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Public health impacts of flooding: A case study of 2022 flood outbreak in Nigeria

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Abstract

Flooding refers to an excessive outflow or inflow of water, especially across the normally dry ground (occasionally referred to as a natural calamity). Recently, several outbreaks of flood have been reported in several cities in Nigeria. In recent months, the number of people affected by widespread flooding across Nigeria has risen to over 3.2 million out of 5 million people in Africa, with over 600 fatalities. Flood events in recent years resulted in the loss of life and huge damages to human welfare, requiring urgent reaction. We aim to look at the public health impacts of flooding in Nigeria and provide an everlasting solution to the associated challenges. We center our investigations mostly on recent flooding in Nigeria with the different assumptions surrounding it.

Keywords: flood, Nigeria, climate change, Africa

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Introduction

Flooding is defined as the rising and overflowing of a body of water, especially onto normally dry land.[1] It has different types/classes based on the water level, size, duration, wave strength, magnitude of destruction, cause(s), and area affected.[2] Regardless of the cause(s), nature, or type, water overflows to where it is not desired and poses a potential threat to humankind and properties, sometimes with economic consequences.[3]

Over 3.2 million people have been affected by extensive flooding in Nigeria recently, and over 600 people have died.[4] Over 1.4 million people are displaced.[5] Flood is the most frequent and common form of natural disaster which has impacted the public health of Nigeria severely.[6] Since 2012, we are currently experiencing one of the biggest floods in a very long time.[7] Yet, professionals have made little or no efforts to enlighten the masses about some of its causes, consequences, and ways to better cope with the situation. One of the more pressing but neglected long-term consequences of flooding is the interplay between our changing climate and the current situation.[8]

River floods may get less frequent in some regions due to climate change while increasing in size and frequency in others.[9] Such changes in heavy precipitation events may subsequently increase the magnitude and frequency of river flooding as warmer temperatures cause more water to evaporate from the land and oceans.[10] Changes in streamflow and ongoing dredging can also impact flooding patterns. The consequence of human intervention and environmental changes may make the shifting impact of climate on flooding even more challenging.[9] Higher sea levels, new weather patterns, shifting waters and/or air cycles, and more intense storms are all signs of a changing environment.[10] Even waste management

programs contribute significantly to environmental change.[11] Environmental changes have already worsened floods in the United States, particularly in coastal and low-lying areas. Nigeria has an average elevation of 380 meters above relatively low sea level.[12]

Floods can have positive environmental repercussions.[13] Floods preserve biodiversity and vital ecological services in many natural systems.[14] They promote the connectivity between aquatic habitats, connect the river to the land around it, rehydrate groundwater systems, fill wetlands, and transport sediment and nutrients throughout the landscape and into the ocean. Floods cause reproductive events, migration, and dispersal in many species. Except for extreme floods, these natural systems are quite resilient.[15]

But very few have researched and given recommendations on how to mitigate and better play an important role in climatic effects, influencing flooding causes. We aim to look at the public health impacts of flooding in Nigeria and provide an everlasting solution to the associated challenges. We center our investigations mostly on recent flooding in Nigeria with the different assumptions surrounding it.

Materials And Methods

We utilized online scholarly databases such as PubMed, Google Scholar, Scopus, and AJOL, to retrieve articles published that address various flood incidents in Nigeria. We conducted the literature using the keywords: “Flood”, “Flooding”, “Nigeria”, “Climate change”, “Africa”, “Public health”. We included all the articles that present the past and recent issues related to flooding and climate change in Nigeria. Articles that presented other climate changes apart from floods are excluded. About 76 articles were used in writing this article.

Critical Analysis Of The Issue Of The Flood Ravaging Nigerian States

Among the causative agents of flood in Nigeria are dams and climate change. Since late September and early October, Nigeria has been dealing with its greatest flood since the floods of 2002 and 2012, which swamped extensive areas in 30 states, particularly in the country's south-eastern regions, killing 400 people overall and uprooting 1.3 million more.[16] Since late September, Cameroun, a country next to Nigeria with a 1,975 km (1,227 mi) long land border with Nigeria that connects to the Atlantic Ocean in the south and a triangular point with Chad in the north, has opened its reservoir dam known as Lardo, which is situated in the northern province of Cameroun along the course of the Benue River.[17] The construction of this dam in 1982 was intended to provide electricity to the northern part of the country and enable the irrigation of agricultural lands.[18] Since the dam was built, its releases of water occurred in the years 2002 and 2012, each time causing severe flooding in Nigeria, it was anticipated that the Nigerian government would build its reservoir to mitigate the impact of released water by the Cameroonian reservoir every ten years to prevent the total collapse of the dam whose inflow source is the Benue River in Nigeria.[19]

Over 600,000 animals have been killed by the current flood in Nigeria, including large poultry farms, commercial pig farms, commercial cattle rearers, herders who were transporting trucks full of cattle to neighboring states, and then billion-dollar investments in crop agriculture, like the Olam rice farm, which is located in one of the states that have been severely affected by flooding and are worth over $20 million and provide about 30% of the rice consumed in Nigeria.[20]

The flooding destroyed billion-dollar investments made in agriculture and caused a rise in food prices in Nigeria and severe food shortages.[21] The flood submerged agricultural lands, and agricultural produce harvested by farmers could not be transported to neighboring states because the flood's impact destroyed major roads leading to those states, making transportation a high mortality risk.

Children make up about 60% of flood victims (1,500,000). Anambra, Bayelsa, Delta, Benue, Rivers, Kogi, Cross River, Lagos, and Ogun were among the states in the South that were severely impacted by the extreme floods, as were portions of Gombe, Jigawa, Kaduna, Niger, Nasarawa, and Adamawa in the country's north.[22] Nigeria saw the highest number of flood-related casualties as of October 6, 2022, with 2 million people forced to flee their homes, 612 people lost their lives, 200,000 dwellings were damaged, and 7483 individuals contracted cholera or other waterborne illnesses (Figure 1).[23]

Natural catastrophes such as floods are known to severely affect human economic growth, livelihoods, agriculture, and health and well-being (particularly due to the risk of infectious respiratory infections), among survivors' main causes of illness and death.[24]

The government has sent aid to 21 of the 33 states hit by the flood, but more is needed because some of the aid is being stolen and redirected by high-ranking government officials in the flood-stricken areas. The relocated flood victims are receiving less medical care.

Nigeria's already overburdened water and sanitation infrastructure has been made worse by the flood calamity. Human and animal waste frequently contaminate water with pathogens that can spread via feces. Several corpses were washed up by the flood in a cemetery in Yenagoa,

the capital of Bayelsa state, and over 500 corpses were washed away from their graves in a cemetery in Mariga Town Mariga Local Government Council in Niger State, raising health concerns from the offensive smell and potential risk of disease. The displaced are using the water to cook with and boil it to drink because no attention has been given to them or any relief material provided for them.

Nigeria is a great contributor to climate change as its massive industries and factories release a high carbon footprint affecting small island states and neighboring countries in Africa that are surrounded by water.[25] These increasing emissions are causing an exponential melting of the ice caps, and the warming ocean absorbing excess greenhouse gas emissions, is leading to a rise in sea level that leads to extreme weather events, that lead to flooding, as in the case of the massive flooding that occurred in Nigeria. The Nigerian government could resolve this issue by finishing the dam that it began constructing in 1982 as part of an agreement with the Cameroonian government to lessen the impact of the discharge of the Cameroonian lag do dam.

To prevent a future catastrophe brought on by unforeseen circumstances, the government should strictly address issues with poor drainage systems, current urban planning that is inadequate, and unhealthy environmental practices like sand filling of lagoons and swamps with abundant wildlife for estate development that will ultimately exacerbate the current crisis.

Relationship Between Climate Change and Diseases

Climatic changes can considerably impact the medical system through the emergence of numerous infectious diseases (Figure 1).[26] The three key elements of numerous infectious disease outbreaks are pathogens, vectors, and optimal transmission conditions.[16] Ideally, ideal climatic conditions are required for vectors and disease-causing pathogens to reproduce, survive, die off, and distribute spatiotemporally. As a result, abrupt or long-term climatic change may benefit the spread of infectious diseases.[27] Numerous studies have revealed the persistent effect of increasing warming rates on the geographic spread of pathogen-based illnesses.[27-35] Additionally, studies have shown that a rise in global temperature positively impacts skin conditions.[37-47] Injuries to the skin caused by marine and aquatic animals that have expanded their habitats because of hospitable, warm water settings, such as cercarial dermatitis, jellyfish envenomation, and melioidosis, have been linked to more cases and hospital admissions.[30,48-52] In summary, climate regulates the seasonal and geographic distribution of vector-borne diseases and the intensity and timing of disease outbreaks[53-64].

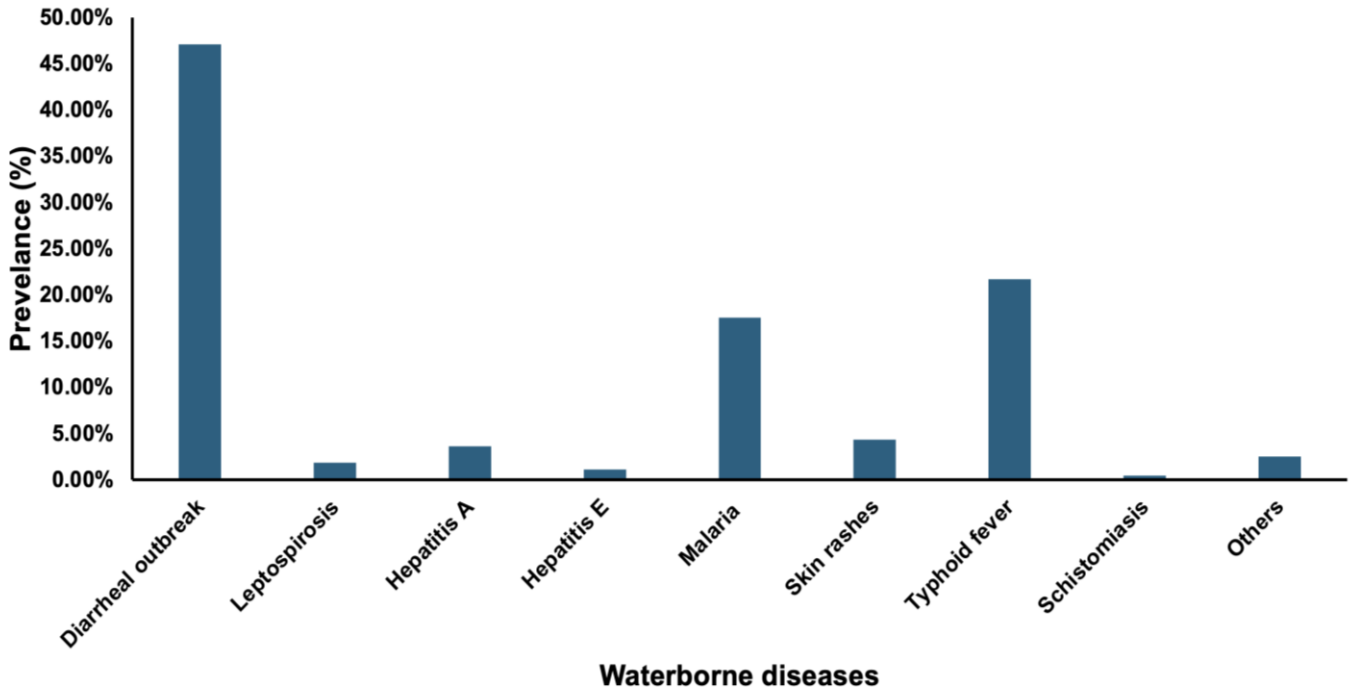

Figure 1: Waterborne disease outbreaks experienced after flood disasters in Nigeria[65]

Recommendations

Natural Hazards such as flood events are part of nature and a natural process.[66-69] Except for some floods generated by dam failure or landslides, floods are climatological phenomena influenced by geology, geomorphology, relief, soil, and vegetation conditions, and more recently climate crisis activity.[70-73]

Referring to the latter, our society has become more vulnerable to natural hazards such as flooding due to our human interventions and activities impacting the natural environment. Urbanization, agricultural practice, deforestation, and alterations in the natural drainage patterns have considerably changed the status quo of river systems, exposing communities to risk and vulnerability to flooding constantly in Niger Delta.[74]

What should the government do?

Flooding is a national crisis and must be tackled at a governmental level.[75] The country can address the flooding menace and minimize its effect through a multi-pronged approach.

Some measures could be proactively taken by federal, state, and local governments, and communities to combat the dangerous impacts of flooding and bring about effective and proactive management of floods in Nigeria. Some of the measures include:

Governmental Policy and Strategies

- Pre-existing government policies and strategies concerning flooding, river basin, urban management, and strategies should be revisited, and new laws and regulations enacted and enforced with independent monitoring of their impacts.
- More research on floods is necessary for a better understanding of effective measures for their prevention and management.
- Strict policies and actions to regulate land allocation and use especially in urban areas must be reviewed to manage the land with indigenous and poor communities. This is to ensure that more lands are not reclaimed especially in Lagos State.
- Buildings should not be erected on waterways, flood plains & wetlands.
- Design and implementation of functional waste management systems at local government and state levels.
- Stringent measures such as impactful fines, effective monitoring, and reward systems should be utilized to ensure compliance.
- Nationwide environmental education with a focus on behavioral changes in the use of resources and waste disposal.
- This should be designed in all Nigerian languages and taught at the community level. It should also be included in both primary and secondary education curricula.

International Joint and Coordinated Action

Rivers do not recognize national borders. As such there needs to be strong cooperation and shared experiences among members of international river basins example: Lake Chad and other West African States. This will strengthen international existing agreements and cooperation on sustainable management of floods, proper documentation, and gathering ideas from member states with local and indigenous best practices that would be needed in preparing, preventing, and managing floods in their region. Based on the results of joint exercises in policy learning, all-embracing flood management plans should be developed for river basins.

There is a need for interdisciplinary cooperation at all government (Federal, State, and local) levels for the co-ordination of sectoral policies regarding environmental protection, physical planning, land use planning, agriculture, transport, and urban development, and co-ordination regarding all phases of risk management: risk assessment, mitigation planning and implementation of measures.

Insurance

Finance should also be an instrument that can both reduce the financial risk for individuals, enterprises, and even whole societies and increase the awareness of at-risk, is flood insurance. The establishment of national funds could be considered to partially cover damage by floods. This will help in supporting the less privileged citizens in the country after the flood.

Nature-based Solutions

Nature is always our ally if we hope to effectively manage the risk of flooding.[76] To mitigate the effect of flooding - whether minor or medium-scale floods, we must consider the important role wetlands, soil, marshes, and forests play because of their storage effect. Each of these elements can retain certain quantities of water for a certain length of time. A large natural storage capacity provides slow rises in water levels and comparatively minor floods. Retaining water in the natural elements should hold priority over swift water run-off. Conserve, protect effectively and, where possible, restore degraded wetlands and floodplains, including river meanders, and oxbows, and especially reconnect rivers with their floodplains. The maintenance of the vegetation edging a waterway is however necessary in a way that is both respectful of the wealth, and biodiversity of these environments, and effective against the risk of flood damage.

A strategy to manage floods ecologically should be based on improving river basin land use, preventing rapid run-off in rural and urban areas, and improving a transnational effort to restore rivers' natural flood zones.

Besides flood mitigation, this will lead to ecological benefits in the form of maintaining biodiversity, groundwater, and cleaner water for communities for recreation and tourism.

Structural Solutions

With recent flood events, we have seen the vulnerability of flood-protecting structures; dams and dykes cannot provide reliable safety against floods that exceed their designed capacities. However, flood protection is never absolute, only a certain level of protection against flooding can be reached. The concept of residual risk should therefore be taken into consideration for each flood control structure. We should build, maintain and rehabilitate dams, floodways, bypassing channels, and dykes to ensure that they are safe and provide a sufficient level of flood protection. Upstream and downstream environmental consequences must be taken into consideration. The risk of flooding, landslides, and dam failures should not be increased when developing flood-control work.

Developers and individuals may adopt flood-proof building technology in coastal areas. Floodproof buildings employ designs built with materials that make structures more resilient to flood damage. However, according to the Federal Emergency Management Agency (FEMA), flood-proofing measures do not inhibit flooding. Still, they reduce the impact on the buildings and make it much quicker and easier to clean up and repair post-flooding, so residents do not continue living in their houses during flooding (FEMA, 2010).[77] Floodproofing buildings require predetermining certain parameters through flood zone mapping and flood monitoring to ensure accurate measurements and installation of the building components.

Citizens Awareness

Government authorities should ensure that the information concerning flood prevention and protection plans is transparent and easily accessible to the public. The information should be disseminated early and actively, not just on request, and be accompanied by the envisaged procedures for public participation. The public should be encouraged to take flood prevention measures and be informed about how to act during flood events to protect themselves and their belongings. The public should become aware that there is a need to adapt or even restrict uses, such as for industrial, agricultural, tourist, or private purposes, in areas at risk of flooding to reduce the potential for damage. In particular, women should be targeted to ensure they have adequate knowledge and access to safety since they are most often the subject of flooding as they tend to look after children and elders.

Flood Mapping

There should be establishment of a flood Geographic Information System (GIS), and information from the GIS should be able to point out Flood hazard areas which would be necessary for planning. It should be made readable and show different hazard levels. They are necessary for the coordination of different actions. They are a planning tool and ascertain that all actors have the same information on the spatial extent of a certain hazard. Flood maps should be used to reduce damage potential by integrating their outputs into spatial and emergency planning. Both types of utilization require the flood hazard/zoning/risk maps to include the worst-case scenario.

Create Flood Plains and Overflow Areas for Rivers

There was a time when floodplains covered large stretches along the river Niger and its tributaries. Today, because of urban sprawl, less than half remain. There should be a plan to restore these floodplains because of their significant role in flood protection, water management, and nature conservation. Flood plains are essential in retaining and absorbing water, shielding nearby towns from heavy rainfall. Necessary steps must be taken to restore these floodplains, and adequate expropriation compensation (which includes relocation and cash settlements) must be offered to the occupants of the land.

Flood Emergency management

Proper contingency plans to respond to flood events should be prepared well. These plans should cover the crisis during and after the flood event, provision of resources, advice to the public about what to do before, during, and after the flood, and evacuation plans that will support such solutions: movables, livestock, and hazardous materials to save the environment from accidental pollution, information on preparations that can be made for evacuating homes and sensitive properties such as hospitals, elderly homes and so on, making provision for emergencies; self-protection and self-help.

Conclusion

Flood events in Nigeria have resulted in major life loss and extensive damage in recent years. The impacts and threat of depleted climate change have exacerbated the emergency. The need for effective flood management control is paramount to reduce the public health hazard posed by the current flood events. We must put major thought and consideration into effectively managing flooding in Nigeria via infrastructure development, risk management, emergency and disaster planning, environmental factors, and international and local collaboration.

Highlights

What Is Already Known?

Flooding is defined as the rising and overflowing of a body of water, especially onto normally dry land. It poses a potential threat to humankind and properties, sometimes with economic consequences.

What Does This Study Add?

Nigeria has witnessed the highest number of flood-related casualties as of October 6, 2022, with 2 million people forced to flee their homes, 612 people lost their lives, 200,000 dwellings were damaged, and 7483 individuals contracted cholera or other waterborne illnesses. Nigeria has become more vulnerable to natural hazards such as flooding due to human interventions and activities impacting the natural environment. Urbanization, agricultural practice, deforestation, and alterations in the natural drainage patterns have considerably changed the status quo of river systems, exposing communities to risk and vulnerability to flooding constantly in Niger Delta. Flooding can be controlled totally in Nigeria through infrastructure development, risk management, emergency and disaster planning, environmental factors, and international and local collaboration.

Consent For Publication

All authors declare their consent to publish this manuscript.

Ethics approval

Not applicable

Competing Interests

The authors declare that they have no competing interests

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Authors Contributions

ROA and VCO conceived and designed the study, conducted research, provided research materials, and collected and organized data. ROA analyzed and interpreted data. ROA, VCO, NPC, CKD, OIO, and AV wrote the initial and final draft of the article and provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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