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Investigating Effects of Climate Change on Health Risks in Nigeria

Ilevbare Femi Monday

Abstract

Climate change has become a major challenge globally. Human activities have several direct and indirect impacts on health. In Nigeria, the impacts of climate change are more devastating due to their vulnerability and low coping capability. Studies on the impacts of climate change on health risks in Nigeria are scarce. With this rationale, this study investigates the effects of climate change on health risks in Nigeria. Evidence abounds that climate change impacts in Nigeria arise from climate change-related causes such as increase in temperature, rainfall, sea level rise, extreme weather events and, especially, increased health risks. Health risks such as cerebra-spinal meningitis, cardiovascular respiratory disorder of elderly, skin cancer, malaria, high blood pressure and morbidity were identified as the direct consequences of climate change. The study concluded that government should raise awareness on adverse effects of climate change which is common among vulnerable groups, like women, children and rural dwellers in Nigeria.

Keywords: climate change, environment, health risks, Nigeria, vulnerability

1. Introduction

Over the years, human beings have relied on the environment for existence and sustenance in a way that man's survival is determined by his interaction with the environment brought about by the activities of man. One of the global events that arise from man-environment transaction is climate change. Climate change has become the subject of debates and discourse among scholars and experts, making it one of the most topical issues in the world agenda today. According to Odey (2012), scientific evidence has revealed that climate change is an all-encompassing threat and is considered the most serious ecological threat to the survival and sustainable development of humanity.

2. What is climate change?

Climate change can refer to a change in climate, attributed directly or indirectly to human activities such as burning, farming, mining and others that have the propensity to alter the atmospheric composition of the earth and to lead to global warming [1]. Climate change has been coined as an increase in average global temperature, which is caused by natural events and human activities. However, the Intergovernmental Panel on Climate Change [2], Fourth Assessment Report (AR4),

gave the most accepted definition of climate change, stipulating that 'climate change is a change in the state of the climate that can be identified by using statistical tests by changes in the mean and variability of its properties, and that persists for an extended period typically decades or longer'. According to Odjugo [3], climate change is different from the generally known terms like climatic fluctuations or climatic variability. Climatic fluctuation or variability refers to variations in the mean state and other statistics such as standard deviations of the climate on all spatial and temporal scales beyond that of individual weather events. However, climate change, like variability, may be due to natural internal processes within the climate system (internal variability) or variations in natural or anthropogenic external forces (external variability).

3. Causes of climate change

The major causes of climate change are either natural or anthropogenic factors. According to Rasak [4], the natural factors are the astronomical and the extraterrestrial factors. These astronomical factors are the changes in the eccentricity of the earth's orbit, changes in the obliquity of the plane of ecliptic and changes in orbital precession while the extraterrestrial factors include solar radiation quantity. The anthropogenic factors in climate change are directly linked to man-environment transactions whose consequences result in the emission of large amount of greenhouse gases into the atmosphere that depletes the ozone layer or activities that reduce the amount of carbons absorbed from the atmosphere.

Researchers have provided evidence that for the past decades, anthropogenic factors such as urbanization, deforestation, population growth, industrialization and the release of greenhouse gases are major factors responsible for the depletion of the ozone layer [5, 6]. However, several studies have identified Africa as the most vulnerable to the impacts of climate change [7]. This reason is not far-fetched due to the fact that developing countries in Africa have experienced and are vulnerable to the impact of climate change because of access to limited climate information, institutions, financial resources and limited adaptation capacity [8]. Nigeria as one of the most populous nations with 173 million people in Africa is not exempted [9]. Nigeria has been adversely affected by climate change due to its vulnerability and low coping capacity [10]. Also, the peculiarity of the country as one of the leading exporters of crude oil faces the danger of balancing global energy demands and engulfs on the need to address climate change and environmental considerations [11].

One major event revolving around climate change in Nigeria is the drying up of Lake Chad. The southern part of Lake Chad is the part of the section of the lake that lies inside Nigerian territory. Some years back, Lake Chad covered an estimated area of over 40,000 km, while presently it now covers 1300 km² [10]. The implication of this occurrence is that the land is laid to wastages by rising temperature which leads to the southwards expansion of the Sahara desert. Hence, farmlands and surrounding villages have become barren due to the overpowering nature of advancing desertification, whose ripple effects have led to the massive migration of people in search of more fertile land.

Adepoju [9] posited that the impacts of climate change in Nigeria include rising temperature, more intense and frequent weather events and sea level rise. Due to Nigeria's population, the consequences are increased water and food shortages, higher exposure to heat stress and ultraviolet radiation [9]. In support of this assertion, Borokinni [12] provided evidence that climate change events affect all aspects of human life, especially the social and environmental determinants of

health, clean air, safe drinking water and food security. Thus, climate change has a lot of implications on human health. Climate and weather conditions have been identified as precursors to factors that affect human health [10]. The effect of climate change on human health has been demonstrated in literature. For instance, Nwoke et al. [13] have linked climate change to higher temperatures, which enhance production of various secondary pollutants and, thereafter, increase in the frequency of allergic and cardio-respiratory disorders and deaths caused by these air pollutants. Furthermore, cases of mental health and population mobility are a result of environmental disasters such as flooding, rising sea levels and shortages of water. Horton and McMichael [14] have identified emotional stresses and mental health problems in response to perception and fear of climate change to constitute health challenge to affected communities. In lieu of this development, the goal of this chapter is to explore the effects of climate change on health risks in Nigeria.

4. Climate change and health risks in Nigeria

Evidence has established that people's health can be affected by climate change [15]. Therefore, vulnerable populations such as young children, pregnant women, older adults, individuals with chronic sickness and disabilities and individuals with fewer resources have been identified to be at increased risk [15]. Furthermore, Hathaway and Maibach [15] have found that among vulnerable people in Asia and Africa, awareness of increasing health harms due to specific changing climatic conditions is high. The consequences of climate change on human health, especially, in Nigeria could be direct and indirect. Omoruyi and Onafalujo [16] explained that one of the direct consequences of climate change in Nigeria includes cerebra-spinal meningitis, cardiovascular respiratory disorder of the elderly people, skin cancer, high blood pressure, malaria, cholera and child and maternal health issues.

5. Cerebra-spinal meningitis and climate change

Cerebra-spinal meningitis is one of the infectious diseases likely to be caused by climate change. Incidences of meningitis, for instance, have been on the rise in Nigeria due to excessive heat. According to Akingbade [17], cases of meningitis have been reported to have increased in Nigeria as a result of excessive heat. The World Health Organization has revealed that 35% of reported meningitis outbreaks in Africa between 1996 and 2010 are from Nigeria, with statistics showing 95% of this disease happening in the northern region of Nigeria [18]. Meningitis is a disease caused by an infection due to bacteria, viruses and protozoa, of the meanings which is the thin lining that surrounds the brain and the spinal cord. cursory investigations found that over 200 people were killed by meningitis in Nigeria and neighbouring Niger Republic within a week. Statistics revealed that there were 25,000 suspected cases and 1500 deaths in the first quarter of 2009 [17].

Abdussalam et al. [18] in an empirical investigation examined the impact of future climate change on meningitis risk in northwest Nigeria by forcing an empirical model of meningitis with monthly simulations of 7 meteorological variables from an ensemble of 13 statistically downscaled global climate model projections from phase 5 of the Coupled Model Intercomparison Experiment (CMIP5) for representative concentration pathway (RCP) 2.6, 6.0 and 8.5 scenarios, with the numbers representing the globally averaged top-of-the-atmosphere radiative imbalance (in Wm²) in 2100. The results suggest future temperature increases due to climate change have the potential to significantly increase meningitis cases

in both the early (2020–2035) and late (2060–2075) twenty-first century, and for the seasonal onset of meningitis to begin about a month earlier on average by late century, in October rather than November. However, Abdussalam et al. [18] suggest that this outcome represents the climatological potential for increased cases due to climate change, as it is assumed that current prevention and treatment strategies will remain similar in the future.

Brenda et al. [19] in an empirical analysis reported that between December 2016 and May 2017, a total of 14,280 suspected meningitis cases were reported across 23 of the 36 states in Nigeria. There were 1145 deaths (8% case fatality rate) among suspected cases. The northern states Zamfara and Sokoto were at the epicentre of the meningitis epidemic in Nigeria.

6. Vector-borne diseases, infection and climate change

Climatic conditions have been shown to affect water-borne diseases in Nigeria [12]. The changes in climatic conditions are germane to lengthen the transmission seasons of important vector-borne diseases and alter their geographic range. Malaria has been identified to be caused by climate conditions caused by a unicellular organism known as *Plasmodium* and transmitted by the bite of infected female *Anopheles* mosquitoes. Evidence shows that malaria accounted for over 45% of all outpatients and about 50% of the Nigerians suffer from at least one episode of malaria each year [20].

Scholars have argued that global warming, a consequence of climate change, could be linked—directly or indirectly—to the persistence as well as the re-emergence of malaria epidemics ([20, 21]). The association between climate change and malaria spread is complex and remains a subject of controversy and debates [21]. Therefore, Adewuyi and Adefemi [21] posited that the spread and severity of malaria in several places and the increased incidences of the disease in some regions could indeed be associated with the effects and consequences of climate change. With this assertion, Adewuyi and Adefemi [21] suggest that the biology of the *Plasmodium spp*, the ecology of mosquitoes and even the susceptibility of humans to malaria could all be affected directly/indirectly by extreme climatic events.

The World Health Organization [11] projected that by 2070, under both high and low emissions, over 400 million people are predicted to be at risk of malaria. Also population growth can cause increases in the population at risk in localities where malaria presence is static in the nearest future. The world's most virulent infections are also highly sensitive to climate temperature, precipitation and humidity have an influence on the life-cycles of the vectors and the infectious agents [11]. The World Health Organization [22] estimates that 212 million people were infected with human malaria parasites globally with Africa accounting for about 90% of these cases in 2015. However, 18 countries together accounted for 90% of the total cases in sub-Saharan Africa with 37 million reported cases representing 29% of these cases from Nigeria alone. Research finding estimates that malaria kills over 400,000 people every year, mainly African children under 5 years of age [12]. In a study aimed to describe malaria transmission trends and analyse the impact of climatic factors on malaria transmission in the highlands of Plateau State, Central Nigeria, carried out by Nanvyat et al. [23], it was found that climatic factors are among the major determinants of malaria transmission in the highlands of Plateau state except in Jos-North LGA where the low model deviance explained (35.4%) could mean that there are important factors driving malaria transmission in the area other than climatic factors.

Similarly, Ayeni [20] has attributed the increase in population, rainfall fluctuation and urban heat cum high thermal discomfort and the problem of unhygienic environment to have contributed to the increase in malaria morbidity in Akure, Southwestern, Nigeria. Ayeni's [20] study based on an evaluation of the existing framework on malaria incidence using meteorology data between 1986 and 2008 and hospital records between 2000 and 2008 as well as relevant field studies indicate that malaria cases increased from 24,092 (of which males and females accounted for 12,477 and 11,615, respectively) in year 2000 to 62,121 (of which males and females accounted for 30,413 and 31,708, respectively) in year 2008.

In Nigeria, evidence suggests an estimated 137,600 diarrhoeal deaths in children under 15 years of age in the baseline period of 2008 [11]. Furthermore, it was reported that under a high emissions event, diarrhoeal deaths which are linked to climate change in children under 15 years of age are projected to be 9.8% of the over 76,000 diarrhoeal deaths predicted in 2030 [11].

7. Cardiovascular diseases and climate change

The World Health Organization [11] has identified air pollution as the single largest environmental health risk [24]. Thus, non-communicable diseases constitute the largest and fastest growing global health burden, with treatment costs placing a massive strain on the government and individual resources. Campbell-Lendrum and Pruss-Ustun [24] reiterated that the major causes of air pollution, and thus of a large proportion of the non-communicable disease burden, are the energy sources that currently drive our transport, electricity generation, industry and food production systems. Poor diet (high consumption of sugar, salt, saturated fat, etc.) and unhealthy lifestyle (smoking, alcohol consumption and physical inactivity) have been implicated as major risk factors of cardiovascular disease and other non-communicable diseases.

8. Skin cancer and climate change

Evidence has proven that climate change has environmental and economic consequences on human health [25]. The effects on human diseases such as skin cancer have been relatively underemphasized. There is a direct link between ultraviolet (UV) exposure from the sun and the development of malignant skin disease [25].

According to Bharath and Turner [25], ultraviolet radiation (UVR) occupies the space between visible light and X-rays on the electromagnetic spectrum. The colour violet corresponds to the shortest wavelength in visible light and UV actually means 'beyond violet' (from the Latin word *ultra*, meaning 'beyond'). UV light can be further subdivided in terms of wavelength: 'long wave' UV with a range of 320–400 nm is known as UV-A; 'medium wave' UV with a range of 290–320 nm is known as UV-B and 'short wave' UV with a range of 100–290 nm is known as UV-C.1. Therefore, UV-C is known to carry the most energy and is the most damaging to biological systems while UVB causes some DNA damage in the skin.

However, three most common skin cancers have been identified. These are: basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and malignant melanoma (MM). Bharath and Turner [25] identified that exposure to ultraviolet radiation is recognized as a risk factor in all three types of cancer. Oripelaye et al. [26] emphasized the alarming rate of solar intensity and HIV epidemic which have progressively eroded the protective effects of melanin especially among black-skinned populations. For instance, Oripelaye et al. [26] in a retrospective study, with research settings at the Obafemi Awolowo University Teaching Hospital, Ile-Ife,

South-western, Nigeria, included as inclusion criteria the patients who were diagnosed with primary skin cancers between January 2008 and December 2017. Their study findings indicate the frequency of primary skin cancers was 1.0%. Females (58.3%) outnumbered the males (41.7%), the ratio being 1.4:1. Furthermore, the spectrum of primary skin cancers documented by this study comprised of squamous cell carcinoma (33.3%), malignant melanoma (25%), Kaposi sarcoma (15.3%), basal cell carcinoma (9.7%) and cutaneous lymphoma (6.9%). The researchers opined that melanin remains a major protective factor for skin cancers among negroids. Hence, albinism and high burden of HIV were identified risk groups for skin cancers [26]. The eradication of HIV and enhanced sun protection were suggested in order to reduce the prevalence of skin cancers among the black race.

9. Elderly health and climate change

One profound effect of climate change is among the aged persons in Nigeria. According to Aina and Adewoyin [27], the vulnerable age are particularly more at risk of climate-related diseases because of the effect of their age on their physiological and immunological compositions. Research has provided credence that the aged are more at risk of climate-related diseases because they have a lower physiological reserve, possess a slower rate of metabolism and a weakened immune system and have a higher morbidity rate [28].

To determine the effects of climate change on the trend and prevalence of climate-related diseases among the aged in an urban setting using Ikeja, Lagos, Nigeria, as a case study, two sets of secondary data—hospital records of 600 adults aged 50 and above with clinically diagnosed cases of climate related diseases and data on climatic parameters of temperature and rainfall—were employed. The data sets were collected for the period 2001–2015. Aina et al. [27] in the study found that temperature declined over the period of study while rainfall increased. The study also showed that incidence of high blood pressure was more prevalent (43%) than any other climate-related diseases among the sampled population. This was followed by fever and respiratory diseases. Incidences of cholera and diarrhoea as well as blindness and skin diseases were relatively few. Furthermore, the study revealed that the cases of high blood pressure, fever and respiratory diseases were positively correlated with year as they showed a progressive annual increase in relation to the fluctuations in rainfall and temperature, particularly increased rainfall. Finally, the fluctuations in rainfall and temperature accounted for 11.5% of the variations in climate-related diseases among the aged in the period studied [27].

10. Mitigation measures

The mitigation and adaptive measures against the effects of climate change are very critical for Nigeria to reduce the health risks brought about by this global threat. The health sector from primary, secondary and tertiary health institutions should identify the major regional health hazards caused by climate change and ensure that the development of risk-lessening adaptations are employed. According to Borokinni [12], adaptation capacities and strategies differ among populations. Borokinni [12] elaborated that this will be particularly necessary where the rates of pre-existing disease such as childhood diarrhoea and malnutrition are already high and which would become higher due to the multiplier effects of climate change. Hence, effective adaptive strategies should involve collaboration among diverse government sectors, research institutes, various disciplines and communities.

There is the need to protect the environment; hence, there should be awareness of the potential health risks associated with climate change. Relevant agencies should create awareness among citizens including disaster and emerging workers about climate change impacts and how they affect vulnerable populations. This could be achieved by providing basic training, workshops and sensitization programmes to raise awareness and promote climate change adaptation. In addition, the longer-term global health benefits should strengthen support for such actions. The health benefits will result from mitigating actions that address modes of transportation, housing-design, energy generation and agricultural systems. Borokinni [12] emphasized that in many poor populations such as Nigeria, improvements in environment-related technologies will aid to replace indoor-polluting cooking fuels with low-carbon fuels and improvements in family planning literacy, which will lead to fewer, better spaced pregnancies. This will reduce pressures on the climate system. The effectiveness of these actions will directly reduce well-known risk factors for diseases and premature death emanating from air pollution, sedentary lifestyles and dietary excesses. Sedentary lifestyle has been linked to limited physical activity, prolonged sitting at workplace, vehicles, communities, schools and public places [29]. Sedentary behaviours are defined as those behaviours associated with lesser energy expenditure [29]. According to Mfrekemfon and Okey-Orji [29], attention has shifted from a physically demanding life to that of lesser physical activities, which has enabled individuals to be vulnerable to the high risk of having serious health ailments such as obesity, hypertension, cardiac abnormality and cancers. However, these ailments could be avoided if people shun unhealthy lifestyles. Therefore, there is the need for individuals to make conscious efforts and initiatives to engage in more physical activities, and modifying their dietary habits and avoiding unhealthy behaviour.

Innovative urban design has also been identified to have some positive advantages with regard to energy use, greenhouse gas emissions, effects of urban heat, patterns of physical activity and community cohesion. However, four strategies were identified to have the largest aggregate potential for health and SLCP mitigation benefits as well as reducing CO₂.

These strategies are: policies and investments that prioritize dedicated rapid transit and walking and cycling networks in compact cities can promote health in multiple ways, including reduced air pollution exposures, reduced injury risks and greater opportunities for safe active travel; second, promoting healthier diets rich in plant-based foods and low in red and processed meats among affluent populations at risk of a range of diet-related non-communicable diseases will have a positive effect on health; third, encouraging the use of clean and efficient cook stoves and fuels, and cleaner energy sources, in low-income households that currently rely on solid fuels for heating and cooking; fourth, reducing vehicle emissions of both particulate matter as well as ozone precursors (e.g., NO₂) by implementing stricter vehicle and fuel emissions and efficiency standards.

Furthermore, to mitigate the threats of climate change in Nigeria, reducing polluting vehicles and public transportation reduce greenhouse gases, and walking and cycling will facilitate physical activity that improves well-being among the vulnerable population. Agencies and establishments under the Ministry of Health in Nigeria should be engaged in leadership and coordination of health-related matters, especially the ones that are environmental burden diseases. Hence, they should play a dominant role in raising awareness of the health impacts of air pollution and in advocacy activities.

Nigeria is recognized as a fossil fuel-dependent economy with a large climate-sensitive agricultural sector; therefore, the development of a climate change policy and response strategy is critical. Government should invest more in low-carbon

fuels and renewable energy in Nigeria. However, there should be joint efforts between the government and the citizenry in every community to combat climate change in Nigeria. In addition, relevant agencies should conduct periodic assessments of the vulnerability of populations and population groups to climate change and identify appropriate adaptation strategies. Indicators for climate and environmental health in national surveillance systems should be promoted, providing evidence to support decision-making and behaviour to reduce climate-related health risks in Nigeria. Human actions that influence climate change include pressures due to population growth and region-specific types and patterns of consumption. Therefore, it becomes imperative for households and individuals to learn how to adapt to the threats of climate change, and be ready to share information with other stakeholders about their daily experiences with climate change impacts and adaptation. In addition, individuals must be prepared to imbibe attitudinal change in order to build capacity for adaptation towards climate change.

Environmental psychologists can assist in conceptualizing and understanding better the psycho-social aspects of these driving forces behind climate change. This could be achieved by providing behavioural analyses of consumption by targeting on those behaviours that contribute the most to climate change. Hence, individual predictors of consumption that include ability (e.g., income, skills) and motivation (e.g., connection to nature, perceptions of needs versus a luxuries, core psychological needs) to engage in consumption are some of the psychological variables. Climate change can have psychosocial impacts on individuals, groups and communities due to relative risk appraisals, mental models and media representation. However, there are some psychological barriers why people do not respond adequately to the risks of climate change. Among these are ignorance, uncertainty, mistrust, denial, judgmental discounting, habits and perceived behavioural control.

11. Conclusion

The health risks associated with climate change in Nigeria cannot be overemphasized. All populations are affected by climate change, particularly the vulnerable like the children and the elderly people. The impacts of climate change are also expected to increase over the years, which mean that some existing health challenges will increase. Therefore, it is very important for everyone to have a better knowledge and perception about climate change as it affects human health. This is expected to inform people's decision-making about how to reduce the impact of the amount of climate change in the nearest future. In line with this development, environmental education and awareness should be promoted by stakeholders and government to bring about the best adaptation and mitigation mechanisms among vulnerable communities. Also, there should be workshops, seminars and forums on climate change adaptation and mitigation organized regularly in schools, universities, communities, religious houses, motor parks and public places. Research needs on climate change should be identified by the government and researchers. There is also the need for children in Nigeria to be taught the foundation of a climate-smart lifestyle, environmentally friendly behaviour and protection. Furthermore, students from primary to tertiary institutions are empowered with relevant information on how to choose professions that will assist the society to solve emerging environmental problems as a consequence of climate change in Nigeria. Adequate funding of groundbreaking researches from various multidisciplinary disciplines relating to climate change should be given priority in Nigeria. Lastly, all stakeholders should improve regional, national and local capacity to respond to public health needs during climate-related emergencies.

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