

## Climate Change; Our Impact on the Climate and its Consequences; A Cross-sectional Study

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### ABSTRACT

Climate change, sometimes called global warming, is the observed century-scale rise in the average temperatures of the earth's climate systems and its related effects. There are both natural and anthropogenic contributors to climate change. For example, volcanic eruptions are natural contributors and the burning of fossil fuels with the consequent release of greenhouse gases, such as water vapor, carbon dioxide, and methane. This is the largest human influence on global warming.

This study attempted to assess the knowledge, contributory community practices, and perceived effects of climate change in a characteristic suburban community in Africa, where the majority of people are expected to have poor knowledge about the phenomenon. It was a cross-sectional study. The study population comprised townies in the Okada community, excluding students of Igbinedion University. Pre-tested structured questionnaires were the tools for data collection.

Data analysis was done with IBM SPSS Version 21 and the level of statistical significance was set at  $p < 0.05$ . A total of 274 respondents participated. 82.1% of respondents had knowledge of climate change with TV/radio (51.1%) being the most widely reported source of information. More than half of the respondents recognized human activities and natural variability as responsible factors. Bush burning (33.3%), burning of fossil fuels (15.3%) [especially cooking gas] and deforestation (12.4%) were recognized anthropogenic contributors to climate change in Okada. Burning (70.1%) was the predominant method of waste disposal among respondents. Of the perceived effects, poor harvest and crop yield (77%) were the most feared effects of climate change to respondents.

**Keywords:** climate; greenhouse effect; global warming; ecosystem; climate change

### INTRODUCTION

#### BACKGROUND

The world's climate system is an integral part of life-supporting processes, one of many large natural systems that are now coming under pressure from the increasing weight of human numbers and economic activities [1]. The long-term good health of populations depends on the continued stability and functioning of the biosphere's ecological and physical systems, often referred to as life-support systems. As the increasing human impact on the environment alters Earth's geological, biological and ecological systems, many large-scale environmental hazards to human health have emerged. These include global climate change, stratospheric ozone depletion, biodiversity loss, stresses on terrestrial and ocean food-producing systems, changes in hydrological systems and freshwater supplies, and the global dissemination of persistent organic pollutants. Climate change and stratospheric ozone layer depletion are the best known of these various global environmental changes.

Human activities have been identified as a principal cause of ongoing climate change. The Third Assessment Report published in 2001 by the Intergovernmental Panel on Climate Change (IPCC) stated new and more robust evidence that most of the warming observed over the last 50 years is attributable to human activities. [1] Human alteration of the earth is substantial and growing. Between one-third and one-half of the land surface has been transformed by human action; the carbon dioxide concentration in the atmosphere has increased by nearly 30% since the beginning of the Industrial Revolution; more atmospheric nitrogen is fixed by humanity than by all-natural terrestrial sources combined; more than half of all accessible surface fresh water is put to use by humanity, and about one-quarter of the bird species on Earth have been driven to extinction. By these and other standards, it is clear that we live on a human-dominated planet. [2].

Scientists also predict that the increasing emission of greenhouse gases by humanity also threatens to induce a long-term change in climate change. These gases comprise water vapor, carbon dioxide (mostly from fossil fuel combustion and forest burning), plus various other heat-trapping gases such as methane (from irrigated agriculture, animal husbandry, and oil extraction), nitrous oxide, and various human-made halocarbons. The accumulation of these gases in the lower atmosphere has contributed to the recent solid uptrend in world average temperatures.

Human societies have had a long experience with the vicissitudes of climate: climatic cycles have left great imprints and scars on the history of humankind. Civilizations such as those of ancient Egypt, Mesopotamia, the Mayans, the Vikings in Greenland, and European populations during the four centuries of the Little Ice Age have both benefited and suffered from nature's great climatic cycles. Historical analyses also reveal widespread disasters, social disruption, and disease outbreaks in response to the more acute, inter-annual, quasi-periodic El Niño Southern Oscillation (ENSO) cycle.<sup>[3]</sup> The depletion of soil fertility and fresh water supplies and the mismanagement of water catchment basins via excessive deforestation have contributed to various regional populations' decline over the millennia.<sup>[4]</sup> During the twentieth century, the world average surface temperature increased by approximately 0.6°C. There were natural influences on world climate during this time. These include an increase in volcanic activity between 1960 and 1991 (when Mount Pinatubo erupted) which induced a net negative natural radiative forcing for the last two (up to possibly four) decades; and a slight overall increase in solar activity in the first half of the century which may have accounted for around one-sixth of that century's observed temperature increase. The twentieth century's global warming has taken Earth's average surface temperature above the centuries-long historical limit of the amplitude of natural variations.

The unprecedented prospect of human-induced (anthropogenic) changes to the global climate has prompted an extensive international scientific effort to assess the evidence. The IPCC, established within the U.N framework in 1988, was charged with advising national governments on climate changes causes and processes, likely impacts and their associated costs, and ways to lessen the consequences. The IPCC's Third Assessment Report projects an increase in average world surface temperature ranging from 1.4 to 5.8°C over the twenty-first century. It is noteworthy that the climatic variations before 1850 were essentially due to natural forcing processes cosmological alignments, volcanic activity, solar activity, etc. Since 1850, there has been an increasing influence via the human emission of greenhouse gases over the biosphere's capacity to absorb them without increasing atmospheric concentration. The IPCC also reported that even if humankind manages to curb excess greenhouse gas emissions within the next half-century, the world's oceans will continue to rise for up to 1000 years, reflecting the significant inertial processes as heat is transferred from surface to deep water.

#### STATEMENT OF PROBLEM

Global climate change would affect human health via pathways of varying complexity, scale, and directness and with different timing. Similarly, impacts would vary geographically due to both environment and topography and the local population's vulnerability. Results would be both positive and negative (although expert scientific reviews anticipate predominantly negative). This is no surprise since the climatic change would disrupt or otherwise alter an extensive range of natural ecological and physical systems that are an integral part of the earth's life-support system. The more direct impacts on health

include those due to changes in exposure to weather extremes (heatwaves, winter cold); increases in other extreme weather events (floods, cyclones, storm surges, droughts); and increased production of certain air pollutants and aeroallergens (spores and molds).<sup>[5,6]</sup> Acting via less direct mechanisms, climate change would affect the transmission of many infectious diseases (primarily water, food, and vector-borne diseases) and regional food productivity (especially cereal grains). In the longer term and with considerable variation between populations due to geography and vulnerability, these indirect impacts are likely to have greater magnitude than the more direct.<sup>[7,8]</sup>

Developing countries are the most vulnerable to climate change impacts because they have fewer resources to adapt socially, technologically, and financially. Thus, global climate change is anticipated to have far-reaching effects on the sustainable development of these countries.<sup>[9]</sup> Africa is vulnerable to several climate-sensitive diseases, including malaria, tuberculosis, and diarrhea.<sup>[10]</sup> For vector-borne infections, the distribution and abundance of vector organisms and intermediate hosts are affected by various physical (temperature, precipitation, humidity, surface water, and wind) and biotic factors (vegetation, host species, predators, competitors, parasites, and human interventions). Various integrated modeling studies have forecast that an increase in ambient temperature would cause worldwide net gains in the geographical distribution of particular vector organisms (e.g., malarial mosquitoes).

However, some localized decreases might occur. Furthermore, temperature-related changes in the life-cycle dynamics of both the vector species and the pathogenic organisms (flukes, protozoa, bacteria, and viruses) would increase the potential transmission of many vector-borne diseases such as malaria (mosquito), dengue fever (mosquito), and leishmaniasis (sand-fly) although schistosomiasis (water-snail) may undergo a net decrease in response to climate change<sup>[11,12]</sup>.

Many factors contribute to and compound the impacts of current climate variability in Africa and will negatively affect the continent's ability to cope with climate change. These include poverty, illiteracy and lack of skills, weak institutions, limited infrastructure, lack of technology and information, low primary education and health care levels, poor access to resources, low management capabilities, and armed conflicts. The overexploitation of land resources including forests, increases in population, desertification, and land degradation pose additional threats.<sup>[13]</sup> As a result of global warming, the climate in Africa is predicted to become more variable, and extreme weather events are expected to be more frequent and severe, with increasing risk to health and life leading to increased risk of drought, flooding in new areas, and inundation due to sea-level rise in the continent's coastal areas. Africa will face increasing water scarcity, and stress with a subsequent potential increase of water conflicts as almost all of the 50 river basins in Africa are transboundary.<sup>[14]</sup> Agricultural production relies mainly on rainfall for irrigation and will be compromised in many African countries, particularly for subsistence farmers in sub-Saharan Africa. Under climate change, much agricultural land will be lost, with shorter growing seasons and lower yields, causing a general decline in most subsistence crops grains such as sorghum, maize, millet, and groundnut. Of the total additional people at risk of hunger due to climate change, although already a large proportion, Africa may well account for the majority by the 2080s.<sup>[15]</sup>

Under climate change, rising temperatures are changing the geographical distribution of disease vectors migrating to new areas and higher altitudes; for example, migration of the malaria mosquito to higher altitudes will expose large

numbers of previously unexposed people to infection in the densely populated east African highlands.<sup>[16]</sup> Future climate variability will also interact with other stresses and vulnerabilities such as HIV/AIDS (which is already reducing life expectancy in many African countries) and conflict and war, resulting in increased susceptibility and risk to infectious diseases (e.g. cholera and diarrhea) and malnutrition for adults and children<sup>[17]</sup>.

Future sea-level rise can cause huge impacts on the African coastlines, including the already degraded coral reefs on the Eastern coast. National communications indicate that the coastal infrastructure in 30 percent of Africa's coastal countries, including the Gulf of Guinea, Senegal, Gambia, Egypt, and the East-Southern African coast, is at risk of partial or complete inundation due to accelerated sea-level rise.<sup>[18]</sup> Future sea-level rise also threatens lagoons and mangrove forests of both eastern and western Africa. It is likely to impact urban centers and ports, such as Cape Town, Maputo, Dar-Es-Salaam, and Lagos.

Despite the concerns regarding the problem, a reason for worry is the purported situation where a significant proportion of Africans (Nigerians inclusive), especially those living in rural areas, are alleged to have little or no knowledge of the phenomenon called climate change or global warming. However, the effects are felt by them, for example, the current flooding problem currently widespread and experienced in the coastal parts of Nigeria. This is perhaps attributable to the low literacy levels and poverty that may prevent access to the subject matter <sup>[17-18]</sup>. Thus, ignorance on the part of the population is as great a worry, if not greater, than the implications of global warming itself, since knowledge and identification of a problem is the first step in addressing the issue. Global climate change is thus an essential addition to the spectrum of environmental health hazards faced by humankind that seeks to challenge the progress made on the grounds of environmental sustainability <sup>[18]</sup>

### JUSTIFICATION

Global climate change is a significant addition to the spectrum of environmental health hazards faced by humankind. It is a known fact that other nuisances are a crucial component of environmental health, and climate change is a serious nuisance that can cause environmental, ecological, and even economic destruction. Climate change is more or less now a part of our lives as humans because humans are the major contributors to the situation and are also the species at the forefront of the issue and very likely to bear the wrath of the case <sup>[7]</sup>. If we are to avoid the irreversible build-up of greenhouse gases and global warming, we need to act urgently at a potentially huge cost to the economy and society worldwide.

It is a known fact that the first step in problem-solving is to identify the problem itself <sup>[3]</sup>. Failure of the community or society at large to identify the problem itself would perhaps be a graver situation than at least the condition is known, which would be the first step to addressing the hazard that global warming poses to our environmental health. Awareness of the threats facing the environment and then handling them head-on is a more cost-effective option than dealing with the environmental, ecological, and economic implications that a nonchalant approach would bring. Since most greenhouse gas emissions come from developed countries, communities in the developing world are still bound to experience the impacts of the hazards <sup>[11]</sup>.

However, it is believed that the majority of the population living on the African continent - due to the perceived high levels of illiteracy - have next to no knowledge about the issue or any idea of practices that may contribute to the anthropogenic burden of climate change. Findings from this research would provide insight about current practices in

rural communities, if any, and how they contribute to climate change, and perhaps suggest proactive ways to tackle the environmental nuisance called global warming.

### RESEARCH QUESTIONS

Questions which this research project will answer include:

- (1) What is their knowledge of the phenomenon called climate change?
- (2) Which practices in the community may be contributory to climate change?
- (3) What are the perceived effects of global warming on their health and their environment?
- (4) Which adaptive measures, if any, are currently being carried out in the community in an attempt to adapt to, or confront climate change?

### GENERAL OBJECTIVE

This study examines the community perspective on climate change in Okada, Ovia North-East LGA, Edo State, Nigeria. Specific Objectives

- (1) To assess their knowledge of the phenomenon called climate change.
- (2) To determine which practices in the community may be contributory to climate change.
- (3) To assess the perceived effects of global warming on their health and their environment.

### LITERATURE REVIEW

Climatic change is a change in the usual weather found in a place. It is a change in earth's climate. This change could be a change in the earth's typical temperature or a change in precipitation patterns. While the weather can change in just a few hours, it takes hundreds or even millions of years for the climate to change.<sup>[19]</sup>

Earth's climate is naturally dynamic. There have been times when it has been warmer than it currently is now, and there have been times when it was cooler. These times can last thousands or millions of years. Meteorologists and archeologists see that earth's climate is getting warmer. Earth's temperature has gone up about one-degree Fahrenheit in the last 100 years. This may not seem like much, but these small changes in Earth's temperature can have significant effects, and some effects are already being felt. The warming of earth's climate has caused the melting of polar ice caps, resulting in rising sea levels. Agriculture has been hit as well, as it has changed the timing of when certain plants grow, with floods and typhoons causing damage to crops causing famine and starvation. Many things can cause the climate to change all on its own. Earth's distance from the sun changes, and this affects the amount of energy released as solar energy <sup>[12,13]</sup>. This also affects the ocean and sea levels. Natural phenomena such as volcanic eruptions also affect the climate. Scientists have also recognized that anthropogenic (human-induced) causes of climate change such as burning fossil fuels like coal, oil and gas to power cars and machines, heat and/or cool our homes, and as sources of energy for cooking. The burning of fossil fuels releases greenhouse gases such as water vapor, carbon dioxide, and methane into the atmosphere. These gases cause warming of the air. These can change the climate of a place and, by extension, change earth's climate.<sup>[19]</sup>

Scientists have reason to believe that earth's temperature will keep rising for the next 100 years. This would cause more snow and ice to melt, leading to rising sea levels.



While some places would get hotter, and others will have colder winters with more snow. Some areas might get torrential rain with resultant flooding, while others suffer ongoing droughts. Hurricanes might even become more intense in some areas.<sup>[20]</sup>

Earth images are taken periodically by astronauts and scientists from space by NASA and other international space agency satellites. Meteorologists also use meteorological tools to look at the sun and the energy it sends out. Together, these are important for learning about earth's climate. These tools can help scientists objectively monitor climate change. Scientists believe simple measures can be used to combat climate change although there are natural contributors to the phenomenon<sup>[4,8]</sup>. These simple measures to deal with climate change's anthropogenic contribution include using less energy and water, switching off lights and electronic appliances like televisions when leaving a room, turning off the water when brushing your teeth, and very importantly, planting trees.<sup>[21]</sup>

### KNOWLEDGE OF CLIMATE CHANGE

A descriptive cross-sectional study of 1,019 rural respondents using a multistage sampling method was conducted in South-Eastern Nigeria in 2013 to determine the knowledge of climate change. It revealed that about 911 (89.4%) of respondents opined that there had been a change in climate in the last ten years. Supernatural reasons were prominent among respondent-reported causes of climate change. Poor knowledge of causes but a good knowledge of the effects of climate change was found in this study. About two-thirds of respondents had a good knowledge of the causes of climate change, while half had a good knowledge on the effects of climate change. A significant association was found between educational status ( $P < 0.001$ ), occupational status ( $P < 0.01$ ), and attitude to causes of climate change<sup>[22]</sup>.

In a descriptive cross-sectional study conducted in Cross River state, Nigeria to access the knowledge of climate change using 140 rural dwellers in 4 communities, results showed 71.7% of the people were aware of climate change. They also indicated that the onset of rains is now delayed while cessation is earlier against the trend in the past. The study further indicates that, though there are natural causes, 66.7% of rural people accepted human activities as major causes of climate change. The results also showed that the effects of climate change in rural areas include poor crop yields (56.7% response); reduced soil fertility (66.7% response); increase flood (56.7%), poverty and food shortage (50% response). The sources of peoples' awareness show widespread information from environmental education/sensitization by NGOs and extension workers as well as media which at the moment is lacking and limited to radio talks and jingles.<sup>[23]</sup>

In a cross-sectional study carried out in Yenagoa Bayelsa state, Nigeria in 2014 among 360 households randomly selected and administered questionnaires. The results showed that 43.33% of respondents lack adequate knowledge of climate change. Further interview revealed that 55.3% of the respondents were unaware that carbon dioxide (CO<sub>2</sub>) is the major greenhouse gas, contributing about 55% to global warming. It was revealed that respondents' major sources of information on climate change were personal experience and television (66.33%). Also, 48.7% of the respondents believed that one of the major natural causes of climate change is divine providence.<sup>[24]</sup>

A cross-sectional study carried out in Ajiwa and Dutsinma agricultural zones of Katsina State to access the knowledge of climate change, 200 respondents were randomly selected and interviewed using structured questionnaire.

The study found a high level of awareness of climate change among the respondents, with only 1.5% claiming unawareness. The most important sources of information are: identified by 96%; radio (88.5%); cooperative societies (71%); rural markets (63.5%); and extension agents (59.5%). Longer dry season was identified by 83% of the respondents as manifestation of climate change in the study area. Other indicators of climate change that were observed include: erratic rainfall pattern (79.5%); severe harmattan (72%); droughts (64.5%); and increased pest incidences (52%)<sup>[25]</sup>.

### COMMUNITY PRACTICES THAT MAY BE CONTRIBUTORY TO CLIMATE CHANGE

A cross sectional study carried out in Bayelsa showed that respondents were more aware of the anthropogenic (human-induced) causes of climate change. For instance, 283 (94.3%) of respondents are aware that the burning of fossil fuels is a major cause of human-induced climate change. Of this number, 61.3% strongly agreed, while 33% agreed. Only 17 (5.6%) respondents are ignorant of the burning of fossil fuel as a human-induced cause of climate change. Similarly, 73.6%, 73.3%, and 78.4% respondents perceived urbanization, water pollution, and deforestation as major human causes of climate change, respectively. In a similar vein, 84%, 87%, and 81.6% of respondents strongly agreed and agreed that ozone layer depletion, gas flaring, and industrialization are equally major causes of human-induced climate change, respectively.<sup>[26]</sup>

Cross sectional studies were carried out in Akwa-Ibom and Lagos states among university students and government officials on the knowledge and effect of climate change in Nigeria. Most university students (89.2%) and ministry officials (92.9%) "strongly agreed" or "somewhat agree" that human activity is responsible for climate change. Most respondents (70.9% students and 77.4% ministry officials) agreed that natural climate variability is also responsible for climate change; although, agreement on this was not as strong as for human activity. There were no significant differences in the p values been  $p = 0.1858$  and  $p = 0.1919$  in the distribution of the responses between the two study populations for the question on human activity and natural variability, respectively, being responsible for climate change.<sup>[27]</sup>

### PERCEIVED EFFECTS OF CLIMATE CHANGE ON HEALTH AND ENVIRONMENT

In a descriptive cross-sectional study carried out in South East Nigeria among 1,019 rural respondents using a multistage sampling method, the various effects of climate change were explored and most respondents stated that climate change will have an effect on food production. While 80.5% stated that climate change will lead to reduced food production, 7.7% actually stated that it will lead to increased food production. About two-thirds of respondents stated that climate change will lead to drying up of wells, while some (10.6%) stated that it will lead to increased water supply. This increased water supply was different from flooding, which was mentioned by 4.1% of respondents. Respondents were however less committed to stating how they felt that climate change will affect farmland. The highest proportion of respondents who stated that climate change will affect farmland was 18.1%, who believed that climate change will lead to hard and infertile soil. In addition to the effects on the elements, the knowledge of respondents about the effects on humans was also captured. Respondents knew that climate change could lead to ill health (46.5%), suffering (25.1%), hunger (12.5%), and decreased income (14.9%), amongst other responses. Only 2.2% of respondents stated that scarcity of water for domestic use was a distinct effect that affected females differently from males.

Effects distinct to children stated by respondents included delayed/poor growth (8.0%) and death (1.7%) [28].

In a cross-sectional study carried out in Yenagoa, Bayelsa state, Nigeria in 2014, respondents were convinced that the temperature of Yenagoa had increased with 52.7% and 40% of the respondents respectively, strongly agreed and agreed that temperature in the city has increased. Those interviewed claim that they can hardly sleep well at night these days without fan or air conditioner because of sweating as a result of increased temperature, most especially during the dry season, which was not the case in the past. The responses show that 34% and 49.7% respondents strongly agreed and agreed, respectively, that precipitation patterns have changed over the years in terms of duration and intensity. The flood episode of 2012, which affected over 90% of Yenagoa and most coastal settlements of Nigeria, was attributed partly to climate change, resulting from sea level rise and unpredictable precipitation pattern by environmentalists, government agencies, and other stakeholders. This probably explains why 82% of the respondents perceived sea level rise and flooding as potential impacts of climate change. Specifically, 34% and 48% of the respondents strongly agreed and agreed, respectively, while only 9%, 1.7%, and 7.3% respondents disagreed, strongly disagreed, and cannot say, respectively. The unpredictable precipitation pattern in Yenagoa and flood episodes had posed serious challenges to agricultural practices, which had impacted negatively on the level of productivity. Since Yenagoa is located in the tropics, where malaria is so prevalent, respondents believed that climate change could exacerbate the incidence of malaria and other diseases in the area, as the environment becomes friendlier to the rapid breeding of the vector-borne diseases. This explains why 81% of respondents strongly agreed and agreed that climate change increases health challenges.[24]

In a study carried out in Ghana on farmers to know their perceived effect of climate change, a survey questionnaire targeting farmers with at least 30-years of farming experience in the area was administered in six of the eleven agricultural enumeration areas in the catchment. Of the 466 farmers interviewed, 79 % utilized rain-fed practices while 21 % utilized some form of irrigation. Results indicated that nearly 90% of the farmers interviewed believed that temperature increased over the past 30-years, while over 94 % of the farmers believed that amount of rainfall, duration, intensity and rainy days has decreased. Nearly 96 % of the farmers believed that their farms are extremely vulnerable to decreased rainfall, droughts and changed timing of rainfall events. Climatic data of the catchment indicates a rising trend in temperature but no long-term changes in annual and monthly rainfall, thereby possibly increasing levels of evapotranspiration.[29]

A cross sectional study was conducted between August 2013 and July 2014 in the Tanahu district of Nepal, with analysis based on 258 face-to-face interviews with household heads utilizing structured questionnaires with the objective of this study been to explore community perceptions of climate variability and human health risks. In this study, over half of the respondents (54.7%) had perceived a change in climate, 53.9% had perceived an increase in temperature in the summer and 49.2% had perceived an increase in rainfall during the rainy season. Half of the respondents perceived an increase in the number of diseases during the summer, 46.5% perceived an increase during the rainy season and 48.8% during winter.[30].

A cross sectional study was done on small holder farmers in Kwara state Nigeria on one thousand two hundred respondents with a qualitative data been used for this study. The research findings revealed that 70% of respondents are aware of climate change in the study area. Majority of the respondents (50.5%) perceived increase in rainfall while 30 percent of the respondents perceived that there has been no change in annual rainfall but year to year variation. A significant number of respondents perceived that rain days with heavy rainfall were increasing. This must have been due to rampant flood events as some of them narrated their ordeal from incessant floods which was not the case in time past. Majority of the respondents (50.7%) perceived a delay in the onset of rain in many more years than 30 years ago while 38 percent agreed that the onset of rainfall has not changed significantly but varied from year to year. 48.2 percent of the farmers observed rain cessation to be earlier while 36 percent of them perceived that the time of cessation of rains had not changed. However, 44.2 percent of the respondents perceived that dry spells particularly during the growing season were becoming common in the study area. High proportion of the respondents 48.9% did not notice any change in the number of rain days in the last 30 years. 47.4 percent of the respondents observed that the length of harmattan in the study area is decreasing while 42.5% observed no change.[31]

A cross sectional study to assess adaptation strategies to climate change effects among rural women in savannah and forest zones of Oyo State, Nigeria, a total of 117 rural women were randomly selected from the two randomly selected LGAs in the state. Data were collected through a structured interview. A higher percentage in the savannah (88.2%) than the forest (67.8 %) was in their active years (20–50 years). About 41 % (savannah) and 32% (forest) had no formal education. Awareness of climate change was high (78.7 % and 69.6 %, respectively), while farming-related activities were the main livelihood. Also, 93 % admitted that climate change had a severe influence on their livelihoods through reduction in the amount of rainfall on their farmland. Respondents adopted different strategies such as multiple cropping, crop rotation, changing planting periods, storage of water for future use, and diversifying into other areas of livelihood to adapt to climate change effects. However, there was also a significant difference in the influence of climate change ( $t = 4.605, p = 0.000$ ) and adaptation strategies ( $t = 6.637, p = 0.000$ ) between the women in the two ecological zones [32].

In a cross-sectional study carried out in Northern Thailand in Akha and Lisu communities, average age of Akha and Lisu respondents was 47 and 43 years, respectively. Almost all the respondents were illiterate in both cases. The farm land owned by Akha communities was of an upland type, and by Lisu was a lowland type. Rice and corn are two major crops in the area, however fruit trees were also grown by Akha communities, and beans by Lisu. A substantial majority of 95% and 90% respondents from Akha and Lisu communities respectively, perceived that they were experiencing variation in climate variables at present compared to some 10 or Climate 2017, 5, 57 5 of 16 20 years ago. 56% and 51% of respondents belonged to the 40- to 60-year age category in Akha and Lisu, respectively, indicating that they had experienced the changing climatic condition over the years. 81 to 85% of respondents who had perceived such change were engaged in agriculture, and hence the perceived change could be based on the impact they had observed in farming. Similarly, 74% and 71% of farmer households who had perceived climate change were usually small holders who had less than 1.3 hectares of farm size.[33]

A cross sectional study carried out in South-Western Nigeria with historical meteorological data, in order to assess the way farmers' have observed climatic trends over the years. The results show that about 67% of farmers who participated had observed recent changes in climate. Perceptions of rural farmers on climate change and variability are consistent with the climatic trend analysis. Results illustrate that not less than 11 out of 30 years in each study site experienced lower-than-normal rainfall. Climatic trends show fluctuations in both early growing season and late growing season rainfall and the 5-year moving average suggests a reduction in rainfall over the 30 years. Climatic trends confirmed farmers' perceptions that Early Growing Season and Late Growing Season precipitations are oscillating, that rainfall onset is becoming later, and EGS rainfall is reducing. Overall impacts of climate change on both crops and livestock appear to be highly negative, much more on maize (62.8%), yam (52.2%), poultry (67%) and cattle (63.2%). Years of farming experiences and level of income of farmers appear to have a significant relationship with farmers' choice of adaptation strategies, with  $r \geq 0.60$  at  $p < 0.05$  and  $r \geq 0.520$  at  $p < 0.05$  respectively. The study concluded that farmers' perceptions of climate change mirror meteorological analysis, though their perceptions were based on local climate parameters. Smallholder farmers are particularly vulnerable to climate change since the majority of them do not have enough resources to cope.<sup>[34]</sup>

In a cross-sectional study, which used rural settlements in Otukpo, Nigeria as a case study. Primary and secondary data were utilized for the study. Data collection was done through the use of a questionnaire with open-ended questions and questions with multiple answers. A total of 100 questionnaires were randomly distributed among household heads in 10 settlements selected from 58 rural settlements for the study. Spatial distribution of the rural settlements was analyzed using the nearest neighbor statistical analysis while descriptive statistics such as graphs and tables were used to present data. Rural settlements in Otukpo are randomly distributed and may be tending towards clustering. This was indicated by an Rn index value of 0.96 from the nearest neighbor analysis. Most of the settlements (59%) have a distance of two to three kilometers between them. There is an inadequacy of functional facilities and poor access to services in the rural settlements in Otukpo. Respondents in rural settlements in Otukpo are faced with the risk of agricultural occupational loss (22%), water shortages (42%), flooding (29%), land based conflicts (16%), health hazards (12%), erosion (26%), and migration (57%). With evidence of climate change ascertained globally including Nigeria, the study concludes that rural settlements in Otukpo and elsewhere are vulnerable to the effects of climate change.<sup>[35]</sup>

A study that attempts to assess perception level of rural people to climate change in selected communities was conducted in Cross River State, Nigeria. Primary data were collected from 120 rural dwellers in 4 districts. This data centered on knowledge (awareness) level of climate variability/change causes, effects, mitigation, and adaptive strategies. The data generated were analyzed using descriptive statistics. Results showed 71.7% of the people are aware of climate change. They also indicated that the onset of rains is now delayed while cessation is earlier against the trend in the past. This corroborates the meteorological parameters obtained from Nigeria Meteorological Agency. The Study further indicates that, though there are natural causes, 66.7% of rural people accepted human activities as significant causes of climate change/variability.

The results also showed that the effects of climate in rural areas include poor crop yields (56.7% response); reduced soil fertility (66.7% response); increased flood (56.7%), poverty, and food shortage (50% response). The sources of peoples' awareness show general information from environmental education/sensitization by NGOs and extension workers and media, which is currently lacking and limited to radio talks and jingles.<sup>[23]</sup>

In a cross-sectional study carried out in Akwa-Ibom, Uyo, and Lagos state among university students and government officials on the knowledge and effect of climate change in Nigeria, respondents were asked, "Which of the following will affect Nigeria as a consequence of climate change?" and were given eight choices, all of which could be selected if respondents deemed them to be climate change consequences to the country. Of the eight options, the three most commonly chosen for both study populations were rising temperatures (77.3% students and 77.4% ministry officials), flooding (59.0% students and 73.8% ministry officials), and sea-level rise (48.5% students and 71.4% ministry officials). Melting glaciers was the least selected option for both study populations. Ministry officials were significantly more likely to select five of the eight choices, and there was no significant difference in responses for the remaining.<sup>[34]</sup>

## MATERIALS AND METHOD

### STUDY AREA

This study was carried out in the Okada community, Ovia North-East LGA, Edo State. The district lies between latitude 6° North and longitude 5° East. It has an area of 2,301 km<sup>2</sup> with an estimated population of 153,849 with 81,090 males and 72,759 females as of the 2006 national census. The people of Okada are mainly Christians, with few Muslims and traditional worshippers. The majority of the people are Benin and Yorubas. Other ethnic groups such as Urhobo, Hausa, Igbo and Fulani are also present. Farming, Timber processing, and trading are some of the principal occupations of the indigenes in this community. The major landmarks in the community include Igbinedion University teaching campuses, Residential area (Crown estate), Igbinedion University Teaching Hospital, Okada Grammar school, Okada Police Station, Townhall, Magistrate, and High court, Okada market, Local government secretariat, NYSC Orientation camps, and various commercial banks.

### STUDY DESIGN

A descriptive cross-sectional study design was used to examine the community perspective on climate change in Okada, Ovia North-East LGA, Edo State, Nigeria.

### STUDY POPULATION

Residents of Okada were sampled for the study, out of which a total of 274 persons were enrolled.

### SELECTION CRITERIA

#### Inclusion criteria

Respondents must have lived in Okada for a minimum of six months prior to the commencement of the study. Residents fifteen years old and above were also included to ensure they can give accurate answers to questions.

#### Exclusion criteria

Residents who did not give consent were excluded. Students of Igbinedion University were also excluded.

### STUDY DURATION

The study was carried out from 1st January to 31st December 2017.

**SAMPLE SIZE DETERMINATION**

Estimated sample size was determined using the Cochran formula for a cross-sectional study. A total of 274 respondents were sampled viz:

$$n = \frac{z^2 pq}{d^2} \quad (\text{Cochrane, 1963})$$

Where:

- n = Minimum sample size
- z = Standard normal deviation (using 1.96 at 95% confidence interval)
- p = p value from a population of similar characteristics to the study population= 20% (0.2)
- q = 1.0- p
- q = 1.0-0.2 =0.8
- d = Degree of precision or error = 5% (0.05)

$$n = \frac{(1.96)^2 \times 0.20 \times 0.80}{(0.05)^2}$$

$$n = \frac{3.84 \times 0.14}{0.0025}$$

n = 245.6 (Minimum sample size calculated)  
 Non-Response Rate (Nrr) = 10% of minimum sample size  
 Minimum sample size with non-response rate of 10%

$$= \frac{N}{1-Nrr}$$

$$= \frac{245.8}{0.9}$$

$$=273.1$$

=274 (Total sample size calculated)

**SAMPLING TECHNIQUE**

A multistage sampling technique involving three stages was used:

- Stage 1: Selection of community
- Stage 2: Selection of houses
- Stage 3: Selection of household

**METHOD OF DATA COLLECTION**

This was done using a structured interviewer-administered, questionnaire containing both open and closed-ended questions. The questionnaire was divided into four sections viz;

- Section A: Socio-demographic profile
- Section B: knowledge of the phenomenon of climate change
- Section C: Practices in the community which may be contributory to climate change
- Section D: Perceived effects of global warming on health and the environment

**STANDARDIZATION OF DATA COLLECTION**

Final year medical students standardized questionnaires under the supervision of lecturers and consultants of the Department of Community Medicine, Igbinedion University, Okada, Edo State.

**TOOLS FOR DATA COLLECTION**

Data was collected using a standardized interviewer-administered questionnaire.

**METHOD OF DATA ANALYSIS**

Data were checked for completeness, serialized, and entered into IBM Statistical Package for Social Science (IBM SPSS Statistics) version 21.

**METHOD OF DATA COLLECTION**

Univariate analysis was conducted for relevant variables. Bivariate analysis was done to test for association between dependent and independent variables, using the chi-squared test and Fisher's exact test. A p-value <0.05 was considered statistically significant.

**DATA PRESENTATION**

Results were presented using frequency tables, prose and charts/graphs, and summary statistics.

**ETHICAL CONSIDERATION**

Approval for the survey was granted by the Head of the Department, Community Medicine. Permission was sought from the head of the Okada community and other indigenous stakeholders. Verbal consent of respondents was also sought before the administration of the survey tools. Confidentiality was assured as questionnaires were anonymously filled. Respondents were also assured that participating in the study constituted no risk to their privacy nor will harm come to them if they decline.

**LIMITATION(S) OF STUDY**

Data was obtained based on self-reporting and could be subject to information bias from the respondents.

**RESULTS**

**TABLE 1A : Socio-Demographic Characteristics of Respondents**

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Age Range(s) (years)</b>		
15 – 19	35	12.7
20 – 24	69	25.2
25 – 29	83	30.4
30 – 34	28	10.2
35 – 39	14	5.1
40 – 44	14	5.1
45 – 49	14	5.1
50 – 54	14	5.1
55 – 59	0	0
60 – 64	3	1.1
<b>Mean 29.43</b>		
<b>Sex</b>		
Male	164	59.9
Female	110	40.1



VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Religion</b>		
Christian	248	90.5
Islam	13	4.7
ATR	13	4.7
<b>Occupation</b>		
Student	75	27.4
Artisan	35	12.8
Public servant	21	7.7
Trader	112	40.9
Farmer	31	11.3
<b>Level of Education</b>		
Primary	35	12.8
Secondary	138	50.4
Tertiary	88	32.1
None	13	4.7

TABLE 1B: Socio-demographic cont'd

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Ethnicity</b>		
Benin	113	41.3
Yoruba	28	10.2
Igbo	28	10.2
Urhobo	28	10.2
Ogoja	21	7.7
Others	56	20.4
<b>Marital Status</b>		
Single	143	52.2
Married	131	47.8
<b>Family Type</b>		
Monogamous	122	44.5
Polygamous	42	15.3
Single	110	40.1

The majority of the respondents (30.4%) were between the age ranges 25 - 29, with no respondents in the age ranges 55 - 59 years. Mean age: 29.43

Most of the respondents (59.9%) were male, while (40.1%) were females.

A higher proportion of the respondents (90.5%) were Christian, with the remaining respondents equally split between Islam and ATR.

Higher proportions of respondents (40.9%) were traders, while a lesser proportion of respondents (7.7%) were public servants.

Most of the respondents (50.4%) had attained secondary school level of education, with only a few (4.7%) having no formal education.

Most of the respondents were Benin (41.3%) were the predominant ethnic group.

The above-average of the respondents (52.2%) were single, while (47.8%) were married.

The majority of the respondents (44.5%) were of a monogamous family setting, while (15%) were of a polygamous setting.

TABLE 2: Respondents knowledge and source of information

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Knowledge</b>		
Yes	225	82.1
No	49	17.9
<b>Source of information</b>		
Tv/radio	140	51.1
Newspaper/magazine	32	11.7
School	32	11.7
Internet	14	5.1
Others	56	20.4



The majority of the respondents (82.1%) have heard of climate change, and most of the respondents (51.1%) had their source of information from Tv/radio.

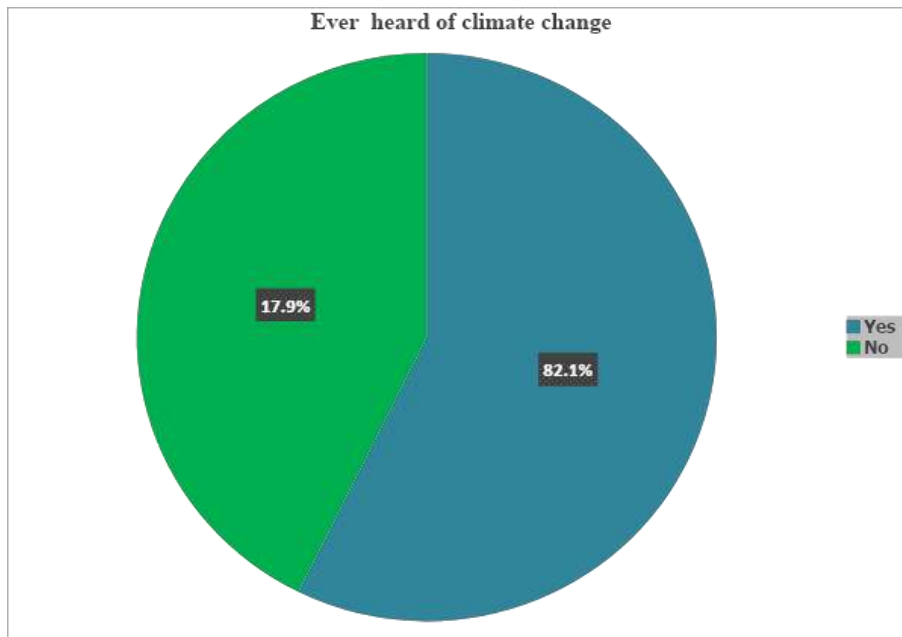


FIGURE 1: From the pie chart, slightly above half of the respondents (82.1%) have heard of climate change.

TABLE 3: Factors responsible for climate change

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Human activities</b>		
Yes	157	57.3
No	117	42.7
<b>Natural variability</b>		
Yes	166	59.7
No	112	40.3

The majority of the respondents (57.2%), (59.7%) believed that human activity and natural variability respectively is/are responsible for climate change.

In comparison (42.7%), (40.3%) did not believe that human activity and natural variables, respectively, were accountable for climate change.

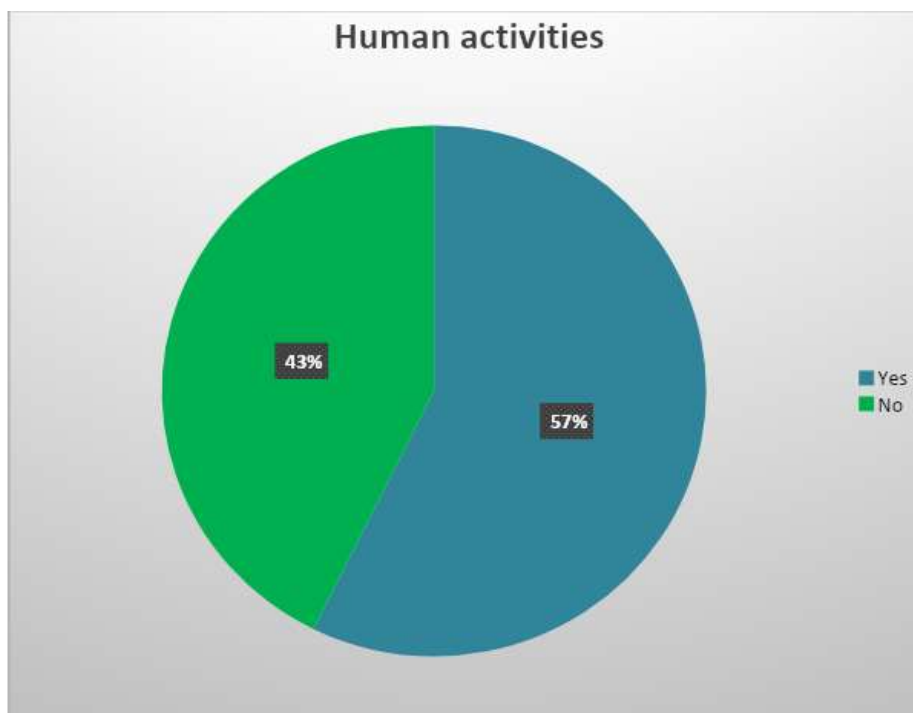
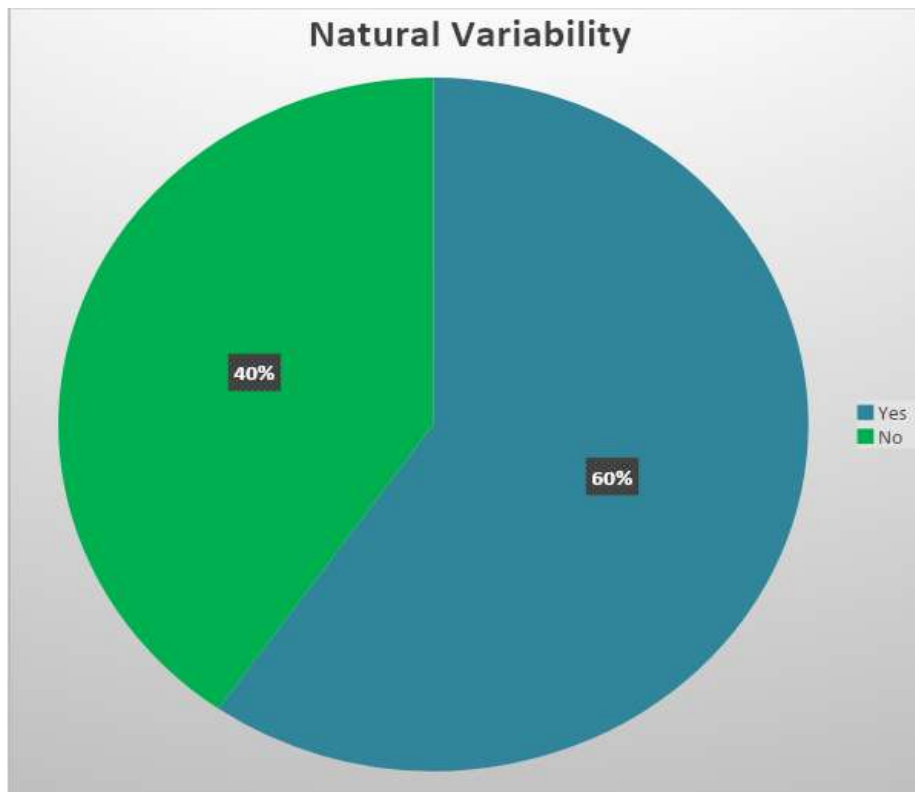


FIGURE 2: From the pie chart, most of the respondents (57%) believe human activities are responsible for climate change.



**FIGURE 3:** From the pie chart, most of the respondents (60%) believe natural variability to be responsible for climate change.

**TABLE 4:** Meaning of climate change to respondents

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Meaning of climate change</b>		
change in temperature	70	25.5
Change in environment	56	20.4
Change in weather condition	82	29.9
Change in climate due to global warming	6	2.2
I don't know	60	21.9

The majority of respondents (29.9%) understood climate change to be a change in weather conditions, followed by (25.5%) of respondents who believed it to be a temperature change.

**TABLE 5:** Which of the following do you think will affect or affect Nigeria as a consequence of climate change?

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>The consequence of climate change in Nigeria</b>		
Sea level rise	27	9.9
Drought	31	11.3
Flooding	32	11.7
Coastal erosion	13	4.7
Rising temperature	64	23.4
Desertification	49	17.9
Increasing intensity and frequency of extreme weather events	36	13.1
None	22	8.0

The majority of the respondents (23.4%) believed the effect of climate change in Nigeria to be an increase in temperature, while only a few of them (9.9%) thought it to be sea-level rise.

**TABLE 6:** Effects of human practices on climate change

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Human practices and climate change</b>		
Strongly agree	125	45.6
Agree	54	19.7
I don't know	42	15.3
Disagree	20	7.3
Strongly disagree	33	12.0

Majority of respondents (45.0%) strongly agreed with the fact that human practices affect climate change.

**TABLE 7:** Practices that contributes to climate change

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Practices that contribute to climate change</b>		
I don't know	91	33.2
Bush burning	93	33.9
Burning of fossil fuels	42	15.3
Deforestation	34	12.4
Others	14	5.1

The majority of the respondents (33.9%) were involved in the practice of bush burning, while (33.2%) of respondents were ignorant of the practices that contributed to climate change.

**TABLE 8:** how do you dispose of waste

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Dispose of waste</b>		
Burning	192	70.1
Waste management	54	19.7
Pit	28	10.2

The majority of the respondents (70.1%) practiced burning as a means of waste disposal, while only a few of them (19.7%) (10.2%) respectively were involved in waste management and pit.

**TABLE 9:** Energy source used in cooking by respondent

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Energy source</b>		
Firewood	49	17.9
Charcoal	21	7.7
Sawdust	14	5.1
Kerosene	52	19.0
Gas	131	47.8
Electricity	7	2.5
<b>Reason for the preferred choice</b>		
It's cheap	69	25.2
Its efficiency	163	59.5
Cultural factors	14	5.1
Food taste is attributable to energy source	28	10.2

Most of the respondents (47.1%) claimed to use gas as their source of energy, and more than half of the respondents (59.5%) earned this choice due to its efficiency.

Only a few of them (2.5%) were involved in using electricity as an energy source for cooking.

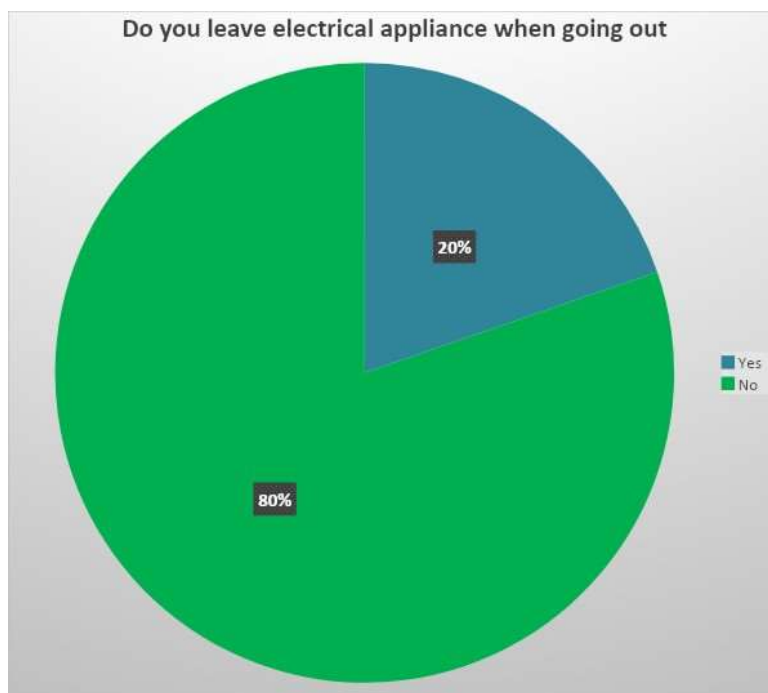


FIGURE 4: The pie chart (80%) of respondents claim to not leave their electrical appliances on when going out.

TABLE 10: Do you leave electrical appliances when going out

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Electrical appliance on when going out</b>		
Yes	54	19.7
No	220	80.3
<b>If yes, do you know this can be contributory to climate change?</b>		
Yes	69	25.2
No	205	74.8

Most of the respondents (80.3%) claimed to not leave their electrical appliances on while going out. Most of the respondents (74.8%) were ignorant of the contributory effect of electricity on climate change.

TABLE 11: Climate change can have negative effect on the environment

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Climate change and its negative effect on the environment</b>		
Strongly agree	142	51.8
Agree	55	20.1
I don't know	63	23.0
Strongly disagree	14	5.1

Slightly above half of the respondents (52.5%) strongly believed that climate change has a negative effect on the environment, while very few of the respondents (5.1%) strongly disagreed with this.

TABLE 12: Climate change can increase sea levels

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Climate change and increase in sea levels</b>		
Strongly agree	122	44.5
Agree	41	15.0
I don't know	83	30.3
Disagree	21	7.7
Strongly disagree	7	2.6

The majority of respondents (44.5%) strongly believed that climate change could result in increased sea levels, while only a few (2.6%) strongly disagreed with this.



**TABLE 13:** Climate change can result in poor harvest and crop yield

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Climate change causes poor harvest and crop yield</b>		
Strongly agree	180	65.7
Agree	31	11.3
I don't know	49	17.9
Disagree	7	2.6
Strongly disagree	7	2.6

The majority of respondents (65.7%) strongly agreed to the fact that climate change results in poor harvest and crop yield, while only a few (2.6%) (2.6%) respectively disagreed and strongly disagreed with this.

**TABLE 14:** Climate change can cause an increase in flooding

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Climate change and increase in flooding</b>		
Strongly agree	115	42.0
Agree	48	17.5
I don't know	69	25.2
Disagree	35	12.8
Strongly disagree	7	2.6

The majority of the correspondents (42.0%) strongly agreed that climate change could cause an increase in flooding.

**TABLE 15:** Climate change can have a negative effect on human

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Climate change and negative effect on human</b>		
Strongly agree	170	62.0
Agree	55	20.1
I don't know	42	15.3
Strongly disagree	7	2.6

The majority of respondents (62.0%) strongly believed that climate change has a negative effect on humans.

**TABLE 16:** Knowledge of the effects of climate change

VARIABLE	FREQUENCY (n) (274)	PERCENT (%) (100%)
<b>Effects of climate change</b>		
Sea level rise	42	15.3
Others	14	5.1
Drought	7	2.6
Flooding	49	17.9
Coastal erosion	30	11.0
Rising temperature	41	15.0
Melting glaciers	14	5.1
Desertification	14	5.1
Increasing intensity and frequency of extreme weather events	21	7.7
None	42	15.3

Most of the respondents (17.6%) believe the effect of climate change to be flooding, followed by sea-level rise (15.1%) and rising temperature (14.7%).

**TABLE 17:** Level of Education of correspondents and if yes, how did you hear of it cross-tabulation

		IF YES, HOW DID YOU HEAR OF IT					
		TV/RADIO	NEWSPAPER/MAGAZINE	SCHOOL	INTERNET	OTHERS	TOTAL
LEVEL OF EDUCATION OF CORRESPONDENTS	NONE	0(0%)	7(50%)	0(0%)	0(0%)	7(50%)	14
	PRIMARY	5(16.1%)	5(16.1%)	0(0%)	0(0%)	21(67.7%)	31
	SECONDARY	70(50%)	14(10%)	21(15%)	7(5%)	28(20%)	140
	TERTIARY	63(70.8%)	6(6.7%)	13(14.6%)	7(7.9%)	0(0%)	89
<b>TOTAL</b>		<b>140</b>	<b>34</b>	<b>34</b>	<b>14</b>	<b>56</b>	<b>274</b>

Chi squared (x2) = 104.543, p = 0.001.

Most of the respondents with both secondary and tertiary school levels of education mainly obtained their source of information from TV/RADIO, while those with no level of education were the least informed. This result is statistically significant at 1% (p >0.01).

**TABLE 18:** Occupation of correspondents and what does climate change mean to you cross-tabulation

		WHAT DOES CLIMATE CHANGE MEAN TO YOU					
		CHANGE IN TEMPERATURE	CHANGE IN THE ENVIRONMENT	CHANGE IN WEATHER CONDITIONS	CHANGE IN THE CLIMATE DUE TO GLOBAL WARMING	I DON'T KNOW	OTHERS
OCCUPATION OF CORRESPONDENTS	STUDENT	21	21	27	6	0	75
	ARTISAN	0	12	7	0	12	31
	PUBLIC SERVANT	14	7	0	0	0	21
	TRADER	28	14	42	0	28	112
	OTHERS	7	0	7	0	21	35
<b>TOTAL</b>		<b>70</b>	<b>56</b>	<b>83</b>	<b>6</b>	<b>63</b>	<b>274</b>

Chi squared (x2) = 12.167 p, =0.001

Most traders and students believed climate change to be a change in weather conditions, while only a few students thought it to be a change in the climate due to global warming. These studies might be biased due to the lesser population of students; hence this result is statistically significant at 1% (p>0.01).

**TABLE 19:** Climate change can cause an increase in flooding, and have you heard of climate change cross-tabulation

		HAVE YOU HEARD OF CLIMATE CHANGE		
		YES	NO	TOTAL
CLIMATE CHANGE CAN CAUSE AN INCREASE IN FLOODING	STRONGLY AGREE	108	7	115
	AGREE	48	0	48
	I DON'T KNOW	41	28	69
	DISAGREE	21	14	35
	STRONGLY DISAGREE	7	0	7
<b>TOTAL</b>		<b>229</b>	<b>49</b>	<b>274</b>

Chi squared 60.178, p= 0.001

The majority of the respondents that strongly agreed to climate change causing an increase in flooding have heard about climate change. This result is statistically significant at 1% (p>0.01)

## DISCUSSION

Okada community has a young population, with the highest proportion of respondents being in the age group 25-29 years; the mean age was 29.43. This finding is expected as Nigeria, like most developing nations, is known to have an expansive population [1,3]. A more significant proportion of persons is in the younger age groups as each new birth cohort is more extensive than before. More of the respondents were males. Trading was the predominant occupation, but it was common to find persons who reported being involved in some level of farming, usually subsistence type, in conjunction with some other field and did not regard farming as their primary occupation [24]. Reasons for this might be that many of the townies believe there is a demand for goods and services due to the university's presence. As such, attempting to meet this demand has thus created an alternative means of livelihood for them. The university and the hospital are essential employers of labor and have contributed immensely to the community's economy [31]. In addition, students of the nearby polytechnic in Usen town and other universities were highly represented in the survey because at the time of data collection, quite a number live in Okada, and the Academic Staff Union of Universities was on strike. This was responsible for the high number of respondents who identified as students. More than three-quarters of respondents had at least a secondary level of education. This could be explained by the fact that the presence of the Okada Grammar School has increased the school enrolment rate in the community [33]. While not all who complete secondary school education can proceed to the tertiary level, majorly due to economic constraints, it has dramatically helped reduce illiteracy levels. There were more singles than married couples in the survey, although the difference was not enormous.

The majority of the respondents were aware of the concept of climate change. This was in concordance with a study conducted in Cross River State, Nigeria, and in agreement with another study carried out in Ajiwa and Dutsinma agricultural zones of Katsina State where respondents were aware of the concept of climate change. This could be due to the increasing attention and publicity that climate change is being increasingly afforded. Recently, it was recognized as an actual nuisance, thus warranting public attention as the effects are felt by the entire human race, irrespective of ethnicity, age, or social status.

Among the respondents who were aware of climate change, many reported television and radio as their sources of information. This was in keeping with the study carried out in Yenagoa, Bayelsa State, in 2014, and in concurrence with the study carried out in rural Ajuwa and Dutsinma areas of Katsina State, where the most important source of information was radio. This finding may be because Okada, Nigeria, represents a reasonably informed, suburban-style population and has also benefited from its proximity to metropolitan Benin City. Also, a significant proportion of respondents are quite literate with at least a secondary level of education. Mass media such as television and especially radio are pretty popular among residents in Okada, like most Nigerian cities, suburbs, and towns, which they rely on for information and entertainment [33].

Over half of the respondents recognized that there are anthropogenic factors that contribute to climate change. This was in contrast with a study carried out in South-Eastern Nigeria where supernatural reasons were cited as the cause of climate change.

The reason for the finding in this current study may be the higher literacy levels and the suburban nature of the Okada community, which represents a better-educated population compared to one which may be found in a strictly rural one. An even higher proportion of respondents cited natural variability as the cause of global warming [27-28]. This was in contrast with a study carried out in rural Cross River state, where more respondents recognized the human-induced causes of climate change. A reason for this is that a lot of NGOs and extension workers' pay more attention to health educating oil-producing communities in the delta regions of the county where crude oil is explored on matters relating to climate change, perhaps in belief that they are more likely to suffer the effects of climate such as increasing temperatures in these communities, thereby neglecting other communities in the country, forgetting that there are other anthropogenic contributors to climate change such as felling of trees and bush burning which are common in Okada due to the timber processing industry [34]. This carries a risk of creating a gulf in the information available in these other communities like Okada.

Of all the possible responses, respondents believed climate change to mean either a change in weather, a change in temperature, or a change in environmental conditions, with only a microscopic number recognizing it to represent a difference in climate due to global warming. This was likely due to people failing to recognize that weather and climate are two different but related entities, thereby equating both as the same [34].

Many respondents believed rising temperatures, followed by desertification, to be the most damning consequences of climate change in Nigeria, followed closely by flooding and drought. This was in keeping with a study done in rural Cross River State. A reason for this finding may be that Edo and Cross River states share similar ecologies and are thus likely to suffer similar environmental impacts of climate change [26]. These impacts threaten to truncate efforts to end hunger, achieve food se, improve prove nutrition, and promote sustainable agriculture (in line with SDG 2). Consequences of desertification are already being felt as desertification has led to the southward migration of Fulani herdsmen in search of foliage and grazing land for their livestock which has led them into unfamiliar terrains, with the occasional inadvertent grazing on farmers crops, resulting in conflicts, killings and retaliatory killings which perhaps would be unheard of if they had sufficient grazing and arable land up north.

While about two-thirds of respondents were aware of the human-induced causes of climate change, the remaining third did not. Of these practices, bush burning, burning of fossil fuels, and deforestation appeared to be the most typical contributors to climate change in Okada. This was in agreement with studies carried out in Akwa Ibom and Lagos states, where almost all respondents agreed that anthropogenic or human-induced activities were responsible for the phenomenon. In the Okada community, the predominant method of waste disposal is the burning of refuse. This is because there appears to be no municipal waste management agency involved in waste management [1,8]. Another equally important community practice contributing to climate change seems to be the burning of fossil fuels as cooking gas is the energy source used for cooking, with most persons asked stating its efficiency as the reason for their choice. This choice is likely due again to the suburban characteristics of the population.

While a great proportion of the population do not leave electrical appliances on when leaving their homes, they were unaware this simple habit could help mitigate the effects climate change in the long run, and mostly switched off appliances so as not to incur hefty power bills at the end of the month due to unnecessary waste<sup>[9, 23]</sup>.

A great proportion of respondents agreed that climate change could exact a negative effect on health and the environment. Of all the perceived effects of climate change, a reduction in food production seemed to be the most feared effect, which respondents as this were the most reported. This was closely followed by flooding, rising sea levels, and rising temperature,

respectively. These findings agree with studies carried out in Yenagoa, Bayelsa State, and rural South-Eastern Nigeria in 2014<sup>[34]</sup>. This may be explained that a sizeable number of respondents were farmers and might have suffered reduced crop yield in recent times. This signifies a real challenge as Nigeria already suffers from malnutrition, especially among children, which might be further worsened by increased food shortage due to drought, with consequent worsening of hunger and poverty<sup>[20]</sup>. This would threaten to exacerbate the economic turmoil further already being experienced in the country, alas to a point warranting external aid. Respondents also believed that flooding was attributable to climate change due to rising sea levels and unpredictable patterns of weather events. All these might combine to truncate the nation's ability to meet its sustainable development goals, such as its attempt to end poverty (SDG 1) and end hunger, achieve food security, improve nutrition, and promote sustainable agriculture (SDG 2)<sup>[35]</sup>.

## CONCLUSION

Climate change is a phenomenon that is no longer foreign or far-fetched as its effects are becoming felt by humans of all races and backgrounds increasingly. Humanity must thus quickly recognize this nuisance because recognizing a problem is the first step to dealing with it as then and only then can any measures be taken to address it head on. It is thus a worrying sign that while more people had a good idea of the phenomenon and its effects on health and environment as compared to those who did not, knowledge of contributory community practices was lacking, and so can do next to nothing in terms of enacting simple measures in an attempt to deal with it. A lot more can thus be done to help create more awareness about the nuisance as it were, to promote and enhance environmental sustainability for the sake of this generation and more importantly, to safeguard the future of generations yet unborn, to not render the planet virtually inhabitable for humankind.

## RECOMMENDATION

### To the Federal Government

The federal government should carry out more environmental health promotion programs on the effects of climate change and the contributory community practices. Also, there should be stricter legislative laws against bush burning, felling of trees, and in the long run, the government should gradually reduce the burning of fossil fuels as a source of energy by shifting to adopt more renewable ones.

### To the State Government

The state government should encourage the use of waste management agencies in the disposal of waste, and its use should be at a much-subsidized rate to stimulate individuals patronize this means of disposing of waste rather than bush burning.

## The Local Government

The local government should provide more waste disposal sites in the community and carry out more health promotion programs on the effects of bush burning and other contributory factors to climate change.

## Non-Governmental Organisations

Non-governmental organizations should carry out more health education programs on climate change and global warming to make more individuals aware of the contributory factors, effects, and how they can curb them.

## Community Health Department

The community health department of Igbinedion University should carry out more health promotion programs at the community level to health educate individuals on climate change and global warming.

## Individuals

Individuals should reduce as much as possible any activity that may be contributory to climate change and global warming, such as bush burning, leaving of home appliances on, burning of fossil fuels, and so on.

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