International Journal of Environmental Chemistry and Ecotoxicology Research
Vol.3, No.1, pp.1-13, September 2020
ISSN: Print: 2399-3464, Online: 2399-3472
Published by European Centre for Research Training and Development UK (www.eajournals.org)

FLOODING AND ITS PUBLIC HEALTH IMPLICATIONS ON RESIDENTS OF CALABAR SOUTH, CROSS RIVER STATE, NIGERIA

Simon Alain Inah [1], Esther Patrick Okpa [1], Elizabeth Libuo-Beshel Nji [1], Darlington Egbe Egbonyi [2], Fredrick Elemi Mboto [3]

[1] Department of Public Health, University of Calabar, Calabar
[2] Department of Environmental Resource Management, University of Calabar, Calabar
[3] Department of Environmental Health, College of Health Technology, Calabar

ABSTRACT: *Flooding and its consequent implications on the inhabitants of Calabar South Local Government Area is a serious public health issue. Flood is a natural event; an overflowing of a large amount of water beyond its normal limit. Flooding is the most common serious physical urban problem which results from high river levels, limited capacity of drainage systems and blockage of water ways and channels all over the world. Flood is known to cause great damage to people's lives, belongings and properties. The specific objectives of this study were; to determine the knowledge of respondents on the effect of flooding, perceived factors influencing flooding, and respondents' perception on the health implications of flooding and to identify the coping strategies among victims. A multistage sampling technique was used in the selection the respondents. The instruments used for this study were questionnaire and observational checklist which was administered to 400 respondents. Results from the study indicate that the factors responsible for flood occurrence in the study area was linked to poor road design (36.5%), improper waste disposal (26.5%) and poor drainage channels (21.5%). Majority of the respondents (86.5%) indicated that flooding causes high risk of malaria due to stagnant water. Over seventy percent of respondents (70.5%) agreed that flooding causes diseases. Less than fifty percent (40.5%) of respondents are exposed to chemicals and contaminants in water. More than forty percent (40.5%) of respondents relocated as a coping strategy. From direct observations it was noted that (63.5%) of respondents surroundings had no drainage system and (57%) was unsanitary. Based on these findings, it is concluded that there is flooding and severe public health implications among residents of Calabar South Local Government Area. It is recommended that since Calabar is located in a tropical zone characterized by heavy rainfall, all road constructions should be provided with adequate drainage systems, to avoid constant flooding especially during the rainy season and resident in the area should avoid the habit of indiscriminate waste disposal.*

KEYWORDS: Flooding, Health implication, Drainage, Calabar South

INTRODUCTION

Calabar metropolis has been experiencing yearly severe flooding and landslides within and around the metropolis with substantial costs, in terms of loss of lives and destruction of properties caused

by rainfall. Rainfall is a climate parameter that affects the way and manner man lives. It affects every facet of the ecological system, flora and fauna inclusive. Hence, the study of flooding is important and cannot be over emphasized (Obot, Chendo, Udo & Ewona, 2010; Osang. Ewona & Obi, 2013). Combination of high temperatures due to global warming and high humidity of the humid tropical climate are responsible for recurring flood in Calabar, the capital of Cross River State (Udo, Ani & Oduro-Afriye, 2002; Osang et al, 2013).Floods are environmental hazards of meteorological phenomena, but very often induced by man's improper utilization or abuse of the physical environment. Flooding can be defined as an overflow that comes from a river or other body of water and causes or threatens damage, (Adebayo & Jegede, 2010). Floods are among the most dramatic forms of interaction between man and his environment. They occur both in the developed or developing world and are always associated with heavy loses of lives and properties, misery, hardship, diseases, and at times, famine (Ebuzoeme, 2015). Abam (2006) defined flood as large volume of water which arrives at and occupy the stream channel and its flood plain in a time too short to prevent damage to economic activities, including homes.

Apart from traffic congestion, flood is the most common serious physical urban problem in most Nigerian cities, this usually result from high river levels, concentration of overland flows following heavy rainfall, limited capacity of drainage systems and blockage of water ways and drainage channels. (Olajuyigbe, Oorotowa and Durojaye, 2012).

All over the world, flood is known to cause great damage to people's lives, belongings and properties. Flood causes one-third of deaths, one-third of all injuries and one-third of all damage from natural disasters (Etuonovbe, 2011). Fewtrell and Kay (2006) further stated that injuries to human beings have also been recorded as health problem associated with flood in the gutters and potholes are covered during flooding thus causing impaired movement for people. This damage is normally felt by various "receptors" being people, buildings, infrastructure, agriculture, and open recreational spaces. Even social and emotional costs from flooding are significant and are often widespread and indiscriminate in flooded areas. They include displacement from homes, loss of personal valuables, fear and insecurity caused by such experience. The economy can be serially affected by flooding as businesses may lose patronage, stock, data and productivity. Tourism, farming and livestock can equally be affected. Utilities and transport infrastructure can be rendered inefficient by flood. Portable water supplies may be contaminated in a flood which has immediate health effects upon human beings and animals. Other vital infrastructures may also be damaged just like the loss of electricity experienced in Britain in 2007 summer floods (Royal Institute of British Architects, 2009).

Flood as a natural disaster has been described as a phenomenon which is a part of earth's bio-physical processes, which can be devastating due to anthropogenic activities and climatologically factors (Adetoro and Akanni, 2018). The European Union's flood directive defines a "flood" as the temporary ring by water of land not normally covered by water. A flood event may occur due to large stream flow magnitudes such that the flow rate exceeds the capacity of the main channel at a location (i.e., the flow exceeds the bank full discharge) or may occur for lowerstream flow rate when the flow happens (McGraw-Hill, 2017).

The area is also characterized by overcrowding and poor sanitation resulting from high level of refuse generation, indiscriminate dumping of refuse, open defecation, bushy surroundings, blocked gutters, potholes creating stagnant pools of water for mosquito breeding and odour nuisance (Inah, Uwadiegwu, Eko, & Inah, 2017). The management of waste is an unending problem in developed and low income countries and it is an increasingly serious issue in respect of flood risk management for obvious reasons. The poor disposal of waste frequently leads to blockages in drainage and watercourses; this effectively reduces their capacity of storage and conveyance and leads to flooding. During a flood, waste and other debris collected by flood waters can cause increased damage to properties and lead to higher flood losses. As a result of the flood the deposition of waste in drainage can block access of running water and be a source of toxins and breeding cites for disease vectors (Lamond, Bhattacharya & Bloch, 2012). Within the cities, human activities such as rapid industrialization and urbanization, population growth, exploitation of natural resources and location of infrastructures exacerbate occurrence of floods. Although flood is a natural occurrence, it often leads to disasters as a result of human-created vulnerability, which is a consequence of human-environment interactions (Ndoma, 2015).

Aim of the study

The specific objectives of this study were to determine the knowledge of respondents on the effect of flooding in Calabar South Local Government Area; determine the perceived factors influencing flooding in the study area; determine respondents perception on the health implications of flooding in the study area and, to identify the coping strategies among victims of flooding in the study area.

METHODOLOGY

Study setting

The study setting was Calabar South Local Government Area, Cross River State Nigeria. Its headquarters is located at Anantigha. It has an area of 264km^2 and a population of 191,630 as at the 2006 census; it was created from the former Calabar Municipality Local Government and has twelve wards. The Local Government is headed by a local chairman as chief executive with 12 councilors representing each of the 12 political wards.

The Efik and Efut are the indigenes in Calabar South. It is a Christian town with few religions. It has numerous public and private owned schools, standard hostel and resorts, a cultural center, churches, mosques, relaxation centers and several health centers and private clinics. Majority of the people are public servants in government establishment while some are business men and women.

Study design

A cross-sectional descriptive study design was used for this study with a quantitative approach; this involved the administration of structured questionnaires and the use of observational checklist on affected household of respondents.

METHODS OF DATA COLLECTION

A multistage sampling technique was used in selecting the wards, streets and households. The use of structured questionnaire aided in the collection of data from respondents. The questionnaire captured information on the social-demographic characteristics of respondents, knowledge, health implications, coping strategy and factors affecting flooding. The 420 questionnaires administered were retrieved with the help of three trained research assistants. Each completed questionnaire was checked manually on hard copy to ensure that there was no missing information. Data entry and analysis was done using Statistical Package for Social Sciences (SPSS). The result was expressed in percentages and presented in tables and charts.

Ethical Consideration

A letter of introduction was obtained from the Department of Public Health Ethics Committee, University of Calabar. This was used to seek and obtain ethical clearance from the Local Government Council, Calabar South. Thereafter, a verbal consent was obtained from the respondents, after assuring them of anonymity, confidentiality and importance of the study.

RESULTS AND DISCUSSIONS

Socio-demographic characteristic of respondents

A total of 420 copies of the questionnaires were distributed and only 400 questionnaires were correctly filled and returned giving a response rate of 95.2%. As shown in table 1, the dominant age of respondents was 30-39 years with 126(35.5%) followed by those aged between 40-49years 96(24.0%), 85(21.3%) were between 18-29 years, 57(14.3%) were aged between 50-59 and 36(9.0%) were between 60 years and above. Most of the respondents, 390(97.5%) were Christians while 10(2.5%) were Muslim. Majority of the respondent 234(58.4%) were married, 119(29.8%) were single, 24(6%) were widowed while 23(5.8%) were divorced.

Most of the respondents, 168(42.0%) had attended Secondary School, 145(36.3%) had tertiary education, 21(5.3%) had primary education and 66(16.5%) had no formal education. A greater proportion of the respondents, 110(27.6%) were civil servants, 84(21.1%) were traders, 67(16.8%) were farmers, 29(7.3%) were fishers, while 108(27.1%) were students/other occupation not mentioned. Most of the respondents, 184(46%) speaks Efik, 98(24.5%) speaks Ibibio 94(23.5%) speaks Ejagham, while 24(6.0%) speak other languages (Table 1).

Table 1: Socio-Demographic characteristic of respondents (n= 400)

Variable	Frequency	Percentages (%)
Age in years		
18-29 years	85	21.25
30-39 years	126	31.50
40-49years	96	24.00
50-59years	57	14.25
60 years & above	36	9.00
Total	**400**	**100**
Marital status		
Single	119	29.8
Married	234	58.4
Widowed	24	6.0
Divorced	23	5.8
Total	**400**	**100**
Education status		
Primary	21	5.3
Secondary	168	42.0
Tertiary	145	36.3
No formal education	66	16.5
Total	**400**	**100**
Occupation		
Farming	67	16.8
Traders	84	21.1
Fishing	29	7.3
Civil servants	110	27.6
Other occupations	108	27.1
Total	**400**	**100**
Religion		
Christian	390	97.5
Islam	10	2.5
Traditional religion	-	-
Total	**400**	**100**
Ethnic group		
Ejagham	94	23.5
Efik	184	46
Ibibio	98	24.5
Other ethnic groups	24	6.0
Total	**400**	**100**

Knowledge of respondents on the effect of flooding

Most respondents, 360(90%) agreed on the seasoning rate of flooding in Calabar South Local government Area, 40(10%) disagreed. A greater proportion of respondents, 362(90.5%) agreed on frequent flooding in Calabar South local government, 38(9.5%) disagreed. Most respondents on opinion whether flooding causes pollution, 292(73%) agreed while 108 (27%) disagreed. Majority of the respondents 312(78%) agreed that flooding causes soil infertility through erosion, while 88 (22%) disagreed. A greater number of respondents were of the view that lack of good drainage in calabar South causes flooding, 218(54%), while 184 (45%) disagreed (Table 2).

Perceived factors responsible for flooding in Calabar South LGA

On factors responsible for flooding in Calabar South, 146(36.5%) of respondents indicated that poor road design is a contributing factor to flooding, 106 (26.5%) agreed on improper waste disposal, 86(21.5%) accepted poor drainage design while 62(15.5%) accepted deforestation. Most of the respondents, 124(31%) said that flooding causes them to loss customer, 44(11%) said they loss passengers, 146(36.5%) said that flooding hinders them from moving across the flooded area, 86(21.5%) stated that flooding causes less monetary income for their business. Most of the respondents, 152(38%) agreed that moving around through flooding area usually delay their day activities, 142(35.5%) said it prevent their shopping or conducting business, 84(21%) said it prevents them from getting to work on time. 22(5.5%) said it causes motor vehicle malfunction (Table 3).

Table 2: Knowledge of respondents on the effect of flooding (n=400)

Variables	Frequency	Percentages
Seasonal rate of flooding in Calabar South LGA		
Yes	360	90.0
No	40	10.0
Total	**400**	**100**
Frequent flooding in Calabar South LGA		
Yes	362	90.5
No	38	9.5
Total	**400**	**100**
Flooding causes pollution soil and water		
Yes	292	73.0
No	108	27.0
Total	**400**	**100**
Flooding causes soil infertility through erosion of rich top soil		
Yes	312	78.0
No	88	22.0
Total	**400**	**100**

Table 3: Perceived factors responsible for flooding in Calabar South LGA (n=400)

Variables	Frequency	Percentages
Factor contributing to flooding		
Deforestation	62	15.5
Poor drainage design	86	21.5
Poor road design	146	36.5
Improper waste disposal	106	26.5
Total	**400**	**100**
How does flooding acts as hindrance to you		
Loss of customers	124	31.0
Loss of passenger	44	11
Hinder from movement across flooded area	146	36.5
Less monetary income for your business	86	25.5
Total	**400**	**100**
Moving around through flooded area causes		
Delay day's activities	152	38.0
Prevent shopping or conducting business	142	35.5
Prevent getting to work on time	84	21.0
Causes motor vehicle malfunction	22	5.5
Total	**400**	**100**

Health Implications of flooding among residents and housing in Calabar South

Results on table 4 shows the health implications of flooding among residents and housing in Calabar South that most respondents indicated that flooding causes diseases, 282(70.5%) agreed, while118 (29.5%) disagreed.100% respondents agreed that flooding destroy human life, animal life and properties. Most of the respondents, 346(86.5%) agreed, while 54(13.5%) disagreed on flooding as the cause of high risk of malaria due to stagnant water. On the physical health effects experienced during or after flooding, 162(40.5%) said they experience exposure to chemical and contaminants in flood waters, 102(25.5%) experienced cold, flu, sore throat or throat infections, 52(13.0%) experienced headaches, 42(10.5%) said they experienced shock, while 42(10.5) experienced skin irritation. Most of the respondents, 380 (95.0%) agreed to be victims of flooding while 20(5.0%) disagreed. On coping strategies during flooding, 182(45.5%) said they relocate, 82(20.5%) indicated that they receive help from church, 72(18.0%) receive help from friends or relation, while 64(16.0%) indicated that they borrow money from bank or neighbours (Table 4)

Table 4: Health Implications of flooding among residents in Calabar South (n=400)

Variables	Frequency	Percentages
Flooding causes water borne diseases		
Yes	282	70.5
No	118	29.5
Total	400	100
Flooding destroy human life, animal life and properties		
Yes	400	100.0%
No	0	0.0
Total	400	100
Flooding causes high risk of malaria due to stagnant water		
Yes	346	86.5
No	54	13.5
Total	400	100
Physical health effects experience during or immediately affect after the flooding		
Shock	42	10.5
Cold, coughs and throat infection	102	25.5

Headaches	52	13.0
Expose to chemicals and contaminants in flood waters	162	40.5
Skin irritation	42	10.5
Total	400	100
Have you being a victim of flooding		
Yes	380	95.0
No	20	5.0
Total	400	100

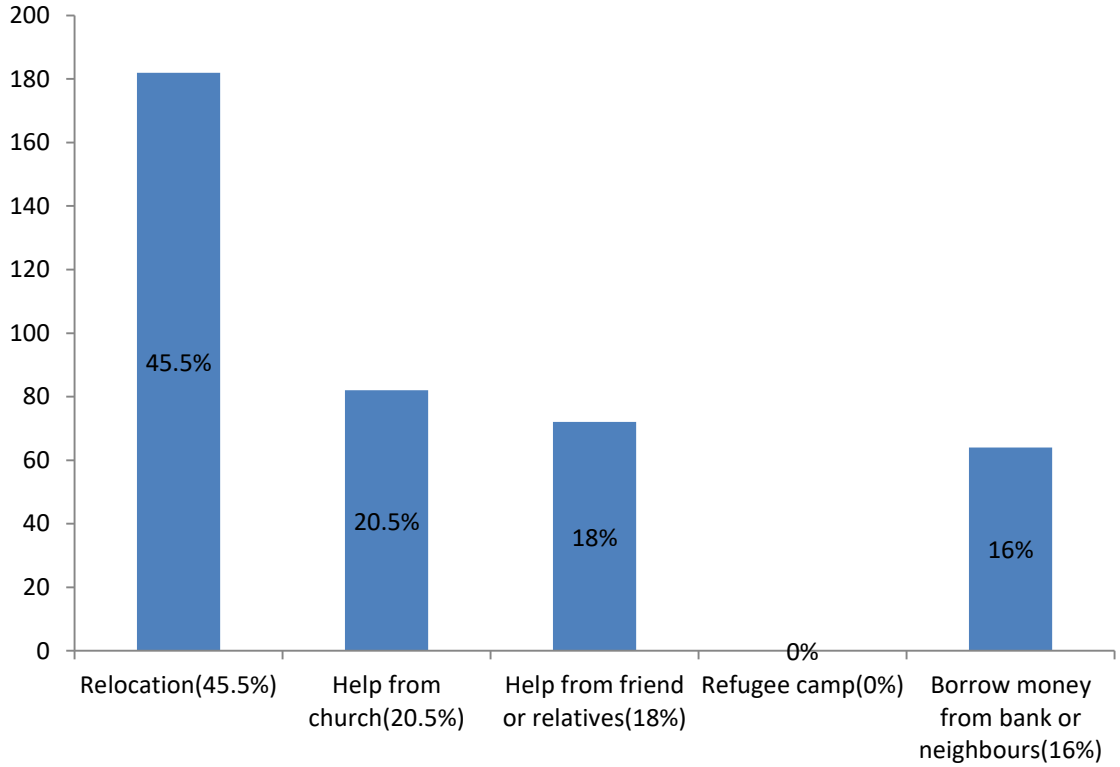

FIG. 1: Coping strategies during and after flooding

Observational checklist of flood affected areas in Calabar South LGA

It was observed that 228(57.0%) of respondents lived in mud houses plaster with cement, 126(31.5%) lived in block houses, 32(8.0%) in mud houses while 14(3.5%) lived in wooden-made houses. It was observed that 156(39.0%) of respondents' surrounding was swampy while 244(61.0%) was plain. It was also observed that 146(36.5%) had drainage system present while 254(63.5%) do not have, 172(43.0%) were sanitary while 228(57.0%) were unsanitary. It was observed that 172(68.0%) had refuse dump available while 128(32.0%) do not have. Most respondents' surrounding 240(60.0%) had stagnant water, while 160(40.0%) do not have (Table 5).

Table 5: Observational checklist of flood affected area in Calabar South LGA (n=400)

Variables	Frequency	Percentages
Type of housing		
Mud	32	8.0
Mud plaster with cement	228	57.0
Block	126	31.5
Wooden-made	14	3.5
Total	**400**	**100**
Topography of the area		
Swamp	156	39.0
Plain	244	61.0
Total	**400**	**100**
Presence of drainage system		
Available	146	36.5
Not available	254	63.5
Total	**400**	**100**
Sanitary condition of the drainage system		
Sanitary	172	43.0
Unsanitary	228	57.0

Total	**400**	**100**
Refuse dump		
Available	272	68.0
Unavailable	128	32.0
Total	**400**	**100**
Present of stagnant water		
Present	240	60.0
Absent	160	40.0
Total	**400**	**100**

CONCLUSION

From the findings, it was concluded that there is flooding and public health implication among residents of Calabar South Local Government Area, Cross River State, Nigeria. Thus, it can be concluded that certain factors responsible for flooding in Calabar South LGA which include poor road design, improper waste disposal, poor drainage design and deforestation and the health implications of flooding among residents include water borne diseases, malaria, cold, skin irritation, headaches, etc. flooding also destroy human life, animal life and properties. The study also identified coping strategies during flooding to include relocation, help from church, help from friends or relation, relocation to refugee camps among others.

RECOMMENDATIONS

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

- All roads constructed in Calabar should be provided with adequate drainage to avoid constant flooding especially during the rainy season.
- Residents in Calabar South should avoid the habit of indiscriminate waste disposal and building on drainage channels.
- Building without plan approval in every part of Calabar should be unacceptable. In fact, all structures built on drainage way of right should be demolished to reduce the carnage caused by flood.
- The present drainage system should be cleared on a regular basis to allow free flow of water to prevent continuous floods especially that of CRUTECH staff quarters
- The state government of Cross River State should improve on the construction of drainage, because lack of good drainage can affect the road and the day to day activities of Calabar South Local Government.
- The governments should carry out massive awareness campaigns on the need for people to stop dumping waste in the drainage channels.

REFERENCES

[1] Abam, T.S.K., 2006. Development Policy Framework for Erosion and Flood Control in Nigeria. EARTHWATCH - Magazine for Environment and Development Experts in Nigeria, 5(1), 25-32.

[2] Adebayo,W.O. &Jegede,A.O. (2010)." The Environmental Impact of Flooding on Transportation Landuse in Benin City, Nigeria. African Research Review, 390-400.

[3] Adetoro, O., &Akanni, O. (2018). Flood Vulnerability Assessment in Ilaje, Ondo State, Nigeria. *Journal of Geography, Environment and Earth Science Internation, 16(1), 1-11.*

[4] Ebuzoeme, O.D., (2015), Evaluating the effects of flooding in six communities in Akwa Anambra State of Nigeria; department of Architecture; *Journal of Environment and Earth Science: ISSN 2224-3216 5*

[5] Etuonovbe, A.K., 2011. Devastating Effects of Flooding in Nigeria. FIG Working Week 2011

[6] Fewtrell, L & Kay, D (2006) flooding and health; A review of the literature urban flood management project report for the flood risk management. Consortium- University of Wales, Abevstwyth

[7] Lamond, J.N, Bhattacharya and Bloch, R., (2012), The role of solid waste management as a response to urban flood risk in developing countries: *WIT transitions on the environment; ISSN 1743-3541 159.*

[8] Obot N. I, Chendo,M. A S. O. Udo and I. O. Ewona (2010) Evaluation of Rainfall Trends in Nigeria for 30 Years (1978-2007*) International Journal of the Physical Sciences Vol. 5(14), PP 2217 – 22224 Nov. 2010*

[9] Ndoma, E. (2015) Effectiveness of drainage networks on flood in Calabar Metropolis, Nigeria.

[10] Olajuyigbe, A.E.; Rotowa, O.O. and Durojaye, E. (2012). An Assessment of Flood Hazard in Nigeria. The Case of Mile 12, Lagos. *Mediterranean Journal of Social Sciences. 3(2): 367-377.*

[11] Osang. J. E., Ewona, I.O, Obi E. O., UdoimukA, B, Kamgba F.A, (2013); Analyses of Radiation and Rainfall pattern in Kano State Northern Nigeria (1978-2007), *International Journal of Scientific & Engineering Research,4(9), September-2013 971ISSN 2229-5518*

[12] Udo S. O, O.E.Ani and K. Oduro-Afriye., (2002). Effect of Moisture and bulk density on soil temperature *Global Journal of pure and Applied Science vol. 8, No. 1 January 2002. 125-132*

[13] Inah, S. A., Uwadiegwu, Z., Eko, J. E., & Inah, J. A. (2017). Environmental Sanitation Practices on Malaria Control and Prevention in Abi Local Government Area, Cross River State, Nigeria. *Asian Journal of Medicine and Health, 6*(2), 1-12. doi: 10.9734/AJMAH/2017/34870.