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ANALYZING HUMAN BEHAVIOURAL RESPONSES TO FLOOD HAZARDS AND FLOOD RISK MANAGEMENT IN LOKOJA, NIGERIA

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ABSTRACT

In recent flooding events, behavioral responses and its attendant hazards are on a global scale becoming devastating, high, and recurrent and a threat to sustainable development. Understanding human behaviours in and around flood water is needed to help inform effective preventive strategies. This study evaluates behavioral responses to flood events and risk management in Lokoja. Data needed include those on peoples' behavioral responses, types of flood hazards and flood risk management strategies. Data for the study were drawn from both primary and secondary sources. Administration of questionnaire was the research instrument and survey design were adopted while a total of three hundred and eighty (380) questionnaire were retrieved from four hundred (400) administered. The respondents were drawn from Lokoja Town. Descriptive and inferential statistical techniques were elicited for this study. The finding reveals that at Adankoloon the most common risk of flood, 31(8.15%) reported spread of diseases. Gadumo, 27(7.10%) reported injuries, but 9(2.36%) reported water pollution. On behavioral responses to flood events in the study area, Adankolo 20(5.26%) reported embankment, 28(7.36%) observed construction of flood walls. At Lokongoma, 22(5.75%) respondents reported the use of levees. On flood risk management strategies, at Adankolo, 31(8.15%) reported the use of flood sensitivity maps, 22(5.78%) reported avoidance of flood prone areas/plains. At Phase 2, 12(3.15%) reported use of flood sensitivity map. Analysis shows Pv> .05. This study recommends that for flood hazards to be mitigated, the type of flood be known and appropriate flood management technique should be employed.

Keywords: *Behaviour, Response, Flood, Hazards and Risks.*

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1.0: INTRODUCTION

Globally, flooding has become a major disaster in recent years due to several factors, including an ineffective drainage system, climate change and extreme weather events, which directly impact growing population and rapid urbanization. Flooding is a general or temporary condition of partial or complete inundation of normally dry area of land from the overflowing of inland or tidal waters from any source land. In developing countries like Nigeria, flooding results from several factors: from large amount of rainfall, within a short period of time, continuous excessive precipitations, especially along borders and coasts, uncontrolled rapid population growth, inadequate preparedness and lack of political-will. How individuals prepare for and respond to extreme weather event (floods) differs with short and long-term consequences on the environment and man National Bureau of Statistics (NBS, 2023).

In the face of natural disasters, human behaviours can often be unpredictable and intriguing. Floods which have the potential to cause immense devastation and disrupt communities, have the ability to bring out both best and the worst in people. Understanding the various human behaviours that manifest during such crises are critical in order to effectively retort and mitigate the impact of any disaster. Generally, natural disasters like flood abounds and human behaviours play a crucial role in determining the outcomes of such events. Understanding how people respond to such event is essential for effective disaster management and preparedness. The behaviour of individuals, businesses and government agencies before, during and immediately after a disaster (flood) can dramatically affect impact and recovery time. Floods have caused the largest proportion of losses among all-natural catastrophes during recent decades resulting in global losses worth USD 60 billion in 2016 alone. Climate change, distorted and unpredictable global precipitation patterns, sea level rise and other anthropogenic activities within and around the environment may further exacerbate the frequency, duration, intensity and severity of flood hazards (Aerts, Botzen, Clerke, Cutter, Hall, Merz, Michel-Kerjan, Mysiak, Surminski and Kunreuther (2018). Today, as one of the most common natural disasters and drowning is thought to be a leading cause of death during times of flood. Understanding the behavioural response of those at risk of flooding can be of critical importance to both individual and community impact. Behavioural research into natural hazards has developed considerably and encompasses a wide variety of discipline. It is widely acknowledged that the relationship between risk awareness, risk understanding, attitudes towards risk and behaviour response are extremely complex and thus encouraging positive behaviour can be challenging. Behavioural Responses to Flood Hazards (BRFHs), Flood Risk Reduction (FRR) and Flood Risk Management (FRM) has undergone considerable changes in recent years particularly the interest in the active involvement of citizens at risk in the management of floods has increased over the past decades.

Throughout human history, flooding had a major impact on people's safety and livelihood. Understanding people's flood related behaviours and responses may generate helpful actions in the development of more effective strategies aimed at lessening flood risks including its mortality and morbidity (Drobot, Benight and Gruntfest (2007). The cascading crises after a flood event can have wide ranging implications on flood preparedness, mitigation, response and point to the need of better understanding of human behaviour during times of flood (Tim, Pan, Ractham, and Kaewkitipong, 2017). This knowledge can help to inform strategies to improve behaviours and reduce flood related losses to property and livelihood (Few and Pham (2010). Historically, there has always been a diverse extreme weather event. Floods are widely discussed today due to increased public awareness especially in the developed economies and greater destruction caused by them perhaps; flood is one of the most dramatic

interactions between man and his environment (Spencer et al, 2011). In recent years there have been a number of catastrophic floods events in particular that have resulted in tragic loss of lives. Flood disaster is not a recent phenomenon in Africa in general and Nigeria in particular in recent times. There is emerging evidence that people affected by flooding suffer adverse effects on their mental well-being (Malojevic et al, 2017). The frequency, duration and intensity of flood disaster has become a serious issue in the national development process of Nigeria as flood disaster have caused serious environmental damages, loss of lives and other heavy economic issues (Adebayo, 2017). The town (Lokoja and its environs) has been experiencing its destructive tendencies which are sometimes enormous.

Flooding is one of the most common natural disasters (Doocy, Daniels, Murray, and Kirsh, 2018), and drowning is thought to be a leading cause of death during times of flood (Di Mauro, De Bruijn and Meloni, 2012). The World Health Organization (WHO, 2014) estimates that between 1980-2009, flood has claimed the lives of over 500,000 people around the world (WHO, 2014). Reports into causes of death due to interacting with flood water have identified several factors impacting drowning during times of flood including accidental fall (Preden, Franklin and Leggat, 2018; Peden, Franklin, Leggat and Aitken, 2017). Driving into floodwaters is a leading activity immediately prior to flood related drowning, a fact that has been highlighted in a number of countries (Diakakis and Deligianakis, 2013). Other behaviour that may increase risks of mortality and morbidity during times of flood include living on floodplains or near water bodies prone to flooding (Apel, Aronica, Kreibich, and Thicken, 2009; Plate, 2002). As well as the behavior in the lead up and immediately after flood that can impact health and safety such as refusal to evacuate and flood related infections and diseases (Heath, Kass, Beck and Glickman, 2001). Human behaviour is vulnerable to crises and diseases and, as a consequence, such event brings about challenges for prevention efforts (Pelling, 2003) and it's important to reduce negative impact as a result of effective management of human behaviour in crises and disasters. Although not all flood related death and injuries are preventable especially when individuals are unexpectedly inundated with water leaving no time to make decisions, where decision making is possible, individual behaviour in and around flood water during a flood event may help to prevent flood related incidents (Hamilton, Peden, Keech, and Haggar, 2018). Therefore, understanding human behaviour in and around flood water is needed to help inform effective preventive strategies. This is because decisions informing the peoples' behaviour responses in flooding are likely to be psychological in nature involving a range of social and motivational factors (Hamilton and Keech 2016). Once safety compromising in and around flood water can be identified, investigation into the mechanisms that guide these risky acts can be elucidated and interventions developed. With extreme weather events predicted to result in increased frequency and severity of flooding over the coming decades as a consequence of global climate change (Doocy et al., 2013), there is a need for more effective preventive strategies to reduce flood related loss of life. Flood event can inflict major disruption of society and cause significant infrastructural and environmental damage. However, as one of the devastating naturally occurring environmental hazards, the risks and hazards of flood cannot be overemphasized (Drabek, 2001).

Floods occur in Nigeria in three main forms: coastal flooding, river flooding and urban flooding. Coastal flooding occurs in the low – lining belt of the mangrove and fresh water swamp along the coast (Folonrunsho and Anosika 2001; Ologunorisa 2004). It occurs in the flood plains of large rivers when sudden short-lived flash floods are associated with river in the land areas where sudden heavy rain can change them into destructive torrents within a short period (Anosika 2001; Ologunorisa, 2004). (Ali 2005). Aderrerho (2004)

2.0: MATERIALS AND METHODS

This study delves into the intricate relationships between flood events and human behaviours, examining the range of responses and actions observed in the face of such calamities and shedding light on respondents' risky behaviours, pre-flood preparedness, types of flood hazards, flood management strategies and flood warning systems in Lokoja, Nigeria. *A survey design was adopted for this study.* Needed data includes those on people's risky behavioural responses to flood events, behavioural response to pre-flood preparedness, types of flood hazards in the study area, flood risk management strategies and that on respondents' perception on flood warning systems. Data sources include primary and secondary sources. Research instrument was questionnaire administration. Purposive sampling method was employed for this study while simple random sampling method was also elicited for questionnaire administration. Four hundred questionnaires were administered but three hundred and eighty were retrieved for this study. Both descriptive and inferential statistics were employed for the study. The study tested the hypothesis that says ''there is no statistically significant association between behavioural response to flood and flood hazards in the study area.'' Several studies examined flooding from different viewpoints: Simon and Alkali (2016). Abam (2006), Nwafor (2006), Ayoade (1988,) Askew (1999), Folonrunsho and Anosika (2001), Ologunorisa (2004), Ali (2005), Aderrerho (2004), Okereke (2007); Kolawole *et al* (2011), Mmom and Aifeschi (2003) but non analyzed the behavioural responses to flood hazards and flood risk management in Lokoja. Therefore, understanding human behaviour in and around flood water is needed to help inform and develop effective preventive strategies.

3.0: DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

Table 1.0: Risky Behaviours during Flood Events by Respondents

Neighbourhood	Walking in Flood water		Driving in Flood water		Recreation Activity During Flood		Evacuation Behaviour		Relocation Behaviour		Property Protection		Rescuing Others		
	Respdent	%	Respdent	%	Respdent	%	Respdent	%	Respdent	%	Respdent	%	Respdent	%	%Total
Adankolo	15	3.94	18	4.73	9	2.36	20	5.26	13	3.42	20	5.20	7	1.84	27.10%
Gadumo	7	1.84	12	3.15	11	2.89	15	3.94	8	2.10	15	3.94	17	4.47	22.36%
Lokongoma	13	3.42	15	3.94	12	3.15	18	4.73	5	1.31	17	4.47	20	5.26	26.31%
Phase 2	8	2.10	11	2.89	4	1.05	13	3.42	9	2.36	28	7.36	19	5.0	24.21%
Total	43	11.31	56	14.73	36	9.47	66	17.36	35	9.21	80	21.05	63	16.57	100.0%

Source: Field Survey, 2024.

As seen in table 1, residents of the flood prone areas do undertake some risky behaviours in the event of flood. In Adankolo, 15(3.94%) of the total respondents reported to have walked in flood water. 18(4.73%) drove in flood water. While flood still persisted in the study area, 9(2.36%) engaged in recreational activities. In a bid to evacuate, 20(5.26%) respondents at Adankolo exhibited such risky behaviour. At Gadumo community, 17(4.47%) showed risky behavior in the bid to rescue others been affected by flood water. In an attempt to protect one's property, 15(3.94%) of the total respondents stood and refuse to evacuate flooded plains but, 12(3.15%) drove cars in the flood water believing that nothing will happen. 20(5.26%) in Lokogoma tried to rescue others been flooded but 18(4.73%) showed a risky character in their evacuation behavior. At Phase 2 community, 13(3.42%) exhibit risky behaviour during evacuation activities as a result of flood event. 11(2.89%) reported driving

into flood water which indeed is risky. This result reveals that for property protection 80(21.05%) was the highest risky behaviour among residents of the study area as respondents struggle to rescue their properties from flood water. This is closely followed by evacuation behaviours 66(17.36%). This is because several residents of the study area either own a house or rented one with some household properties in them and were not ready to lose them.

This finding agrees with Easterling et al (2000), Patz, Engelberg and Last (2000) who reported that with extreme weather events predicted to result in increased frequency, intensity and severity of flooding over the coming decades as a consequent of global climate change, there is need for more effective prevention strategies to prevent flood related loss of life. Given that many fatalities in flood waters are associated with behaviours that put one at risk, e.g. driving into floodwater and that deaths could be minimized through adoption of safety behaviours, identification of the social, environmental, and psychological factors that determine these behaviours is essential to inform the development of behavioural interventions and policies aimed at minimizing risk and reduce flood related incidents. Caotes (1999) observed that several studies on correlation between drowning deaths and entering or crossing floodwater from Australia using several databases to examine flood deaths from 1788 to 1996, showed that 28.3% (n=398) of fatalities were associated with attempting to cross creek, river, or stream with most of these occurring on the boats (n=131) or by walking, wading, and swimming (n=103). A further 10.2% (n=142) of fatalities were associated with an attempt to cross a road, bridge, culvertor ford. Another study from Australia by Haynes et al., (2017) with overlapping- timeframes reached similar conclusions reporting that attempts to cross bridges, causeways, crossings, culverts, fords, or watercourses during a flood are a major reason for flood fatalities in Australia. In Greece, Diakakis and Deligiannakis (2013) reported that more than half of all car crash fatalities related to flooding between 1970 and 2010 occurred after travelling across a waterway with most occurring in regional areas (70%) during night time (46.7%) by locals (78.1%) on paved roads (41.5%). On saving others, Duclos et al (1991) on flash flood survivors reported that saving their own lives and those of others were one of the most common major concerns 19% after participants realized the danger of the situation. The study also showed that people were most likely to be saved by members of the public such as their neighbours (40%, n=20) or family member (20%, n=10) rather than trained emergency services personnel such as firefighters (12%n=6), the Red Cross (10%, n=5), or the army (8%, n=4). Vinet, Lumbroso, Deossez and Boissier (2012) suggested that in France, family members especially partners, may also pose risk- many fatalities occurred in couples (n=22) whereas only five fatalities of just one partner dying were registered. Vorst (2010) suggested an improved evacuation model to reduce flood induced fatalities.

Table 2: Behavioural Responses to Pre-Flood Preparedness

Neighborhood	Embarkment		Flood Walls		Levees		Dam		Groynes		Boulders		%Total
	Respondents	%	Respondents	%	Respondents	%	Respondents	%	Respondents	%	Respondents	%	
Adankolo	20	5.26	28	7.36	16	4.21	18	4.73	13	3.42	8	2.10	27.10
Gadumo	21	5.52	13	3.42	9	2.36	7	1.84	8	2.10	27	7.10	22.36
Lokongoma	31	8.15	12	3.15	22	5.78	13	3.42	20	5.26	2	0.52	26.31
Phase 2	18	4.73	10	2.63	17	4.47	21	5.52	15	3.94	11	2.89	24.31
Total	90	23.68	63	16.57	64	16.84	59	15.52	56	14.78	48	12.63	100.0

Source: Field Survey, 2024.

As revealed by table 2 on the different response patterns of respondents in Adankolo to flood event in the study area, 20(5.26%) reported the building of embarkments along the flood plain while 28 (3.76%) believed in construction of flood walls but 13(3.42%) of the total respondents reported the construction of groynes along the flood plain. 21(5.52%) of the total respondents reported that use of embarkment to reduce flood impacts while 13(3.42%) reported the use of floodwalls, 9(2.36%) opined the use of levees and 7(1.84%) of the total respondents reported the construction of dams. In Lokongoma, 22(5.75% also reported the use of levees, 25(5.26%) believe in the construction of groynes but 12(3.15%) reported the use of flood walls to reduce flood impacts in the study area. Garvin (2001) and Slovic, (2000) reported that it is widely acknowledged that the relationship between risk awareness, risk understanding, attitude towards risk and behaviour response are extremely complex thus, encouraging positive behaviour can be challenging. Individual and group responses are needed to take effective and appropriate actions in effective flood management. Decisions by those at risk (and subsequent actions or inactions) span the entire spectrum of flood risk management and may include, as example, decision and behaviour to reduce flood fatalities (mortality and morbidity).

Table 3: Types of Flood Hazards in the Study Area

Neighbourhood	Spread Disease		Spread of Chemical Hazards		Injuries		Water Pollution		Loss of Life		Road closure	
	Respondents	%	Respondents	%	Respondents	%	Respondents	%	Respondents	%	Respondents	%
Adankolo	31	8.15	27	7.10	19	5.0	21	5.52	2	0.05	3	0.78
Gadumo	18	4.73	11	2.89	27	7.10	9	2.36	13	3.42	7	1.84
Lokongoma	9	2.26	6	1.57	13	3.42	31	8.15	22	5.78	19	5.0
Phase 2	12	3.15	17	4.49	9	2.36	21	5.52	19	5.0	14	3.68
Total	70	18.42	61	16.05	68	17.89	82	21.57	56	14.73	43	11.31

Source: Field Survey, 2024.

As revealed by table 3, in Adankolo settlement 8.15% of the total respondents reported the spread of diseases among the residents in the event of flood. 7.10% of the total population also reported transport of chemical material from a source region to their destination. In response to probable injuries during flood event, 7.10% reported so in Adankolo but 4.73% respondents observed spread of diseases within the study area. 2.26% of the total respondents reported pollution of water sources as a result of flooding. At Lokongoma, 3.42% reported occurrence of injuries due to flood incident but 8.15% of the total respondents reported pollution of domestic water sources in the study area but 1.57% of the total respondents reported transportation of chemical hazards into residential areas. At Phase 2, 5.52% of the total respondents observed pollution of domestic water sources. However, 2.36% observed injuries and 3.15% reported spread of diseases among the residents of the study area. Ruin, Lutoff, and Shabou (2017) reported that as much as flood-related mortality and morbidity is preventable and often the result of individuals' behavioural responses in the flood event, gaining a better understanding of people's flood related behaviour is essential so that prevention strategies can target these behaviours and the underpinning mechanisms that guide these risky acts.

Table 4: Flood Management Strategies

Neighbour hood	Flood Sensitivity Map		Construction of dams and reservoirs		Construction of floodways		Self-Closing Flood Barriers		Coastal/flood plain Management		Total	
	Respondents	%	Respondents	%	Respondents	%	Respondents	%	Respondents	%	Total	%
Adankolo	31	8.15	22	5.78	18	4.73	17	4.47	15	3.94	103	27.10
Gadumo	21	5.52	14	3.68	27	7.10	13	3.42	10	2.63	85	22.36
Lokongoma	17	4.47	15	3.94	16	4.21	22	5.78	30	7.89	100	26.31
Phase 2	12	3.15	19	5.0	22	5.78	15	3.94	24	6.31	92	24.21
Total	81	21.31	70	18.42	83	20.84	67	47.63	79	20.78	380	100.0

Source: Field Survey, 2024.

Table 4 reveals respondents' methods of flood management in the study area. In Adankolo, 31(8.15%) of the total respondents reported the use technology of flood mapping. 22(5.78%) observed dam and reservoir construction, 18(4.73%) reported the construction of flood ways while 17(4.47%) observed construction of self-closing flood barriers. In Gadumo, 10(2.63%) reported proper coastal management to prevent flooding, 13(3.42%) also reported the use of self-closing flood barriers but 21(5.52%) reported the use of flood sensitivity map to know beforehand the likely flood plains in the study area. At Lokongoma, 22(5.78%) of the total respondents reported the construction of self-closing flood barrier while 30(7.89%) observe proper coastal management of the confluence city. In Phase 2, 19(5.0%) reported construction of dams and reservoirs within the confluence City. 22(5.78%) of the total respondents reported construction of flood ways within the capital city of Lokoja. This result corroborated with Diakakis and Deligiannakis, (2017) in Greece who reported that further exploration of methods in the event of flooding to improve preparedness, increase the likelihood of evacuation, and reduce 'risky' behaviour during floods is needed and should be taken seriously, like the use of GPS/GIS tools in flood management procedures.

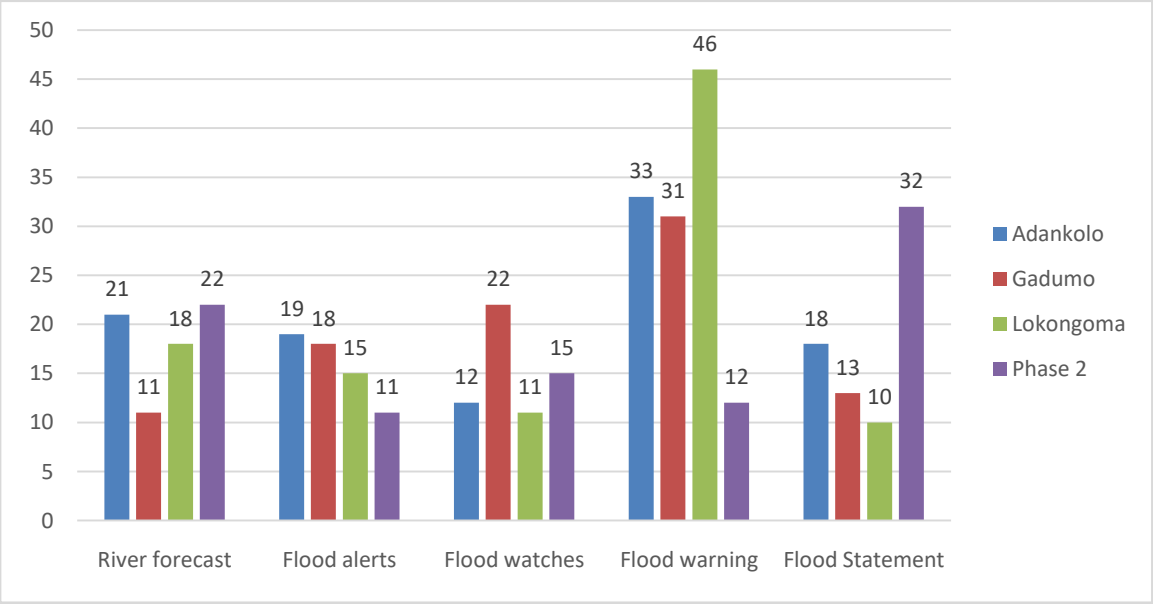


Figure 1: Respondents Perception on Flood Warning Systems

Source: Field Survey, 2024.

As shown by figure 1, several flood warning systems were reported by the respondents in the study area. In Adankolo settlement, 21(5.32%) reported river forecast, 19(5.0%) opined flood alerts as 33(8.68%) reported flood warning. In Gadumo, 31(8.15%) of the total respondents reported flood warning, 22(5.78%) opined flood watches while 18(7.43%) believe flood alerts. At Lokongoma, 46(12.10%) reported flood warning while 18(4.73%) observed flood

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.000[a]	16	.220
Likelihood Ratio	16.094	16	.446
N of Valid Cases	5		

a. 25 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

DECISION RULE: Since P > .05, we reject H_1. In other words, respondents' behaviour in flood event has no statistically significant effects on flood hazards in the study area.

forecast and 15(3.94%) reported flood alerts. At Phase 2, 32(8.42%) opined flood statement then 22(5.72%) reported river forecast. The result indicates that flood warning systems as flood risk management systems were adopted by the respondents in the study area. The results imply that flood statement 73(19.21%) and flood forecast 72(18.94%) were the most perceived systems adopted in the study area. To have a fore-knowledge of flood event in the study area, this finding is supported by Saysoth, Robert, and Paul (2014) and Hamilton (2019) in a paper that reviewed the techniques of a number of flood warning systems reported that in developing countries inadequate flood forecast have made flooding impacts to be more harmful due to a number of factors such as flood data collection processes, flood warning channels and inappropriate technology adaptation.

4.0: RESEARCH FINDINGS

i It was revealed that property protection (21.03%) was the most perceived flood risky behaviour among respondents followed by evacuation behaviour (17.36%) and then rescuing others (16.57%).
ii The study exposed the fact that construction of embarkment (23.68%) was the most adopted method by respondents in pre-flood preparation.
iii It was also uncovered that spread of diseases (18.42%) was the most reported perceived flood hazard in the study area.
iv The study unraveled the fact that construction of floodways (21.84%) closely followed by production of flood sensitivity maps (21.31%) were the most perceived flood management strategies.
v Flood warning and river forecast methods were the prevailing perceived flood warning systems in the study area.

5.0: SUMMARY AND CONCLUTION

Human behaviours during flood events are complex and multifaceted as it influences human beings' attitude and disposition to extreme weather events. This paper provided insight on respondents' behaviours that are related to flood hazards and flood risks management strategies in a city prone to flooding in recent times. The risky behaviours were examined and

the links to exposure was tracked using descriptive statistics. Pre-flood preparedness, types of flood hazards, flood management strategies and flood warning systems were examined. The findings of this study will help both public and private sectors to develop effective flood risk behaviours and communication strategies for effective and improved public awareness creation, emergency response and preparedness in the event of flooding in Lokoja towns. Future work will focus on how the public flood related behaviours will change over time for positive flood risk management. It's important to note that while these behaviours can help reduce the impact of flood, they should be complimented with broader efforts to address climate change and its influence on extreme weather events.

5.1: RECOMMENDATIONS

i Technologically based property protection methods be adopted by the settlers of the flood plains or they relocate to safer zones.
ii Proper design and construction of flood infrastructure such as drainage systems and bridges should be intensified to manage flood water.
iii In the event of flooding, emergency health workers must be on ground with appropriate training and medications to avert spread of diseases among the inhabitants.
iv Raising awareness about flood risks, promoting preparedness, and educating communities on proper response measures can help individuals make informed decisions.

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