themselves in various developmental activities, such white-collar job, once they are 20 years and above.

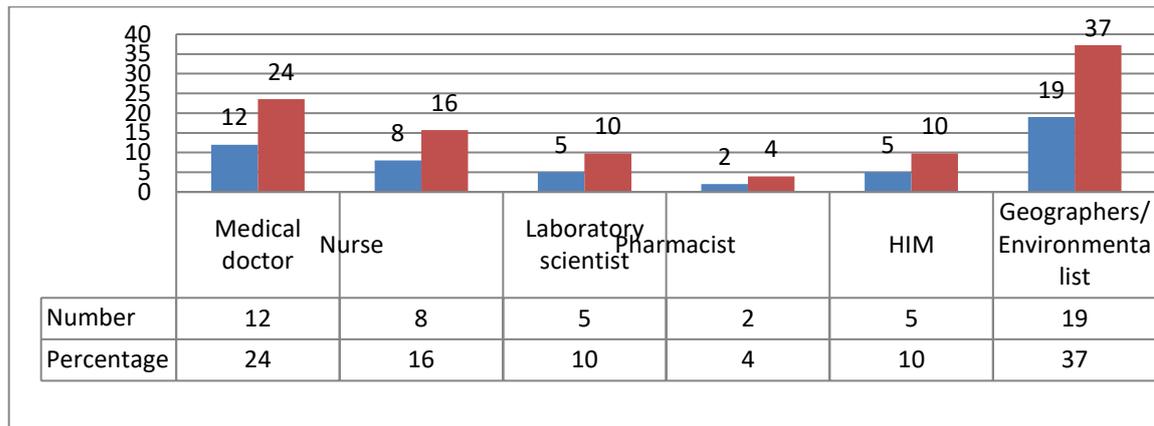


Figure 4: Professional Status of Respondents
Source: Authors (2023)

Educational Attainment of Respondents

Figure 5 presents responses on educational background of the respondents where some 23% and 15% had obtained B.Sc/B.A/MBBS/HND certificates and OND certificates respectively. Those with M.Sc and PhD qualifications represent 9% and 4% respectively. This attest to the fact that the respondents are well educated as the majority obtained first degree.

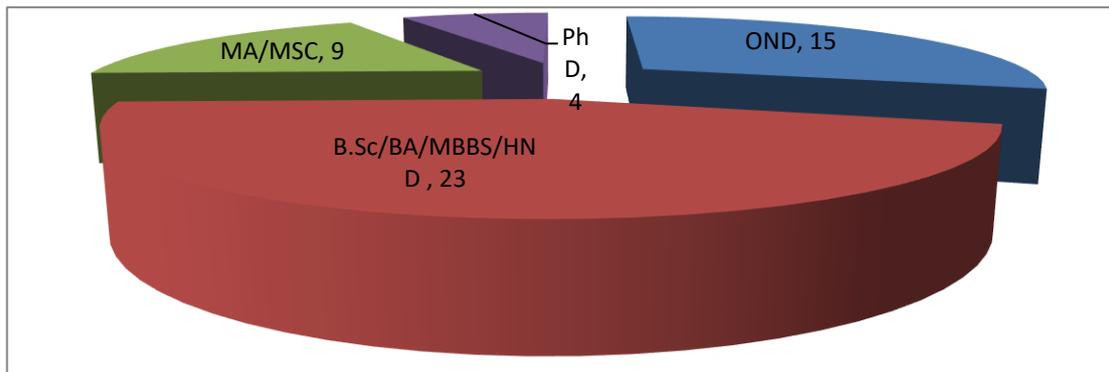


Figure 5: Educational Attainments of Respondents
Source: Authors (2023)

Section B: Impact of Climate Change on Human Health in Sokoto State

Major Health Implication of Climate Change and Climate Variability in Sokoto State

Table 2 Health Effect of Climate Change in Sokoto State

Health effect of Climate Change	Frecquency	Percentage
Extreme of weather condition hot and cool	51	100
Environmental degradation	48	94
Inadequate food and water supply	51	100
Poor water quality standard	48	94
Prevalence of allergens	38	75
Air pollution	51	100
Changes in vector ecology	38	75
Psycho social impact	38	75
Total Multiple Response		

Source: Authors (2023)

Table 2 above show that extreme of weather condition (degree of hotness and coldness), inadequate food and water supply, air pollution, changes in vector ecology, are the major health implication of climate change on health with 100% responses, followed by environmental degradation and poor quality of water with 94% responses. While prevalence of allergens and psycho social disorder accounted for 38 responses for each. However, these effects of climate change in turn affect the complete physical, mental and social wellbeing as WHO (2000), define the term health. For instance, degradation of environment may affect the sources of water and food supply, and other means of livelihood, this is because literatures show that 65% of the inhabitants of Sokoto state are agrarian farmers. Similarly, flooding and drought as a result of heavy downpour or absent of rainfall may also affect the sources of livelihood and in turn lead to the prevalence of diseases the socioeconomic wellbeing of the people and sometimes lead to death.

Illnesses Associated with Extremes of Weather Condition in Sokoto State

Table 3: Diseases Associated with Extremes of Weather Condition in Sokoto State

Diseases Associated with Extremity of Weather Condition	Frequency	Percentage
Health related illness	51	100
Cardiovascular failure	41	80
Injuries,	49	96
Mental disorder	49	96
Meningitis	42	82
Malaria fever	44	86
Diarrhea	46	90
Exacerbate chronic health condition such as diabetes, cardiovascular diseases, and obesity among others	46	90
Rheumatism	41	80
Sun burns diseases	42	82
Arthritis	47	92
Carrrtarh	47	92
Total Multiple Response		

Source: Authors (2023)

Extremes in of weather condition refer to extremity in the degree of hotness or coldness as a result of changes in climate variability. As can be seen from Table 3 above, greatest percentage of respondents show that cardiovascular disorders such as heart failure, hypertension, and cardiac failure, prevalence of malaria fever, meningitis, diarrhea, rheumatism, arthritis, catarrh and common cold are the major diseases associated with extremity of weather condition ranging from 80-100% responses. Others are injuries, mental disorder, heat stroke, dehydration and worsening the chronic ill health condition such as hypertension, diabetes, and obesity among others. These findings correspond with what Abiodun (2007), and Ayoade (2003) and WHO, (2005) reveals bout the effect of climate change on health of Africans and Nigerian inclusive.

Effect of Environmental Degradation on Human Health

Table 4: Diseases Associated with Environmental Degradation in Sokoto State

Effect of Environmental degradation on Human Health	Frequency	Percentage
Forceful migration	51	100
Insecurity	51	100
Mental disorder	44	86
Diseases diffusion	33	65
Malnutrition	38	75
Cholera out break	38	75
Total		

Source: Authors (2023)

Environmental degradation refers to the reduction in the quality and capacity of an environment in terms of agriculture, sources of raw materials and the like. As can be seen from Table 4 above the effects of environmental degradation on human health, are force migration, 100%, insecurity, 100% metal disorder 85%, malnutrition 75%, cholera outbreak 75% and diseases diffusion 65%. This shows that loosing of quality of the environment affects human health in many ways ranging from physical, mental, social and economic wellbeing of the people.

Effect of Inadequate Water, Food Supply and Drought on Human Health

Water and food are necessary and basic requirement for human health and survival. Figure 6 show that malnutrition, hunger, cholera outbreak, respiratory diseases push migration and mental disorder are the diseases associated with inadequate water of food supply ranges from 80 -100 % of responses. This corresponds with IPCC (2007) which indicated that Africa faced inadequate water supply as a result of impact of climate change.



Figure 6: Diseases Associated with Inadequate Water and Food Supply on Human Health in Sokoto State
Source: Authors (2023)

The Most Vulnerable Group to the Effect of Climate Change in Sokoto State

Table 5: People of Higher Risk of Effect of Climate Change in Sokoto State

Health effect of Climate Change	Frequency	Percentage
Low-income earners	51	100
Laborers	49	96
Children	49	96
Pregnant women	44	86
Aged	44	86
Farmers	31	60
People with disability	41	80
people suffering with chronic diseases	36	70
Total Multiple Response		

Source: Authors (2023)

Table 5 above show that the people and group of people that are most vulnerable to the effects of climate change are low-income earners 100%, laborers 96% children 96%, pregnant women 85% and aged people 85%, people with disability 80%, people suffering with chronic ill health such as diabetes, cardiovascular disorders hypertension and obesity among others with 70% and people engaged in farm activities accounted for 60%. This finding is tantamount to what Oladipo, (2010), and UGCRP, (2016) pointed out that, laborers, children and aged people are the most vulnerable people to the effect of climate change on human health. Similarly, we can understand that most of the low-income earners are the category of people who are always out searching for means of survival, and for the children's pregnant women and aged people their immune system is weak and can get easily affected with the impact of climate change on their health.

Effect of Flooding on Human Health in Sokoto State

Table 6: Diseases Associated with Flooding on Human Health in Sokoto State

Effect of Flooding on Human Health	Frequency	Percentage
Water borne diseases such cholera, typhoid, dysentery, diarrhoea	49	96
Increase in vectored microorganism	38	75
Survival of pathogens	35	68
Increase of infectious diseases	38	75
Respiratory disorder	32	62
Total Multiple Response		

Source: Authors (2023)

Flooding refers to a situation whereby some areas are submerged with water as a result of heavy rainfall, blockage of culvert and breakdown of dams which sometimes lead to the loss of farmland, properties, prevalence of diseases and even the loss of lives in the affected area. Flooding is the component of climate change effect on human health, and annually many areas in the state are affected. As can be seen from Table 6 above the major illnesses associated with flooding in the state are increase of water borne diseases, 95% such as cholera outbreak, typhoid fever dysentery, diarrhea, and increased in infectious diseases 74% such as salmonellosis and shigellosis, increase survival of pathogens 68% and respiratory disorder accounted for 62%. This shows that flooding has a significant impact on human health in Sokoto state.

Perceptions of People on the Impact of Climate Change on Health in Sokoto State

The study indicated that respondents are aware of the implication of climate change on health as the greatest percentage of 85% agreed that climate change has a significance impact on human health it was only 15% are neutral. This means that professionals in the state are aware of the health effect of climate change on human health in Sokoto state.

Effect of Air Pollution on Human Health in Sokoto State

Table 7: Diseases Associated with Air Pollution on Human Health in Sokoto State

Effect of Air Pollution on Human Health	Frequency	Percentage
Asthma,	44	86
Allergies disorder,	44	86
Acute chronic respiratory disorder,	40	78
Water borne diseases	40	78
Eyes diseases,	38	74
Lung Diseases,	38	74
Cholera,	36	70
Typhoid fever	34	67
Dengue fever,	32	63
Skin rashes	32	63
Total Multiple Response	378	

Source: Authors (2023)

Table 7 above indicates that air pollution as a result of climate change has an effect on human health and resulted to some ill health condition as follows asthma 85%, allergies disorder 85%, acute chronic diseases 78%, whooping cough 74%, cholera 70%, eye diseases 74%, typhoid fever 67%, dengue fever and skin rashes account for 63 and 60% respectively.

Conclusion and Recommendations

The study found that climate change and changes in climate variability has very significant impact on human health in Sokoto state. These effects include. Extremity in weather conditions, environmental degradation, inadequate food and water supply, poor water quality standard and air pollution among others which in turn affect the physical, mental and social wellbeing of the people. The study recommended that reduction of greenhouse gas emission from burning of fossil fuels, cutting down of tress, bush burning, emissions from transportation and other anthropogenic activities and Plantation of trees to maintain the global circle by removing carbon dioxide (CO₂) from the atmosphere to mitigate and adopt to the effect of climate change impact on human health. The study comes up with the following recommendations aimed at mitigating and adapting the effect of climate change on human health in Sokoto State. They are as follows:

1. Reduction of greenhouse gas emission from burning of fossil fuels, cutting down of tress, bush burning, emissions from transportation and other anthropogenic activities.
2. Plantation of trees to maintain the global circle by removing carbon dioxide (CO₂) from the atmosphere and store it as plant biomass and produce oxygen for human consumption.
3. Improvement of cultivation methods will increase agricultural efficiency, reduce the loss of natural resources and overcome hunger and malnutrition induced by climate change impact.
4. Adequate preparedness to response and manage the effect of climate change on human health in terms of emergency needs and resources allocation.
5. Access to information on climate change and its effect on health, preparedness and response strategies for mitigating and adaptation to its implication.
6. Adequate preparations against the effect of flood and extremity of weather condition.
7. Community mobilisation and participation in mitigation and adaptation strategies to the effect of climate change on health in the state.
8. Improving the efficiency of surveillance of infectious diseases in order to identify, control treat and prevent the infectious diseases induced by climate change in the state.
9. Government should improve the strength and capacity of disaster management agencies such as NEMA, SEPA & LEMA in response to the effect of climate change in the state.
10. Diverting to renewable energy sources such as solar energy and wind power that has lesser environmental impact and provide clean, accessible, affordable, sustainable and reliable energy in the state.

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