# FLOOD RISK AWARENESS AMONG COMMUNITY DWELLERS IN PLATEAU STATE, NIGERIA

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**Abstract**
The study investigated flood risk awareness, among community-dwelling adults in Plateau State, Nigeria. The study adopted the mixed-methods research design. The sample size for the study consisted of 810 community-dwelling adults and 23 staff of the State Emergency Management Agency (SEMA) in Plateau State. The Flood Risk Awareness Questionnaire (FRAQ) and In-depth Interview Guide on Flood Risk Awareness (IDGFRA) were used for data collection. Face validity of the two instruments (FRAQ and IDGFRA) were established by seven experts. The reliability of coefficients (internal consistency) of Sections B and C of the FRAPQ were determined using the Cronbach's alpha. The reliability of coefficients of .96 and .83 were obtained for sections A and B, respectively. Mean and standard deviation used to answer the research questions. Also, the null hypothesis 2 was tested using independent sample t-test while null hypotheses 1,3,4 and 5 were tested using one-way analysis of variance (ANOVA) at 0.05 level of significance and appropriate degrees of freedom.The quantitative findings showed that community-dwelling adults were aware of flood risk to a moderate extent ( $\bar{X}$ = 2.93, SD = 0.77). There was a significant difference in the extent of flood risk awareness among community-dwelling adults in Plateau State based on age, $F(3,785) = 9.335$, $P = 0.000$; education level $F(3,785) = 9.388$, $P = 0.000$; monthly income level $F(3,785) = 11.626$, $P = 0.000$ and the number of years lived in flood-prone areas, $F(2,786) = 19.987$, $P = 0.000$. The qualitative findings also indicated that many adults were aware of flood risks. Based on the study's findings, it was recommended, among others, that flood risk awareness education campaigns should be intensified at the community levels to improve community-dwelling adults' flood risk awareness levels in Plateau State.

**Keywords:** Flood, risk awareness, community dwellers

## Introduction

Floods are considered one of the deadliest natural disasters and major public health problems affecting diverse populations. Between 1998 and 2017, floods affected more than two billion people worldwide (United Nations [UN], 2020; World Health Organization [WHO], 2020). Therefore, the need to improve flood risk awareness of people living in flood-prone areas becomes important. The significant benefits of high level of risk awareness regarding flooding, as reliable approaches to safety and survival by the populace cannot be overemphasized (WHO, 2020). Flood disasters are increasing in frequency and intensity due to climate change in many parts of the globe including Nigeria (WHO, 2020; United States Department of Labour [USDL], 2020).

In Nigeria, flood disasters have occurred in the past few years. The International Organization for Migration (IOM, 2020) reported that flooding had displaced about 15,000 people in the Northwest and North Central of Nigeria. The IOM (2020) further reported that flooding affected the states of Kaduna, Katsina, Sokoto, Plateau, and Zamfara between the 3rd and 9$^{th}$ of August 2020. For instance, in Katsina State, Baure and Kaita Local Government Areas (LGAs) were reported to be the worst affected by floods in 2020. Additionally, IOM reported that over 18,000 shelters were damaged, and almost 10,000 people were affected, with two persons confirmed dead in Baure. In Kaduna State, two deaths were reported in Jema'A, where flooding damaged approximately 36 shelters and affected over 3,300 people (IOM, 2020). This ugly scenario prompted the Kaduna State government to warn of flooding along the Kaduna River after heavy rainfall. In Sokoto State, flooding was reported in Goronyo LGA, damaging about 100 shelters and affecting over 400 people, while in Zamfara State, floods hit Kaura Namoda and Zurmi LGAs, affecting over 800 people (IOM, 2020). Also, in Plateau

State, about 621 homes were displaced and destroyed by flooding, killing six persons and 832 residents injured (UN, 2020; WHO, 2020).

Floods have been variously conceptualized in literature. Marc and Arretyre (2016) conceived a flood as a body of water covering dry land. The authors explained that floods could contaminate foods and drinking water, adversely affecting structures, houses, animals, and farm products and moving fertile soil away from valuable farmland. Wald (2017) viewed flood as a general and temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters from the unusual and rapid accumulation or run-off of surface waters from any source. In this study, flood refers to an overflow of water submerging dry land (United States Department of Labour [USDL], 2020; Federal Emergency Management Agency [FEMA], 2020).

The effects of flood disasters can be grouped into primary and secondary or long-term effects. The direct impact of flooding includes loss of life and damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. Furthermore, studies (Werner, Hunter & Bates, 2016; Bratkovich & Burban, 2017) have observed that flooding has a direct effect on power transmission and power generation resulting in total loss of power supply, loss of drinking water treatment and water supply resulting in loss of drinking water or severe water contamination, and loss of sewage disposal facilities. There may be increased chances of an outbreak of water-borne diseases such as typhoid, giardia, cryptosporidium, and cholera, due to lack of clean water combined with human sewage in the flood waters.

The secondary or long-term effects of flooding may include economic hardship due to a temporary decline in tourism, rebuilding costs, or food shortages. The impact of flooding on its victims may consist of psychological damage, particularly where deaths, serious injuries, and property loss occur (Wemer et al., 2016). There may be increased cases of indoor mold growth resulting in adverse respiratory symptoms and other health problems (Peters, 2015; Brown & Chanson, 2016). Thus, flood exposure is associated with several risks to man, animals, built and natural environment (United States Department of Environmental Protection, 2015).

Also, flood risk is a combination of the probability (likelihood or chance) of flooding happening and the consequences (impact) if it occurred (Local Government Association, 2023). The consequences of a flood depend on two factors, exposure and vulnerability. Exposure is a measure of the number of people or things that may be affected by a flood while vulnerability is a measure of the potential of people or things to be harmed. Flood risk is dependent on there being a source of flooding, such as a river, a route for the flood water to take (pathway), and something that is affected by the flood (receptor), such as a housing estate (Local Government Association, 2023). In this study, flood risk refers to the combination of likelihood or chance of flooding occurring and associated adverse effects if it occurred.

People's awareness of the risks associated with flooding (i.e., loss of live, damage to properties, destruction of farm produces, contamination of water and increased outbreak of diseases) becomes necessary to prevent or limit the devastating effects of flood disasters in their communities. Risk awareness is defined as an assessment of the probability of a hazard and the results (most often - the negative consequences) perceived by the community dwellers or members (Bubeck, Botzen, & Aerts, 2012; Becker, Aerts, & Huitema, 2014). Becker et al. (2014) viewed risk awareness as interpreting an event based on one or more dimensions of the risk frame, such as the probability of harm, worry of the vulnerability to be harmed, trust in hazard information, and the ability to cope. In this study, risk awareness is assessing and interpreting adverse outcomes of flooding by community-dwellers in Plateau State. Therefore, flood risk awareness is the assessment and interpretation of adverse outcomes of flooding by individuals, agencies, associations or professional bodies. The community-dwellers play significant roles in coping with flooding when their awareness level is high.

Community dwellers' level of flood risk awareness can facilitate planning, preventing or mitigating actions in flood-prone areas. The willingness to adopt precautionary measures is positively related to the residents' level of flood risk awareness (Floyd, Prentice-Dunn & Rogers, 2000; UN, 2020). Studies (Grothmann & Reusswig 2006; Miceli, Sotigiu & Settanni, 2008; Terpstra, Lindell & Gutteling, 2009) indicated that adults' low level of risk awareness is responsible for the insufficient or low level of preparedness for flood risks, which in turn generates an inadequate response to flood disasters. A high level of flood risk awareness enhances increased flood risk preparedness and results in maximum flood control and management (United States Department of Environmental Protection, 2015) Risk awareness enhances the adoption of preventive behaviours (i.e., precautionary measures/actions) against natural hazards such as flooding by the residents. The present study examined flood risk awareness, preparedness and enhancement strategies among community dwellers in Plateau State.

High levels of flood risk awareness are crucial in saving lives and properties of flood-prone areas. The government agency for controlling natural disasters and associated problems at the state level in Nigeria is the State Emergency Management Agency (SEMA). The SEMA takes pre-emptive and response actions against natural disasters, including flooding in Plateau State. The State Emergency Management Agency (SEMA) workers are professionals trained in unique disaster management skills in all the states of Nigeria. The activities or operations of workers of SEMA are restricted or limited to the States where they are answerable to the state executive bodies. The SEMA oversees the management, control, and rescue of disaster-affected individuals at the state level (SEMA, 2020). The NEMA Act mandated all states to establish State Emergency Management Agencies while Local governments are to establish Local Emergency Management Committees. The agency also promotes decentralizing disaster risk reduction (DRR) activities at all levels and launches a national multi-sectoral platform for disaster risk reduction. The essence of the efforts mentioned above by SEMA is to ensure the safety of residents of flood-prone areas in the country (FEMA, 2020). Therefore, the community-dwellers in this study are individuals and SEMA workers living in Plateau State.

Certain variables or factors influence the flood risk awareness of adults in flood-prone communities, including those in Plateau State. Studies (Brown, &Chanson, 2016; Ricardo, Hambet, & Davis, 2017; Bratkovich, & Burban, 2017; Mashab, Scarry, & Enerta, 2018; Koch, 2020) conducted on flooding among adults and emergency response workers indicated that certain variables or factors influenced their flood risk awareness and preparedness. Therefore, in this study, variables can influence flood risk awareness of community dwellers in Plateau State. Such variables include age, gender, education level, income level, and the number of years lived in flood-prone areas. However, the present study focused on the demographic variables of age and gender.

The present study was carried out in Plateau State, Nigeria. Plateau State is one of the six North Central Geopolitical Zone states characterized by Hills and Rivers. The state has faulty urban design and planning, and also lacks proper drainages and early warning system and information. Rivers overflow easily due to the activities of the dwellers who do not clear blocked drainages and dump refuse into the rivers. Having adequate flood risk awareness and preparedness by community-dwellers in Plateau State could reduce the loss of lives and damage to properties to the barest minimum.

**Statement of the Problem**

The safety and survival of persons living in flood-prone areas depend on their flood risk awareness level. Adequate flood risk awareness may enable individuals to prevent and minimize the risks of flooding.

However, recent flooding in many parts of Nigeria, including Plateau State, have caused enormous economic, agricultural, human, and material losses. In addition, floods are associated with a high incidence of communicable and non-communicable diseases, such as diarrhoea and tetanus, as well as gastrointestinal conditions. Other cases include cholera and hepatitis A, and water-borne diseases, as well as dengue fever and malaria,

Furthermore, flood risk awareness could be influenced by certain socio-demographic variables such as age and gender. These variables can positively or negatively influence flood risk awareness among community dwellers in flood-prone areas. Thus, an examination of the influences of these variables on flood risk awareness of adult community dwellers in Plateau State could offer more information on their roles and how to moderate them.

Therefore, the present study examined flood risk awareness among community dwellers in Plateau State. This was the focus of the study.

**Purpose of the Study**

The study investigated flood risk awareness among community-dwelling adults in Plateau State. Specifically, the study determined the:

1. extent of flood risk awareness among community-dwellers in Plateau State based on age;
2. extent of flood risk awareness among community-dwellers in Plateau State based on gender;

**Research Questions**

The following research questions guided the study.

1. What is the extent of flood risk awareness among community-dwellers in Plateau State based on age?

2. What is the extent of flood risk awareness among community-dwellers in Plateau State based on gender?

**Hypotheses**

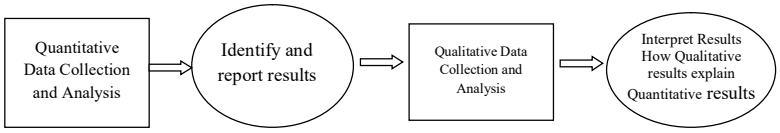
The following null hypotheses were postulated and tested at 0.05 level of significance.

1. There is no significant difference in the extent of flood risk awareness among community-dwelling adults in Plateau State based on age.
2. There is no significant difference in the extent of flood risk awareness among community-dwellers in Plateau State based on gender.

**Methods**

The mixed-methods research design was adopted. Cresswell and Plano Clark (2018) defined mixed-methods research design as the integration of both quantitative and qualitative designs and methods of data collection and analysis to understand a research problem. Specifically, the present study adopted the sequential embedded mixed-methods design. This design involves a first phase of quantitative design and data collection that is accompanied by a second phase of qualitative design and data collection. Additionally, the qualitative data play a supplemental or supportive role to the quantitative data and augments the conclusions of the quantitative data (Cresswell & Plano Clark, 2018).

**Sequential Embedded Design (Two-Phase Design)**




**Source**: Cresswell & Plano Clark (2018)

This study was carried out in Plateau State, Nigeria. Plateau State is made up of Seventeen Local Government Areas and is one of the six states that make up the North Central Geopolitical Zone. The population for the study comprised all the community-dwelling Adults in Plateau State. The population of Plateau State is 3,206,531 (National Population Commission [NPC] & National Bureau of Statistics [NBS], 2021). Further information about Plateau state population by Gender is Males are 1,598,998 while Females are 1,607,533. Population of Plateau by age groups is 0-14 years is 1,411,031,15-64 years is 1,687,381 while 65 years and above is 108,119 respectively. The population of SEMA staff is 23 (Plateau State SEMA Office, Jos, 2021).

The sample size for the study consisted of 833 respondents. The sample size comprised 810 adults and 23 SEMA workers in Plateau State. Only the adults in Plateau State were surveyed in the present study due to certain factors such as their lived experiences of flooding and the ability to narrate vividly their experiences. The sample size for the quantitative aspect of the study was determined using Leslie Kish's single population proportion formula.

The multi-stage sampling procedure was adopted to select the sample. The first stage included the use of simple random sampling technique of balloting without replacement to sample ten local government areas (LGAs) out of 17 LGAs in Plateau State. In the second stage, a simple random sample technique of balloting without replacement was used to sample one community in each of the sampled ten LGAs in Plateau State. This stage produced a total of ten communities. In the third stage, convenience sampling was used to select 81 adults from the ten communities and the 23 Staff of SEMA. Thus, a total of 810 community-dwelling adults and 23 Staff of SEMA in Plateau state were selected for the study. Purposive sampling technique was used to select 30 adult participants for the in-depth interview. Therefore, the sample size for the present study was 833 respondents.

Two instruments were used for this study. These include a researcher-designed questionnaire titled "Flood Risk Awareness Questionnaire (FRAQ) and In-depth Interview Guide on Flood Risk, Awareness (IDGFRA).The FRAQ is made up of two sections, namely: A and B The section A elicited information on demographic characteristics of community-dwelling adults in Plateau State such as age, gender, educational level, income level and number of years lived in flood prone areas. The section B contained 20 item statements on flood risk awareness of the adult residents in the flood prone areas. The items of section B were assigned a 4-point Likert type response format ranging from not aware at all (1 point), not aware (2 points), aware (3 points), and very much aware (4 points). The

respondents were asked to place a tick (√) in the column against the option that best described their flood risk awareness.

The FRAPQ and IDGFRAP were translated into Hausa Language to facilitate comprehension and collection of data from respondents with no formal education or those with poor comprehension of English Language. The translation process from English to Hausa Language followed the guidelines from the WHO (2022).

The qualitative data was collected from 30 participants, comprising 20 adult residents in the ten sampled communities and 10 staff of SEMA using the IDGFRAP.

The returned copies of the questionnaire were examined for correctness and completeness of responses. The correctly completed copies were coded and inputted in the Statistical Package for Social Sciences-(IBM SPSS Version 25 for Windows) for data analysis. Data were analyzed on item-by-item basis using mean and standard deviation for all the research questions while *t*-test ($H_{02}$) and one-way analysis of variance (ANOVA) statistics (Hypotheses 1,3,4 and 5) were adopted to test the null hypotheses at .05 level of significance. A null hypothesis was rejected when the calculated *p*-value is less than 0.05, however, the null hypothesis was not rejected when the calculated *p*-value is greater than 0.05 level of significance. To determine the extent and level of flood risk awareness and preparedness, the real limits of number was used. Thus, mean scores ranging from 1.00-1.99 was considered low extent of awareness; mean scores ranging from 2.00-2.99 was considered as moderate extent of awareness, mean scores ranging from 3.00-3.49 was considered as high extent of awareness, while mean scores ranging from 3.50-4.00 was considered as very high extent of awareness.

For the qualitative data, inductive thematic analysis was used. The six (6) phases of inductive thematic analysis as described by Braun and Clarke (2006) were employed. First, the data transcripts and filed notes were independently read by the researcher and an expert in qualitative data analysis severally (phase 1) and then initial codes were developed (phase 2). The codes were sorted and grouped into potential categories/themes (phase 3). The themes were expanded to cover the key dependent variable (adoption of flood risk awareness) using the coded data. The next phase, which is phase 4, involved using a theme map to ensure consistency across the transcripts between the researcher and the expert who conducted the qualitative data analysis. Phase 5 involved assigning definition and naming of the themes and sub-themes. Phase six (6) involved using the themes to answer the research questions. All analysis decisions were made through a consensus between the researcher and the expert, and all discrepancies were discussed until consensus was achieved. Credibility, dependability, confirmability, and transferability were conducted to ensure trustworthiness (Creswell and Plano Clark, 2018). The transcribed texts, codes and themes were organized and analyzed using Atlas.ti version 22 developed by the Atlas.ti Scientific Software Development

## Results

The findings of the present study are organized based on the research questions and null hypotheses that guided the study.

**Research question one:** What is the extent of flood risk awareness among community-dwelling adults in Plateau State based on age? Data answering this question are contained in Table 1.

**Table 1: Mean Responses on Extent of Flood Risk Awareness among Community-Dwelling Adults in Plateau State based on Age (*n* = 790)**

| | | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 18-29 years (n=166) | | 30-39 years (n=235) | | 40-49 years (n=212) | | ≥50 years (n=177) | |
| S/N | Items | $\bar{x}$ | SD | $\bar{x}$ | SD | $\bar{x}$ | SD | $\bar{x}$ | SD |
| To what extent are you aware that: | | | | | | | | | |
| 1. | Flooding displaces people from their homes | 2.93 | .91 | 2.85 | .75 | 3.06 | .71 | 3.12 | .79 |
| 2. | Flooding can trigger the chances of increased waterborne disease out-breaks such as typhoid, giardia, cryptosporidium, and cholera | 2.71 | .76 | 2.71 | .69 | 2.90 | .66 | 3.06 | .82 |
| 3. | Domestic and wild animals die due to flooding | 2.82 | .85 | 2.82 | .79 | 2.99 | .71 | 3.12 | .77 |
| 4. | People lost their valuables and properties such as houses and cars during flooding | 2.77 | .84 | 2.80 | .76 | 2.92 | .64 | 3.01 | .62 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5. Agricultural products such as fruits, food items and vegetables are destroyed during flooding | 2.88 | .86 | 2.79 | .82 | 2.95 | .70 | 2.99 | .64 |
| 6. Flooding can lead to complete destruction of the spawning grounds for fish and other wildlife habitats | 2.80 | .82 | 2.78 | .76 | 2.88 | .66 | 3.02 | .57 |
| 7. Building such as houses, shops, offices, etc are lost due to flooding | 2.85 | .82 | 2.80 | .76 | 2.93 | .71 | 3.02 | .64 |
| 8. People lost their lives during flooding | 2.97 | .92 | 2.94 | .84 | 3.08 | .79 | 3.29 | .75 |
| 9. Transportation networks are disrupted during flooding | 2.85 | .86 | 2.91 | .85 | 3.00 | .67 | 3.07 | .66 |
| 10. Flooding destroys infrastructure such as bridge abutments, bank lines, sewer lines and sewage disposal facilities | 2.87 | .78 | 2.93 | .87 | 2.98 | .70 | 3.10 | .71 |
| 11. Flooding leads to soil erosion and concomitant sediment deposition? | 2.89 | .87 | 2.89 | .82 | 2.92 | .71 | 3.06 | .72 |
| 12. Farmlands are damaged during flooding | 2.79 | .88 | 2.91 | .82 | 2.96 | .64 | 3.18 | .65 |
| 13. Flooding leads to impaired waterway navigation and hydroelectric power | 2.69 | .89 | 2.88 | .78 | 2.94 | .73 | 3.15 | .69 |
| 14. Flooding leads to total loss of clean drinking water and lack of water treatment | 2.78 | .86 | 2.92 | .79 | 2.95 | .71 | 3.20 | .64 |
| 15. Economic hardship and starvation are highest during flooding | 2.86 | .88 | 2.92 | .80 | 3.01 | .67 | 3.19 | .67 |
| 16. Flooding leads to temporary decline in tourism experiences | 2.72 | .86 | 2.86 | .74 | 2.99 | .76 | 3.14 | .72 |
| 17. Psychological trauma is very high during flooding | 2.77 | .82 | 2.94 | .74 | 3.02 | .71 | 3.07 | .72 |
| 18. Flooding leads to high growth of indoor mold resulting in adverse respiratory cases | 2.64 | .88 | 2.86 | .77 | 2.85 | .81 | 2.84 | .82 |
| **Cluster Mean** | **2.81** | **.85** | **2.86** | **.79** | **2.96** | **.71** | **3.09** | **.70** |

Note: $\bar{x}$ = Arithmetic mean; SD = Standard Deviation

**Guidelines for Interpreting Extent of Flood Risk Awareness**

$\bar{X}$ = 1.00-1.99 (Low extent); $\bar{X}$ = 2.00-2.99 (Moderate extent); $\bar{X}$ = 3.00-3.49 (High extent); $\bar{X}$ = 3.50-4.00 (Very high extent)

Results in Table 1 show that overall, community-dwelling adults aged ≥50 years were aware of flood risk to a high extent ($\bar{x}$=3.09, SD=0.70) while those aged 40-49 years ($\bar{x}$=2.96, SD=0.71), 30-39 years ($\bar{x}$=2.86, SD=0.79) and 18-29 years ($\bar{x}$=2.81, SD=0.85) were aware of flood risk to a moderate extent in Plateau State.

The quantitative findings showed that greater number of the participants in this study were within the ages of 30 to 49 years while lesser proportion were within the ages of 18-29 years and 50 years and above. At the community level, participants aged 50 years and above were aware of flood risks to moderate and high extent. The chronological ages of the participants seemed to influence their flood risk awareness. Interestingly, the participants for qualitative data in all the age categories, especially the SEMA workers/staff were aware of flood risk to a high and moderate extent as indicated below:

> *Flood risk awareness is when people have knowledge of dangers associated with flooding. The dangers include deaths of people, animals, loss of properties and farmlands (IDI #29, Male; SEMA Staff)*
>
> *Flood risk awareness implies when heavy water caused by too much rains kill people, animals and destroy crops (IDI #05, Male).*
>
> *Flood risk awareness means having information about the threats that flooding causes in our community. Examples of such threats or dangers include deaths of people and animals (IDI #13, Male).*

**Research question two.**
What is the extent of flood risk awareness among community-dwelling adults in Plateau State based on gender? Data answering this question are contained in Table 2

**Table 2**
**Mean Responses on Extent of Flood Risk Awareness among Community-Dwelling Adults in Plateau State based on Gender (n= 790)**

| Gender | | Male (n=291) | | Female (n=499) | |
|---|---|---|---|---|---|
| S/N | Items | $\bar{x}$ | SD | $\bar{x}$ | SD |
| To what extent are you aware that: | | | | | |
| 1. | Flooding displaces people from their homes | 3.11 | .83 | 2.90 | .75 |
| 2. | Flooding can trigger the chances of increased waterborne disease outbreaks such as typhoid, giardia, cryptosporidium, and cholera | 2.9 | 0.74 | 2.80 | .74 |
| 3. | Domestic and wild animals die due to flooding | 3.01 | .79 | 2.89 | .78 |
| 4. | People lost their valuables and properties such as houses and cars during flooding | 2.92 | .71 | 2.85 | .73 |
| 5. | Agricultural products such as fruits, food items and vegetables are Destroyed during flooding | 3.00 | .75 | 2.84 | .76 |
| 6. | Flooding can lead to complete destructions of the spawning grounds for fish and other wildlife habitats | 2.91 | .73 | 2.84 | .70 |
| 7. | Building such as houses, shops, offices, etc are lost due to flooding? | 2.94 | .73 | 2.87 | .74 |
| 8. | People lost their lives during flooding | 3.17 | .84 | 3.00 | .83 |
| 9. | Transportation networks are disrupted during flooding | 3.02 | .77 | 2.92 | .77 |
| 10. | Flooding destroys infrastructure such as bridge abutments, bank lines, sewer lines and sewage disposal facilities | 3.00 | .75 | 2.95 | .79 |
| 11. | Flooding leads to soil erosion and concomitant sediment deposition | 3.01 | .77 | 2.89 | .79 |
| 12. | Farmlands are damaged during flooding | 3.04 | .78 | 2.91 | .75 |
| 13. | Flooding leads to impaired waterway navigation and hydroelectric power | 2.95 | .74 | 2.90 | .81 |
| 14. | Flooding leads to total loss of clean drinking water and lack of water treatment | 2.97 | .71 | 2.96 | .80 |
| 15. | Economic hardship and starvation are highest during flooding | 3.04 | .69 | 2.97 | .81 |
| 16. | Flooding leads to temporary decline in tourism experiences | 2.90 | .72 | 2.95 | .83 |
| 17. | Psychological trauma is very high during flooding | 2.92 | .71 | 2.98 | .78 |
| 18. | Flooding leads to high growth of indoor mold resulting in adverse respiratory cases? | 2.68 | .81 | 2.88 | .82 |
| | **Cluster Mean** | **2.97** | **.75** | **2.91** | **.73** |

Note: $\bar{x}$ = Arithmetic mean; SD = Standard Deviation

**Guidelines for interpreting Extent of Flood Risk Awareness**

$\bar{x}$ = 1.00-1.99 (Low extent); $\bar{x}$ = 2.00-2.99 (Moderate extent); $\bar{x}$ = 3.00-3.49 (High extent); $\bar{x}$ = 3.50-4.00 (Very high extent)

**Source**: Researcher.

Results in Table 2 show that overall, both male ($\bar{x}$ = 2.97, SD = 0.75) and female ($\bar{x}$ = 2.91, SD = 0.73) community-dwelling adults were aware of flood risk to a moderate extent in Plateau State. The qualitative findings indicated that male and female participants' extent of flood risk awareness in Plateau State did not differ. Many male and female participants in this study were aware of flood risks while some participants regardless of gender seemed not to be aware of the risks associated with flooding. In response to the question, a male and female participants exemplified here:

> *Flood risk awareness means that a person has knowledge ...that flooding can cause dangers to people. These include diseases such as malaria, diarrhoea, typhoid fever, cholera, and deaths (IDI #12, Male).*
> *Flood risk awareness is when people have information about the negative effects of flooding on the people (IDI #23, Female).*

**Hypothesis one:** There is no significant difference in the extent of flood risk awareness among community-dwelling adults in Plateau State based on age. Data testing the hypothesis are contained in Table 3.

**Table 3: Summary of One-way ANOVA Showing Difference in the Extent of Flood Risk Awareness among Community-Dwelling Adults in Plateau State based on Age (*n* = 790)**

| Variable | Sum of Squares | df | Mean Square | *F* | *P*-value |
|---|---|---|---|---|---|
| Between Groups 13.502 | | 3 | 4.501 | | |
| Within Groups | 378.078 | 786 | 0.481 | 9.357 | 0.000 |
| Total | 391.984 | 789 | | | |

*Note. Df= degree of freedom; F= F-ratio/value*
Significant at $P < 0.05$.

Table 3 shows the results of one-way ANOVA conducted to examine difference in the extent of flood risk awareness among community-dwelling adults in Plateau State based on age. The result show that there was a significant differences in the extent of flood risk awareness among community-dwelling adults in Plateau State based on age, $F$ (3,786) = 9.357, $P$ = 0.000. The post-hoc comparison using Scheffe's test showed that the mean flood risk awareness score for adults aged 18-29 years ($\bar{x}$= 3.61; SD = 0.89) was significantly different from adults aged 40-49 years ($\bar{x}$= 3.71; SD = 0.58) and those aged 50 years and above ($\bar{x}$= 3.97; SD = 0.55). The mean difference scores are –0.203 and -0.365 for adults aged 40-49 years and those aged ≥50 years, respectively. Age group 20-39 years did not differ significantly from either age group 18-29 years, 40-49 years or ≥50 years. Since the p-value is less than 0.05 level of significance, the null hypothesis was rejected. This implies that community-dwelling adults differed in their extent of flood risk awareness based on age.The finding was anticipated and, therefore, not a surprise. This is because the community dwellers, regardless of age, might have experienced flood risks to a measurable extent. Although, older residents, that is,≥50 years, reported a high level of awareness of flood risks compared to their counterparts of other age categories. The finding may suggest that older community-dwelling adults than younger adults who have experienced flood-related dangers ranging from the loss of human lives to damage to properties, agricultural products, transportation networks, and disease outbreaks in the community appreciate flood risks. The findings agree with those of Marfai, Sekaranom, and Ward (2015), who reported that older community-dwelling adults showed very high responses and adopted more adaptation strategies for flooding compared to the younger age cohorts in Jakarta, Indonesia. Similarly, the finding aligns with those of Hernández-Guerrero, Vieyra-Medrano, and Mendoza (2012), who reported that the adaptation strategies in communities under precarious housing for flooding risks in the Peri-urban sector of the city of Morelia, Michoacán, México was high among older residents when compared to younger adults.

**Hypothesis two:** There is no significant difference in the extent of flood risk awareness among community-dwelling adults in Plateau State based on gender. Data testing the hypothesis are contained in Table 4.

**Table 4: Summary of Independent-Sample t-Test of Difference in the Extent of Flood Risk Awareness among Community-Dwelling Adults in Plateau State based on Gender (*n* = 790)**

| 95% C.I. Variable | N | $\bar{x}$ | SD | SEM | t-cal | df | P-val. | LB | UB |
|---|---|---|---|---|---|---|---|---|---|
| Gender | | | | | | | | | |
| Male | 291 | 3.18 | 0.71 | 0.04 | | | | | |
| Female | 499 | 3.74 | 0.71 | 0.03 | 1.564 | 788 | 0.118 | -0.02 | 0.18 |

Note. $\bar{x}$ = *mean, SD = Standard deviation; S.EM = Standard error of mean; p-val.=p-value*

Significant at $P<0.05$.

Table 4 shows the results of independent-sample t-test conducted to examine difference in the mean scores on extent of flood risk awareness for males and females in Plateau State. There was no significant difference in the mean scores on extent of flood risk awareness among community-dwelling adults based on gender, $t$(788) = 1.564, $P$ = 0.118. The magnitude of the difference in the mean scores (mean difference = 0.07, 95% C.I. -0.02 to 0.18) was very small. Since the p-value was

greater than 0.05 level of significant, the null hypothesis was not rejected. This implies that male and female community-dwelling adults did not differ in their extent of flood risk awareness.

Findings in Table 4 indicated that male and female community-dwelling adults were aware of flood risks to a moderate extent in Plateau State. The findings in Table 4 showed no significant difference in the extent of flood risk awareness among community-dwelling adults based on gender. The findings are expected. They demonstrate that both male and female adult members in the community are aware of the dangers of flooding. The findings imply that all the community dwellers, regardless of gender difference, would engage in flood-related activities since their awareness level is commendable. The finding could be attributed to specific life-changing experiences and flood encounters, which might negatively affect every community member. Thus, such a dissatisfying experience usually serves as a deterrent to individuals devoid of gender category. Following other findings, Bratkovich and Burban (2017) reported that the male and female respondents viewed flooding and its effects on trees differently. Similarly, Koch (2020) reported that males were more prepared than female family members to respond effectively to flooding. The discrepancies in the findings could be attributed to study locations and the type of study designs used.

**Conclusion**

The findings showed that community-dwelling adults were aware of flood risk to a moderate extent. The findings of the study provided crucial insight into the flood risk awareness of community-dwelling adults in Plateau State, which were moderate. Thus, there is a need for concerted efforts by public health educators, environmental health experts, and other experts to collaborate and implement education or awareness programmes that promote flood risk awareness of adults in Plateau State. Such programme if effectively implemented, hopefully, will enable community-dwellers mitigate flood-related risks.

**Recommendations**

Based on the findings of the study and conclusions drawn, the following recommendations were made:

1. Flood risk awareness education campaign should be intensified at the community levels in Plateau State in order to improve their flood risk awareness status.
2. The SEMA staff in collaboration with the community members should maintain consistent supervision of the areas that are mostly affected by flooding. Such monitoring would be instrumental in monitoring the geographical as well as environmental changes in the state.
3. There is need for research funding and grants for people as well as SEMA staff in Plateau State to enable them to come up with local content and sustainable strategies for flood control, management and prevention in the state.

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