

Research Article



Flood Incidences as Public Health Challenge in Katsina State, Northern Nigeria

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Abstract: Flood incidences are one of the major environmental hazards that occur yearly in different parts of the world. The year 2022 has witnessed series of catastrophic floods not experienced in recent times in parts of countries such as Afghanistan, Bangladesh, Italy, Pakistan, Niger Republic, Pakistan, South Africa and United State of America. Nigeria like other developing countries in the continent of Africa has also experienced this kind of floods incidences. This paper examines flood incidences as a public health challenge in Katsina state northern Nigeria. Data for the study was generated from a semi-structured questionnaire administered on 100 students. The students are those studying National Diploma in Environmental Health Technology at Hassan Usman Katsina Polytechnic, Katsina, Katsina State. Data on annual flood incidences from 2018 – 2022 was collected from the Katsina State Emergency Management Agency (SEMA) including discussions with the Directors of Information and Search and Rescue. The results have shown that flood incidences within the period under study have become a public health challenge resulting to loss of lives, injuries to victims, destruction of houses and creation of displaced persons among others. These are happening despite the efforts of Katsina State Government to tackle the challenges posed by the floods to public health. It is therefore recommended that on-going flood control projects should continue and more efforts on safeguarding public health from flood incidences be pursued.

Keywords: Floods, incidences, disaster, health, challenges

INTRODUCTION

Flood is one of the major environmental hazards that is occurring in different parts of the world. Flood happens when water over flows or soaks the land that is normally dry (NGS, 2022). Floods are a common occurrence as there are few places on earth where people do not have to be concerned or worried about floods (NGS, 2022). One of the most common ways floods can develop is when streams, or rivers overflow their banks and the water overflows into adjacent lands that maybe inhabited by humans. Hence floods are a major environmental hazard to riverside populations and or where buildings are erected on flood plains and areas liable to flood (Agbonkhese et al., 2014).

Throughout history, humans have always built their settlements in the form of villages, towns and cities near water bodies along rivers inland or along the seacoast (Gillis, 2015). This is in order to use the water for domestic purposes, industrial and other purposes. The siting of human settlements close to water bodies makes them susceptible and vulnerable to the incidence of flooding.

Flood incidences refer to the occurrence of floods which are likely to increase in many regions of the world partly due to global climate change and poor urban governance (Agbonkhese et al., 2014). The year 2022 has witnessed many flood incidences in different continents of the world that have been attributed to climate change among others. In the continent of Asia, serious and devastating flood incidences were experienced in Pakistan, Bangladesh, India, Iran, Afghanistan and South Korea. The 2022 Pakistan floods post disaster needs assessment main report linked the unprecedented floods to climate change (Iqbal, 2022). Other countries that experienced floods in 2022 include Italy (Europe), United States of America (North America), Brazil (South America) and Australia. In the continent of Africa, the countries that experiences floods incidences include Chad Republic, Mali, Niger Republic, Senegal, Sudan and South Africa and indeed Nigeria.

In Nigeria, flood incidences are a common environmental hazard that occurs every year. The magnitude and severity of the floods however differs from one year to another. One of the most recent and devastating flood incidences in the 2022 floods has affected thirty three (33) out of the thirty six (36) states of the federation. As at October 2022 the Nigerian Federal Government has stated that 2.5 million people were affected with 82,000 houses damaged by the floods of 2022 ([Aminu et al., 2022](#)).

The history and frequency of floods in Katsina State has shown that floods have been occurring since the creation of the State in 1987 according to the Information Officer of the Katsina State Emergency Management Agency ([KATSEMA, 2022](#)). Some of the flood incidences are notable as they have led to the loss of lives and destruction of properties in different parts of the State. In 1998, there was flood incidence in parts of the State especially in Jibia town where the Danmarke stream overflow its banks flowing into houses located close to it which lead to the death of four persons and some houses were destroyed ([Ladan, 2020](#)). In 2003, a flood incidence in the State capital Katsina led to the destruction of many houses at Layin Zana residential area and the State Governor allocated part of the Kofar Kaura industrial layout for the victims to build their houses. In 2007, a study by [Ladan \(2008\)](#) observed that the rainy season started late in northern Nigeria including Katsina State but by late July there was torrential rainfall causing flooding. In 2012, there was heavy rains that leads to floods incidences in different parts of Nigeria including Katsina State. According to the State Relief and Rehabilitation Agency (RERA), 18 out of the 34 LGAs were affected by the 2012 floods with 10,536 people affected by the floods as their houses and other properties were damaged and or destroyed ([Daily Post, 2013](#)).

One of the impacts of flood incidences is on public health which this paper seeks to examine. Public health is here defined as the science of protecting and improving the health of the people and their communities which is achieved by promoting healthy lifestyles, researching on diseases and injury prevention and detecting, preventing and responding to infectious diseases ([CDCF, 2022](#)).

Some studies have been conducted on floods and its impacts on public health in Nigeria. The World Health Organization (WHO) reported that floods damage and cause the overflow of sanitation facilities and increase the risk of contamination of water sources ([WHO, 2009](#)). This facilitates the spread of diarrheal disease such as cholera and enhance mosquito breeding and increase vector-borne diseases such as malaria. [Salami et al. \(2014\)](#) interrogates the structural readiness of the health system and the capacity to address disasters and the illness/disease conditions that are the aftermath of flood disasters in south western Nigeria. The study found out that there is inadequate provision of functional health facilities by the government to accommodate comprehensive, quality and long-term infrastructures for flood victims.

[Shinge et al. \(2015\)](#) assessed flood hazard responses among the residents of Katsina metropolis, Katsina state. The study found out that the impacts of flood include damage to farmlands, damage to culverts and buildings, siltation of water ways/channels and outbreak of diseases. [Louw et al. \(2019\)](#) studied the impacts of flood disasters in Nigeria: a critical evaluation of the health implications and management. The study reveals poorly managed health reforms that lead to diarrhea outbreak which is the predominant water borne disease associated with flood disasters in Lagos state.

[Inah et al. \(2020\)](#) studied flooding and its public health implications on residents of Calabar South, Cross River state, Nigeria. The study revealed that majority of the respondents (86.5%) indicated that flood cause high risk of malaria due to the creation of stagnant water and also exposes residents to chemicals and contaminants in water. [Bello et al. \(2020\)](#) examined the impacts of the July 2018 post flood events on human health in Jibia town Katsina State. The results revealed the impacts of floods on human health which include damages to clean water supply, increasing the rates of water-borne diseases and injuries, increases in cases of malnutrition, starvation and loss of lives. [Anabaraonye et al. \(2022\)](#) examined flooding and its impacts on Nigeria's health sector. The study found out that for each potential impact of flooding, the health sectors are particularly affected by it leaving the residents vulnerable to diseases and injuries, risk of malnutrition due to flood shortages among others.

From the studies reviewed, it can be observed that most of the studies are based on southern Nigeria while the two studies on Katsina state are limited to the state capital and Jibia town. This paper is wider in scope as it studies Katsina state at large, by examining flood incidences as public health challenge in Katsina State. This is in line with the Sustainable Development Goal (SDG) number three (3) which is on good health and wellness of the people resident in any community or society. The problem the paper is addressing is the impacts of floods on public health in Katsina State. The objectives of the study are to examine flood incidences in Katsina state, identify and highlight flood incidences as public health challenges, highlight the efforts of the state government in reducing the challenges on public health

and recommend appropriate measures to reduce the challenges for sustainable health among the population.

Description of the Study Area

The study area is Katsina state located in north western Nigeria between latitudes $11^{\circ}30'$ and $13^{\circ}15'$ north of the equator and longitudes $6^{\circ}52'$ and $9^{\circ}20'$ east of Greenwich. The state is covering an aerial extent of 23,850km² and one of the 36 states that comprise Federal Republic of Nigeria (Alo et al., 1998). The capital of the state is Katsina city and Katsina state consists of 34 Local Government Areas which are smaller administrative units within the state (Figure 1). The state has a population of 5,801,584 people based on the last population census held in Nigeria which was the 2006 National Housing and Population Census (NBS, 2017). The population projection for 2016 is 7,831,319 (NBS, 2017). The major occupations of the people are rainy and dry season farming, cattle rearing and trading activities on weekly markets days (Ladan, 2019).

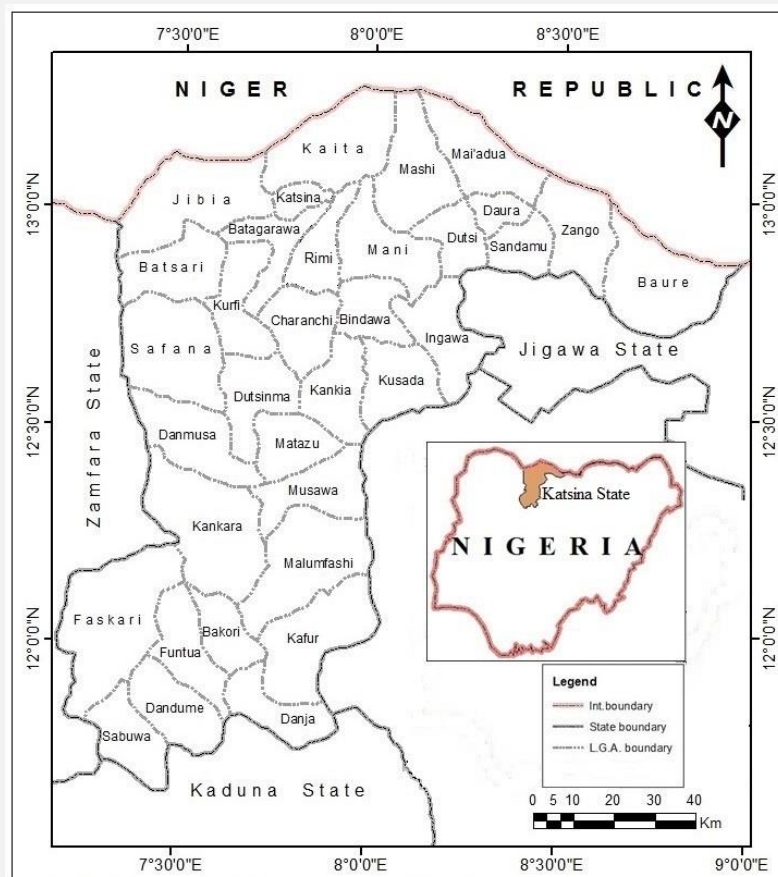


Figure 1. Map of Katsina State

In terms of physical setting, the relief of the state is part of the high plains of Hausaland which generally rises from 360 m in the north east around Daura to 600 m around Funtua in the south west (Ladan, 2019). The drainage consists of a number of rivers and streams that traverse the topography of the state. The major rivers include river Bunsuru, Gada, Galma, Gagare, Karadua, Koza, Sabke, Tagwai and Turami some of which are dammed for irrigation purpose though they are mostly seasonal in nature. The climate is tropical continental type with long dry season and short wet season. The wet season starts from May to September of every year. Mean annual rainfall varies from 1,016 mm – 1143 mm in the southern part of the state around Funtua town to less than 635 mm around Birnin Kuka in Mashi LGA with an annual average rainfall of 800 mm (Alo et al., 1998; Usman et al., 2014). Recent trends have shown that there is an increasing rainfall in different parts of the state which has led to flood incidences and flood disasters in some areas.

METHOD

The methods used to collect data for the study include a semi-structured questionnaire that consists of two sections A and B. Section A consists of questions concerning the demographic characteristics of the respondents while section B consist of the main questions. The main questions are on the frequency or incidence of floods in the local government area (LGAs), do floods affect public health, the impacts of the flood incidences on public health, measures adopted by the state government to reduce the challenges and suggestions to reduce the challenges on public health. The respondents sampled to fill the questionnaire are the students of the National Diploma II Environmental Health Technology of the Department of Environmental Health Hassan Usman Katsina Polytechnic (HUK) Polytechnic, Katsina. They were purposely sampled as they are students of Environmental Health Technology and therefore are knowledgeable on the topic on public health. The sampling technique used therefore is purposive sampling technique which emphasize sampling those who are knowledgeable about the issues and therefore able to provide the required information. The students also come from different LGAs of the state which is important to ensure coverage of LGAs in different parts of the State. A total of one hundred (100) students consisting of both males and females completed the questionnaire in their lecture class on December 7th 2022.

Field visits were undertaken to observe the incidences of flood in some of the areas affected in Katsina state. The flood affected areas sampled include residential areas located along Dan Abdallah stream in Jibia town visited on July 21st 2018, July 16th 2019 and July 18th 2020 though to collect data for another study. Also visited are the residential areas and River Tilla in Katsina metropolis on February 6th 2021 and September 30th 2022. These visits enabled observation on the flood incidences and discussions with some of the residents on flooding and its impacts on the health of the people.

Data on the incidences of floods in Katsina state was collected from the State Emergency Management Agency (SEMA) in addition to discussions on flood incidences with the Directors of Information and Search and Rescue. Secondary data was collected through desk research from textbooks, peer reviewed journal articles, environmental reports, conference papers and internet sourced materials. The data collected from both the primary and secondary sources was analyzed through descriptive statistics in the form of tabulations, percentages and averages.

The statistical tests used to arrive at the results is descriptive qualitative analysis. This is used to arrive at the results which were expressed or shown in tables, graphs and pictorial evidences of the areas affected by flood incidences and drainage constructed to ease flow of flood waters.

RESULTS AND DISCUSSION

Demographic Characteristics of the Respondents

The demographic characteristics of the respondents can be seen on the [Table 1](#) below.

Table 1. Demographic characteristics of respondents

S/N	Characteristics		Frequency	Percentage (%)
1	Gender	Males	56	56.00
		Females	44	44.00
2	Age Range	18-20 years	50	50.00
		21-23 years	40	40.00
		24-26 years	10	10.00
3	Marital Status	Single	84	84.00
		Married	12	12.00
		Divorced	04	04.00
4	Number of children in family	1-5	28	28.00
		6-10	40	40.00
		11-15	20	20.00
		16-21	12	12.00
5	Local Government Area	Northern Part	50	50.00
		Central Part	20	20.00
		Southern Part	30	30.00
6	Residency Status	Students Hostels	32	32.00
		At home in the town	68	68.00

Source: Data analysis (2022)

The demographic characteristics of the respondents as shown on [Table 1](#) above indicated that majority of the respondents (56.00%) are males while a sizeable percentage (44.00%) are females. In terms of age range of the respondent's majority, of them (50.00%) are within the ages of 18-21 years. This showed a youthful nature of the respondents who are quite aware of the flood incidences in the state and their respective LGAs. The marital status of the residents showed that majority of the respondents (84.00%) are single and unmarried. They therefore are staying at their parents' homes with majority among them (40.00%) living together in a family of 6 – 10 children. The respondents are all indigenes of Katsina state with majority (50.00%) living in northern parts of the state where the institution (HUK Polytechnic Katsina) is located. The residency status showed that majority (68.00%) are not residing at the student's hostel and therefore stay at home to commute to the Polytechnic for their studies.

Flood Incidences in Katsina State

On the research question of what is the frequency or incidence of floods in the LGAs, all the respondents (100%) indicated that flood incidences have been occurring every year. Furthermore, according to [KATSEMA \(2022\)](#), Katsina state has been experiencing incidences of floods on yearly basis for many years. This despite series of flood control measures adopted by the present government that came to power from May 2015 to date (May, 2023). [KATSEMA \(2022\)](#) has provided data on the most recent flood incidences in Katsina State. The most recent flood incidences can be seen on the [Table 2](#) below.

Table 2. Most flood incidences in Katsina State

S/N	Year	Local Government Area	No. of Lives Lost	No. of Flood Victims Injured	Houses Affected	Persons Affected
1	2018	1 LGA (Jibia)	71	32	500	2,604
2	2019	7 LGAs	06	15	300	5,000
3	2020	15 LGAs	08	17	6,500	12,961
4	2021	4 LGAs	04	10	1,500	4,160
5	2022	27 LGAs	26	20	16,625	18,245
Total		54 LGAs	115	94	25,425	42,970

Source: SEMA (2022) and Ladan (2020)

From [Table 2](#) it can be observed that floods are an annual occurrence especially during the rainy season from the month of May to October of every year. From 2018 to 2022 virtually all the LGAs of the state were affected particularly those in the southern part that record more rainfall amount and duration than the central and northern parts of the state. From the table it can also be observed that there are several casualties from the floods within the five years under consideration. The casualties are in the form of number of lives that were lost, number of flood victims injured, number of houses damaged or destroyed, and the number of people affected including those that were displaced by the flood incidences. These total casualties clearly show that flood incidences posed challenges to public health in Katsina state.

Flood Impacts on Public Health

On the research question of whether flood incidences have impacts on public health, all the respondents (100%) who are students of environmental health indicted that flood incidences have impacts on public health. This is in line with the study by [Louw et al. \(2019\)](#), [Inah et al. \(2020\)](#) and [Anabaroanye et al. \(2022\)](#).

Impacts of Flood Incidences on Public Health in Katsina State

The flood incidences as shown on [Table 2](#) have impacts on human health in Katsina state. Respondents response to the research question of what are the impacts of flood incidences on public health and which of the impacts is more prevalent in your LGA is varied. These are shown on Figure 2. Some of the respondents (28.00%) indicated that the most prevalent impact of flood incidence on public health in their LGA is destruction of houses. Others indicated that it is displacement of people (24.00%), injuries to flood victims (20.00%), spread of diseases, loss of lives (08.00%) and shortage of food, hunger and starvation.

In the case of destruction of houses, flood incidences destroyed partially or fully houses that served as homes to people. Most of the houses affected are house that were built using locally sourced

building materials such as mud, laterite and clayey. In situations where the floods have become severe such as the 2018 Jibia flood disaster, even houses made of cement blocks became partially destroyed. From Table 2, a total of 500 houses were destroyed as a result of the 2018 floods. The total number of houses destroyed in Katsina state from 2015 to 2018 is 25,425. The destruction of houses affected the health of the heads of households and other occupants psychologically by becoming depressed due to the loss of shelter. The depression increased when the heads of households do not have the financial capacity to rebuild their houses and the government resettlement program took a long time to be completed. From Table 2, a total of 42,970 houses were destroyed by flood incidences within the period under study. Most of the time the victims had no alternative than to make a make-shift arrangement to cover their houses in order to guard their privacy which is depressing. Figure 3 shows a partially collapsed house close to Ginzo stream in Katsina metropolis that collapsed in the year 2020. According to the World Health Organization (WHO, 2017) depression is a common mental disorder among adults who lose their houses and or lose their jobs.

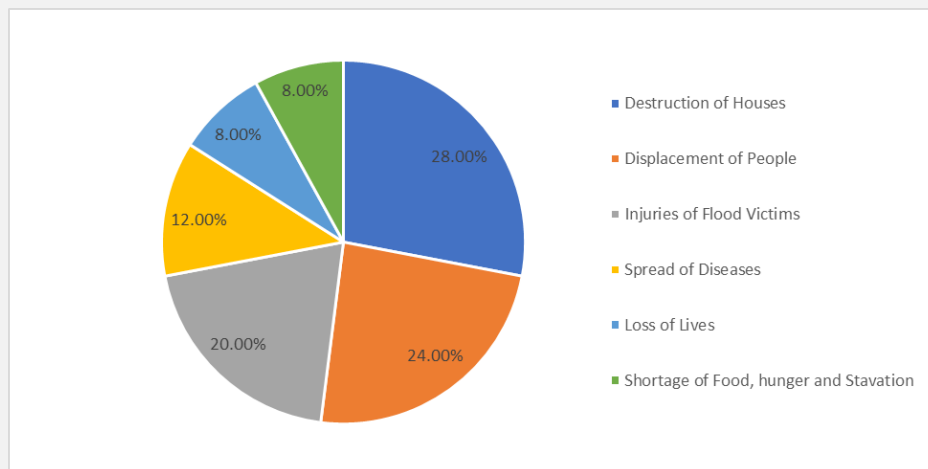


Figure 2. Respondents' responses on the impacts of floods incidences on public health in Katsina State



Figure 3. A house close to Ginzo stream whose wall collapsed during flood incidence in Katsina metropolitan

There are several incidences of floods displacing people whose houses have been destroyed. The people usually find shelter at IDP camps which are public buildings used as camps for those displaced. One of the public buildings commonly used are primary schools which are temporarily transformed to camps. Living at the IDP camps is difficult as the schools are not buildings meant for human habitation and most of the camps do not have adequate health care and sanitation facilities. This has resulted in the outbreak of some diseases at the IDP camps especially where the camps are crowded. From [Table 2](#), it can be observed that 2,604 people were affected who found their way to the IDP camps in Jibia town. [Bello et al. \(2020\)](#) found out that congestion of people at the camp and improper hygienic practices are one of the major causes of outbreak of diseases. Other people who could not go to live at the camps had to squat with neighbors, friends and relations where they are also exposed to diseases due to increased number of inhabitants and inadequate sanitation facilities.

Flood incidences lead to sustaining of various degrees of injuries by the victims. The injuries arise as flood water can easily and speedily move people from one place to another and also move sharp objects such as metals, irons and broken bottles into positions that cause injuries. Also flood waters cover roads, damage roads edges and sweep away motorcycles or motorcars causing injuries and leading to the occurrence of accidents along the roads. From [Table 2](#) it can be observed that 32 people were injured during the 2018 Jibia flood disaster with 17 hospitalized at the make-shift clinic at Muhammad Rabiu Model Primary School Jibia that was used as Internally Displaced Persons (IDPs) camp. The other 15 people were not hospitalized at the camp. A study by [Bello et al. \(2022\)](#) observed that during the Jibia flood disaster injuries have occurred due to the presence of broken bottles, glasses, nails and other sharp objects which have the tendency to cause transmission of tetanus among the victims. From [Table 2](#) another flood incident with large number of injured people is the 2020 flood where 17 people sustained injuries. A total number of 94 people sustained various degrees of injuries from 2018 – 2022. It was further observed that uncompleted flood control projects also caused injuries to people. This is because iron rods were left uncovered which injured pedestrians passing near the uncompleted drainages. This was noticed at Shararrar Pipes beside Benen Gogalo (a section at the end of the drainage on [Figure 4](#)) where pedestrians passing very close to the uncompleted storm water drainage injured their toes as witnessed on December 13th 2022.



Figure 4. One of the storm water drainage projects through houses at Shararrar pipes in Katsina town

Several types of diseases have spread as a result of the flood incidences in Katsina state. One of the most common types are diseases associated with the creation of stagnant water bodies such as puddles where vectors such as mosquitoes can easily breed to spread malaria fever. [Okaka & Odhiambo \(2018\)](#)

noted that floods create new breeding grounds for mosquitoes to breed which leads to an increase in the number of malaria fever infections. Contamination of surface and underground water sources such as wells also cause the outbreak of disease after the occurrence of flood incidences. The contamination of domestic water sources such as wells used for drinking transport bacteria, parasites and viruses into portable drinking water leading to the outbreak of water borne disease (Okaka & Odhiambo, 2018). Also, since flood incidence destroys buildings and toilet facilities, there are persons who live in uncompleted buildings destroyed by floods and they practice open defecation. This was noticed during field visit to the 2018 Jibia flood disaster sites in 2018. According to Bello et al. (2020) there were some cases of cholera among the flood victims after they left the camp to their respective houses with some of the victims even losing their lives.

Incidences of floods leads to loss of lives particularly when the floods reach disaster level. From Table 2, most of the lives were lost due to the floods by drowning in flood waters or flood waters carrying the flood victims in the water and drowning them. There are also instances where floods led to buildings collapsing on people that were sleeping at night resulting to deaths. For example, during the 2022 rainy season flood waters went away with two boys that accidentally fell into the storm water drainage at Tudun 'Yanlihidda in Katsina metropolis. These two boys are among the total of 26 persons that lost their lives due to flood incidences in 2022 in the whole state as can be seen on in table 2. From Table 2 it can be observed that a total number of 115 people lost their lives as a result of flood incidences in five years from 2018 to 2022. Majority of the people (71) lost their lives during the 2018 Jibia flood disaster which is the worst disaster to have occurred in Katsina state (Ladan, 2020).

The shortage of food results as floods destroy farmlands of food crops and therefore in most instances the farmers had nothing to harvest and use as food. For example, during the 2020 rainy season 7,019 hectares of farmlands were destroyed by floods according to SEMA (Vanguard, 2020). The destruction of farmlands means that the victims had no food to eat and therefore hungry. In many instances, it would take time before SEMA undertake an assessment of the food crops lost and make submission to the state government for food assistance to the victims. This means that as time goes on the hunger will continue leading to starvation. Even while the flood victims are staying at IDP camps some of them remain hungry as the food supplied to them is not adequate enough to meet their food and nutritional needs. Displaced persons in most camps complained of hunger due to inadequate food, including Katsina. A study by Ladan & Liman (2021) found out that one of the challenges facing displaced persons due to floods is inadequate food and provisions at the IDP camps. This is in line with the study by Anabaroanye et al. (2022) that found risk of malnutrition due to the shortage of food among flood victims in Nigeria.

Implications of the Impacts of Flood Incidences on Public Health in Katsina State

The impacts of flood incidences on human health has the following implications in Katsina State: (i) SEMA need to continuously warn LGAs that are at the risk of flooding so that measures could be put in place to prevent flood incidences or mitigate the impacts to the barest minimum. The Agency has to stock its stores with adequate relief materials such as foodstuffs and building materials that can be used to provide emergency relief to victims of flood incidences; (ii) The State Ministry of Health have to make adequate preparations to safeguard public health before the commencement of the rainy season when the flood incidences usually occur. Also, the Public Health Department of the ministry have to prepare adequately during the rainy season to tackle the outbreak of diseases caused by flood incidences; (iii) The State Government have to continue to execute flood prevention and control projects with a view to reduce to a minimal level the incidences of floods thereby reducing the impacts on public health. In addition, public enlightenment programs have to be conducted by the State Environmental Protection Agency (SEPA) on the dangers of flood incidences on public health in the State.

Efforts of the state government towards reducing public health challenges

According to the respondents, the present state government that came to power from May 2015 to date (January 2023) has made several efforts with the objectives of controlling flooding and reducing public health challenges in the state. The efforts are highlighted below:

1. The state government has undertaken the construction of flood control structures in 122 locations covering over 150 communities across the state. In the state capital, the intervention has led to the construction of 21.139 m reinforced concrete lined blocks and masonry lined drainages and 24 box culverts (KCN, 2021).
2. In addition to the above, there are gigantic multi-billion Naira storm water and drainage management scheme under Katsina State and World Bank jointly financed Nigeria Erosion and

Watershed Management Project (NEWMAP). The projects are located at Funtua, Jibia, Katsina and Malumfashi towns. The flood control projects can be seen on [Table 3](#) below.

Table 3. Gigantic storm water and drainage management projects in Katsina state

S/N	Location of the project	Flood control project	Purpose of the project
1	Funtua town, Funtua LGA	Funtua town storm water and drainage management project	Control permanent floods along a stream flowing along Gusau road into Bagari quarters.
2	Jibia town, Jibia LGA	Jibia flood incidence control project including stream flow diversion	Expand, construct and rehabilitate collapsed drainages, bridges and roads along areas affected by 2018 flood disaster
3	Malumfashi town, Malumfashi LGA	Malumfashi town storm water and drainage management project	Control perennial flooding along a water way passing through Malumfashi town from Dankanjiba road by passing Ninache bridge.
4	Katsina town, Katsina LGA	Katsina storm water and drainage management project	Control perennial floods along River Tilla from Kofar Guga through Sabuwar Kofa to Shinkafi bridge.

Source: [KCN \(2021\)](#); [Ladan & Saulawa \(2021\)](#)

- KATSEMA has been undertaking an assessment of flood incidences in Katsina. The assessment is used to compile list of affected houses, heads of households, persons injured and displaced for assistance from the state government.
- In instances where the flood incidence and its impacts on the people are severe, the list compiled by SEMA is forwarded to federal government agencies for assistance to the victims. The agencies include National Emergency Management Agency (NEMA) and National Commission for Refugees, Migrants and Displaced Persons (NCRMDP).
- The state government in conjunction with local governments has been providing temporary shelters to those displaced due to flood disasters. Besides providing shelter, foodstuffs and medical facilities are provided at the camp for the victims of floods.
- The State Government has been inviting international humanitarian organizations such as the Red Cross and Red Crescent Society and Medicins San Frontiers (MSF) or Doctors Without Borders to respond to the incidence of outbreak of diseases by providing and distributing medicines and sanitation materials at the IDP camps ([Ladan & Saulawa, 2021](#)).

CONCLUSION

The flood incidences witnessed in different parts of the world have clearly shown that the age of mega floods is here. Nigeria like other countries have also witnessed unprecedented floods in the year 2022 which has affected many states of the federation including Katsina state. Data collected and discussed in this paper has shown that flood incidences have been experienced on yearly basis from 2018 to 2022. This paper found out that flood incidences have become a challenge to public health as they have led to destruction of houses, driving people to displaced persons camps, injuries to victims, spread of diseases, and loss of lives and shortage of food, hunger and starvation. The implications of the results to public health has clearly indicated the need for the relevant agencies such as KATSEMA to adopt the use early warning systems, store enough relief materials to flood victims, the State Ministry of Health making adequate preparations before the rainy season especially the Public Health Department. The State Government is making efforts towards reducing the public health impacts of flood incidences in the State but the ultimate goal of safeguarding public health from flood incidences have not been achieved.

Furthermore, data from KATSEMA indicated that there is high demand for relief materials in view of the yearly occurrence of incidences of not only floods but also rainstorm, hailstorm and windstorm. These incidences therefore call for action on Katsina State Government and other stakeholders to adopt measures aimed at safeguarding public health and wellbeing of the people.

RECOMMENDATION

The following recommendations are offered towards reducing the incidence of floods and the challenges it posed to public health in Katsina state:-

1. Katsina state government should continue to construct storm water drainages with a view to control flooding in the state. This is important considering that here are many residential areas without proper drainages to drain flood water during the rainy season.
2. Katsina State House of Assembly should enact a law prohibiting construction of houses close to rivers, streams and on areas liable to flood or Fadamas. This is very important as these are the areas that are easily flooded on yearly basis and such residents forward complains to SEMA for assistance.
3. Adequate healthcare facilities should be provided for displaced persons while they are staying at the camps. In situations where flood incidences occur in future, a befitting camp with all the necessary facilities should be constructed and used as camp rather than primary schools.
4. Flood control projects that are constructed within residential areas and along major roads should be completed on time. This is because of the delays noticed during the execution of these projects which causes injuries and accidents to residents and road users in Katsina metropolis.
5. SEMA should be made more effective through adequate budgetary allocation to the agency. This is to permit the agency to purchase relief materials such as building materials, foodstuffs, drugs and medical facilities that can be used to assist flood victims urgently.
6. Based on the findings of this research, it is recommended for further researches, that there should be a similar study conducted on each of the three senatorial zones of the State namely Daura zone, Funtua zone and Katsina zone to further study the individual impacts of flood incidences on public health in these zones of Katsina State while identifying the peculiarities between the zones.

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