

Environmental Attitude and Effect of Flooding on Households in Mavoko Peri-Urban Settlements of Nairobi Metropolis, Kenya

¹Omukaga O. Panyako, ²Jacob W. Wakhungu, ³Felix Ngunzo Kioli

^{1,2,3}Department of emergency Management and humanitarian Assistance Masinde Muliro University of Science and Technology, Kenya

Abstract: The increasing peri-urban settlement activities have escalated flooding incidents affecting an increasing number of households in these environments. To assess the relationship between the homeowners' environmental attitude and the effect of flooding on households in Mavoko, this study targeted heads of household; the general public; officials of government and quasi-government institutions. It also solicited views of professional and residents associations responsible for environment and settlement; leaders of religious and community organisations and societies responsible for emergency response and humanitarian support in Machakos and Nairobi Counties. Taking a survey design and using multistage random, purposive and quota sampling techniques, the study collected quantitative and qualitative data using questionnaire, interview guide, document analysis, focus group discussions and observation. Data were analysed through Nomothetic evaluation plus Descriptive, Chi-square and Cramer's V analyses, which revealed that there was a significant relationship between the homeowners' environmental attitude and the effect of flooding on households.

Keywords: Effect of floods, Environmental attitude, Peri-urban flooding, Peri-urban settlements.

1. INTRODUCTION

Nairobi, a rapidly developing capital city of Kenya in East Africa, expanded its city boundaries in 2006 to become a larger metropolis to include the three counties of Kajiado, Kiambu and Machakos, where Mavoko is one such upcoming peri-urban settlement (GoK, 2008). Large populations acquire land and settle in the peripheral settlements, but still feel they are within the city (Douglas et al., 2008). These areas experience rapid demographic and socio-economic transformation accompanied with environmental challenges related to the emergence of urban activities in rural areas (Eakin, Lerner & Murtinho, 2010; UN-HABITAT, 2006). As the urban areas grow in size and peri-urban settlement activities increase, there is an observed increase in flood events in such environments world over (*Action Aid*, 2006; UNISDR, 2005).

The 21st century has witnessed more flood damage in urban and peri-urban environments as reported in Bangkok, Thailand (2011); Brisbane, Australia (2011); Guangdong, China (2007); New Orleans, USA (2005); Dresden, Germany (2002); and Taipei, Taiwan (2001). The floods are observed to have hit developed and developing nations alike; and African cities have also experienced an increase in flooding (*Action Aid*, 2006; Douglas et al., 2008; Jha et al., 2011). Like Accra in Ghana, Kano in Nigeria, Kampala in Uganda and Maputo in Mozambique, Nairobi witnesses perennial flooding incidences (Tucci, 2007; ILGS and IWMI, 2012). Each rainy season, Mavoko and the larger Nairobi Metropolis experiences rain-fed flooding, the worst having been the El Niño rains in 2009 (*Amnesty International*, 2009).

While damage from urban flooding continues to increase, the traditional engineering approaches in the management of flooding in such towns are observed to have lost effectiveness (Eakin et al., 2010; Stern, 2007). It is on this basis that this study considers anthropogenic factors like human settlement from the environmental concern perspective and views flooding and its impact in peri-urban settlements as a social challenge whose mitigation requires psycho-social approach.

2. LITERATURE REVIEW

Over the last ten years, the number of flood events recorded in African cities and towns is higher than the rest of the world with the immediate impact being loss of human life and deterioration of health conditions (Werritty *et al.*, 2007). Infrastructure like clean water supply, communication systems, sanitation facilities, electricity, education and health care are disrupted; as people are uprooted from their homes (Dawson *et al.*, 2008). Loss of livelihoods and reduced purchasing power is most pronounced amongst residents of peri-urban and informal settlements who also suffered more deleterious effect of flooding due to the significant damage to private property, including homes and businesses (IFRC, 2002).

Jha *et al.*, (2011) reported that over 8,800 lives were lost between 1927 and 1995 due to flooding in urban environments in Algeria, Tunisia, Egypt and Morocco. They also report that urban flooding caused 1,148 deaths, rendered 500,000 people homeless and jobless, and destroyed 150,250 homes in Mozambique, Zimbabwe, South Africa, Zambia and Namibia between 2000 and 2009. The worst urban flood events on the continent have been recorded in Western Africa where in 1982, 1991, 1995, 1998, and 1999 flooding affected more than 500,000 people in each case (Amoako, 2012). In 2010 alone, GFDRR (2011) reported that over 1.7m people were affected by flooding with 52,000 cholera cases recorded in its wake. In eastern Africa, between 2002 and 2006, over 210 died and thousands were rendered homeless, with the most affected countries being Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda (Douglas *et al.*, 2008; UN Habitat, 2006). The cities and towns in Sahel region of central Africa, usually associated with desertification, have also had flooding with major flood events occurring in Mali (2002, 2003, 2007), Niger (2003, 2007, 2008), Chad (2001, 2007, 2008), and Sudan (2003, 2006, 2007) (Chukwuocha & Chukwuocha; 2013).

A review of some earlier studies reveals that the impact of flooding could also be understood from the environmental attitude perspective. For example, by demonstrating that people in rural areas were more resilient to flooding than their urban counterparts, Twigger-Ross (2005) attributed this tendency to an observation that rural populations were more pro-nature, with a higher sense of a community amongst them compared to those in urban areas.

In linking the social drivers of physical hazards to the social impacts therefrom, Evans *et al.*,(2004) found that social factors were the most important determinant of the impact of floods. Further, considering demographic variables, Walker *et al* (2005) reported that older people in Europe were more troubled by loss of sentimental items like photographs and an adulterated home than younger people. Thus, the effect of flooding and other natural disasters can be considered as an environmental attitude issue that can be understood from interplay between three types of environments that define the urban and peri-urban settlements namely: the anthropogenic environment, the social environment and the flood risk environment, as illustrated in Figure 1.

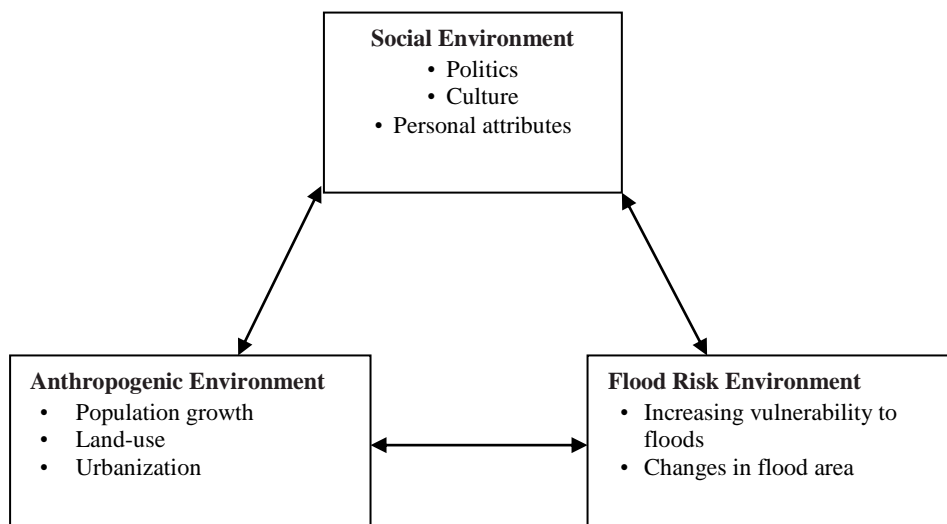


Figure 1: Interplay between human activities in the natural environment and the dynamics in the flood risk environment
(Source: Boshier *et al.*, 2009)

In the social environment, social factors like political power, cultural and personal attributes (like attitude) had an influence on some activities (like population growth, land-use, and urbanization) in the anthropogenic environment, which would determine the dynamics in the flood environment.

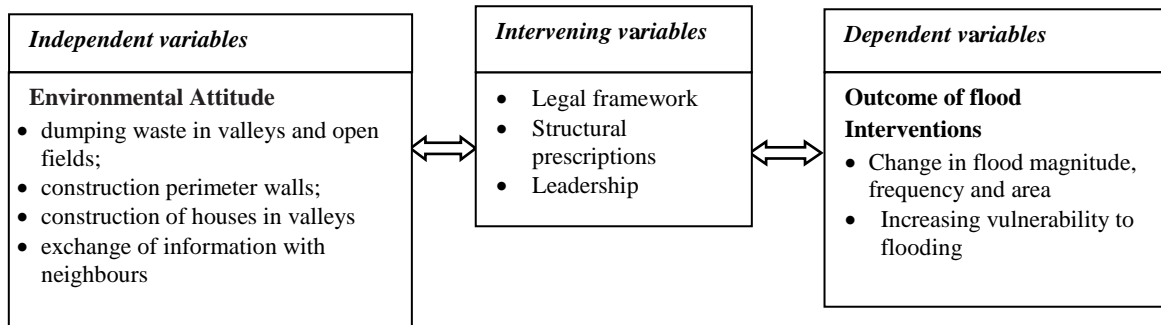


Figure 2: Conceptual framework model for the correlation between independent and dependent variables (Source: Researcher, 2015)

The study hypothesised that the personal attributes bring about unsustainable activities in the anthropogenic environment would exacerbate the flood risk; and increase the vulnerability of the populations to flooding for the households in Mavoko peri-urban settlements.

3. METHODOLOGY

3.1 Study Site:

The research was carried out in the geographical region defined as Mavoko settlement, which covers Mavoko constituency of Machakos County within Nairobi Metropolis. Mavoko settlement was identified for this study because it was considered as forming a special geographical space for academic and practical scrutiny for five reasons. First, the area is a transitional zone between the truly urban Nairobi city and a clearly rural area of Machakos County, hence experiencing rapid socio-economic transformation and environmental challenges related to the emergence of urban activities in rural areas (UN-HABITAT, 2006). Secondly, the study site poses new institutional challenges for socio-ecological planning and vulnerability assessment arising from the intertwined nature of the rural/urban characteristics; the residents' heavy dependence on and exploitation of the natural resources; and the residents' relationships to environmental changes (Eakin et al, 2010).

The third reason was that Mavoko settlement is an integral element of urban systems in spatial, temporal social, economic, functional and planning dimensions, because it and its environment are integral to the growth and operation of the growing Nairobi city (Simon, 2008). Fourth, being at the formative stages of development, the area is a place with the potential for positive change due to the livelihood diversification plus access to services and information that could shape the residents' environmental adaptation (Ricci, 2011). Lastly, the study site is reported to suffer disasters perennially. The area recently suffered mass demolitions of homesteads constructed on illegally acquired land with massive displacement of families; and there occurs flooding every rainy season. The increase in impervious surfaces in the larger Nairobi metropolis will affect local hydrological systems because the area is low lying with a relatively flat surface of poorly draining black cotton soils, exacerbating the residents' vulnerability, thus necessitating better mitigation measures.

3.2 Study Population and Sampling:

The study targeted heads of household; the general public; community and religious leaders; local government officials; leaders of quasi-government institutions, NGOs, CBOs, NEMA; and officials of the Association of architects and physical planners considered to be stakeholders in disaster management in Nairobi. It used the survey design to generate data for the purposes describing the demographic characteristics of the household heads in Mavoko; and to analyse the relationship between homeowners' environmental attitude and the onset of flooding.

It was not easy to determine the exact population size of Mavoko at the time of this study because of the fast growing population. Hence, to determine the number of participant household heads, the study employed John Eng (2003)'s formula for calculating representative multistage random sample size of unknown population size as follows.

$$n = \frac{4z_{\alpha/2}^2 p(1-p)}{d^2}$$

Where:

n = the sample size

- z = the standard normal deviate relating to the 95% degree of confidence set at 1.96
- p = an estimate of the proportion of people falling into the group in which we are interested in the population
- d = the proportion of error we are prepared to accept

In this study p = 0.5. (Choosing 50% provided the most conservative estimate of the random sample size). The confidence interval of 95% was estimated to be within 10% of the true value. The multistage random sample size was then given by:

$$n = \frac{4 * 1.96^2 * 0.5(1 - 0.5)}{0.1^2}$$

$$n = 384.16$$

$$n \cong 385$$

This formula gives a number that is an estimate of the absolute minimum, making it necessary to have more respondents to compensate for loss during follow-up or other causes of attrition. John Eng (2003) and Botsch (2011) recommends an addition of 10% of sample size to compensate for persons that the researcher is unable to contact; and further 30% to compensate for non-response. Thus, the sample size for this study was 600 distributed across all county wards in proportion to their population density as illustrated in Table 1.

Table 1: Sample size distribution in Mavoko, Nairobi, Kenya

County Ward	Pop. Density (No. of people/Km ²)	No. of respondents per sub-location	Totals
Athi River	659	Athi River North	101
		Athi River Township	101
Kinanie	43	Kinanie	7
		Muthatani	7
Muthwani	90	Muthwani	10
		Katani	10
		Ngelani	10
Syokimau/ Mulolongo	1130	Syokimau	177
		Mulolongo	177
TOTAL			600

The sampling of the households who participated in this study was done using the multistage random sampling methods in three stages. First, the study used the lottery technique where the settlements were divided into nine (9) administrative sub-locations in the four county wards as shown in Table 1. In the second phase of sampling, the lottery technique was used to sub-divide the sub-location into small clusters. The urbane sub-locations of Athi River North and Athi River Township in Athi River ward; and Syokimau and Mulolongo in Syokimau/ Mulolongo ward with high population density were clustered into courts. The rural-like sub-locations of Kinanie and Mathatani of Kinanie ward; and Muthwani, Katani and Ngalani of Muthwani ward were clustered based on villages. A list of all the clusters (courts and villages) was drawn with the help of the local leaders. The names and/or identification numbers of all the clusters were written on pieces of paper; and the desired clusters were randomly selected by picking the required number of papers.

From the area, the study identified 34 courts each from Athi River North and Athi River Township Sub-locations; 54 courts each from Syokimau and Mulolongo sub-locations; and three villages each from the five sub-locations in Kinanie and Muthwani county wards. The lottery technique was then used to select three (3) households chosen from each of the identified courts and villages. In order to take a random sample, a sample frame in the form of lists of all the household heads in each of the courts and/or villages were drawn with the help of local leaders who acted like gate-keepers. The names and/or identification numbers of all household heads were written on pieces of papers; whereupon the desired sample was selected by picking the required number of papers.

This approach was guided by Broer and Titherdge (2010), who used the sampling strategy to reach the dispersed eco-self-built community projects in the UK to evaluate whether Eco-Self-Built Communities lead to feasible, sustainable and low carbon lifestyles. Similarly, in her study, ‘public understanding of and response to climate change in the South of England’, Whitmarsh (2005) used this strategy to cover different socio-economic groups within flood-prone and non-flood-prone areas; and different groups within areas with differing levels of exposure to air pollution.

The sample sizes and sampling techniques of other units of measurement and observation in the study population were as shown in Table 2.

Table 2: Study population units, sampling method and sample size in Mavoko, Nairobi, Kenya

Study population unit	Sampling method	Size (N)
Household in Mavoko	Multistage random, Cluster, Lottery	600
General Public in Mavoko	Lottery	8
Ministry of lands officials	Purposive	1
Mavoko Sub-County officials	Purposive	1
Red Cross Officials in Mavoko	Purposive	1
NEMA officials	Purposive	1
Residents Association officials	Purposive	2
Religious leaders	Purposive	2
Professional body of physical planners	Purposive	2
Meteorological department	Saturated	2
Focus Group Discussion	Quota	10 per FGD
Document analysis	Saturated	10
Observation checklist	Saturated	10

This study used non-probability sampling methods to identify interviewees and participants in the FGDs. Purposive sampling was used to select officers of government who head disaster response units as well as managers of quasi-government institutions, non-governmental organizations and community leaders that were to participate in the study.

3.3 Data Collection:

The study used a methodology that embraces both quantitative and qualitative approaches to collect primary and secondary data. The secondary data collection and review preceded the collection of primary data. A review of existing documents provided background information about, and more insights into, the phenomenon of flooding in urban and peri-urban areas (Mogalakwe, 2006). The search for and collection of secondary information was conducted through exploring official and non-official resources. Official sources included publications and policy documents of the KNBS, UN-HABITAT, IFRC and the meteorological department among others.

In order to do an exhaustive document analysis, the study first identified the types of documents available and relevant to the study area, before securing authority for their access. Guided by the *Evaluation Review* (2009), the researcher compiled the relevant documents with respect to the objectives of the study and talked to the custodians before checking the accuracy of the documents by comparing those that contain similar information. The information from documents reviewed was then summarised, indicating the type of document reviewed, the way to reference each document and information relating to specific objectives of the study.

Primary data were collected through questionnaire, key informant interviews, focus group discussions and direct observations. The questionnaires were designed to be completed by respondents with minimal or no assistance from the researcher. A total of 600 questionnaires were hand delivered to the sampled households. The respondents were left with the questionnaires to fill in information including whether the respondent had experienced flooding during their stay at Mavoko; how severely flooding had affected the different aspects of life for households and the different segments of the human population; and about the tendency of the respondent to engage in activities considered negative to the environment for collection after three to seven days. A total of 463 (77.16%) of the questionnaires were returned, which upon scrutinising, 55 questionnaires were discarded because they had not filled in properly.

Key informant interview guides were used to elicit information from officers of government and quasi-government institutions; as well as community and religious leaders to answer the ‘how’ and ‘why’ questions for the study to explore differences, inconsistencies and meanings through conversations (Durand, 2009). The interviews provided expert and community opinions about vulnerability of peri-urban settlement communities to flood disasters and the causality factors;

effects of flooding on the population; and the mitigation measures. It also gave an in-depth understanding of the intervention measures to enhance the community's response to flooding as informed by professional discourses. Appointment letters and interview guides for face-to-face interviews were hand-delivered to twenty (20) key informants in Mavoko. The proceedings were audio-recorded and written responses from the interviewees in form of handouts obtained.

FGDs were used to obtaining in-depth descriptive data on beliefs, perceptions and practices pertaining to the occurrence of, and response to, flooding in Mavoko. The researcher convened two (2) FGD sessions of ten (10) participants composed of two (2) homeowners who participated in the household survey, (two) 2 representative from the church, two (2) elders, two (2) business people, one (1) youth and one (1) woman from within Mavoko in order to explore some of the issues related flooding in the community. One FGD focused on the urbane area of Athi River Syokimau/Mulolongo County ward, while the other focused on the rural-like areas of Kinanie and Muthwani County wards. The FGD guide enabled participants to give information on how homeowners' environmental attitude contributes to the onset of flooding.

The direct observation checklist enabled the researcher to make observations to enrich his understanding of the homeowners' environmental tendencies with respect to the objectives of the study. The observation included noting and recording of events, behaviours and activities related to how community members relate to and care for the environment. It also focused on the extent of flooding and household participation in flood disaster interventions so as to get an in-depth understanding of the local practices.

3.4 Data Analysis:

The data collected were in both qualitative and quantitative form and were analysed using descriptive statistics, Chi-square, Correlation analysis and Nomothetic evaluation. Qualitative data involved tape recorded and written responses to interviews, proceedings at the FGDs, field notes and summary of document content analysis. After reviewing the works of different qualitative research specialists, the researcher used the nomothetic evaluation method to analyse the data from the FGDs; and transcribed and analysed qualitative data from the other sources using the hierarchical coding procedure as illustrated by Whitmarsh (2005). The responses were ordered and grouped through cross-case analysis before it was transcribed and analysed using the constant comparative method to develop relationships and interrelationships from which themes and patterns about flood disaster interventions (Occhio, 2003). The issue of validity was addressed by asking a number of interviewees to comment on the analysis.

Quantitative data were mainly from closed ended questions in the questionnaires. To determine the association between the homeowners' environmental attitude and the onset of flooding, data were collected on the causes and incidences of flooding in the study area through questionnaires. The study used descriptive statistics to measure demographic characteristics before analysing the association through the application of the SPSS. Because the sample size was large (408), the statistically significant Chi-square was not conclusive about the relationship between the variables, hence the need to measure the association between the two variables (Horber, 2013).

Guided by the works of Garson (2012), the current study considered adopting Cramer's V to measure the correlation between the two variables, which were nominal and/or ordinal. This is because: i) It is based on the Chi - square and was easy to generalise across contingency tables of varying sizes; ii) It is not affected by sample size and was therefore very useful in eliminating errors where statistically significant X^2 could have been due to the large sample size instead of any substantive relationship between the variables; and iii) It is interpreted as a measure of the strength of an association between two variables. The coefficient ranges from 0 to 1 Characterised that: (> 0.5) High association; (0.3 to 0.5) Moderate association; (0.1 to 0.3) Low association; and (0 to 0.1) Little (if any) association.

4. RESULTS

4.1 Respondents' experience of flooding:

Regarding the respondents' experience of flooding during their stay at Mavoko, the responses obtained were processed and presented as shown in Figure 3 from which it was observed that 392 (96.0%) of the respondents indicated they had experienced flooding in Mavoko, while 16 (4.0%) of them had not. The small percentage of the respondents who indicated that they had not experienced flooding was noted to be almost similar to the 4.2% who indicated that they had lived in the area for less than one year. Thus, the study found that any person who had lived in Mavoko for more than a year had experienced flooding.

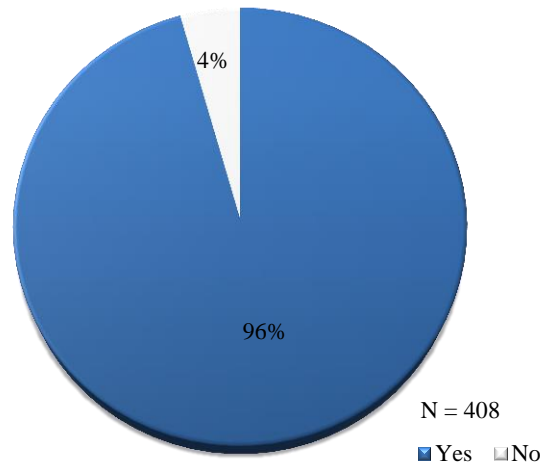


Figure 3: Participants who experienced flooding in Mavoko, Nairobi, Kenya

4.2 Effect of flooding on different aspects of life:

With regard to the effect of flooding on the different aspects of life, document analysis revealed that flooding affected: household access to livelihood opportunities; household access to clean drinking water; household access to safe sanitation and toilet facilities; and children’s access to school. When the respondents were asked to indicate how they rated the disruption level for each aspect during the latest flood incident in Mavoko, the responses obtained were processed and the results presented as shown in Figure 4, from which it was observed 325 (79.6%) of the respondents said that flooding ‘severely’ affected children’s access to school, while 319 (78.4%) of them indicated that flooding ‘severely’ affected their access to clean drinking water. It was also observed that 299 (73.3%) of the responded said flooding ‘severely’ affected their access to safe sanitation and toilet facilities; 237 (58.1%) indicated that it ‘severely’ affected their access to work and livelihood opportunities, while 222 (54.4%) of them said that flooding ‘severely’ indicated their access to recreation and entertainment.

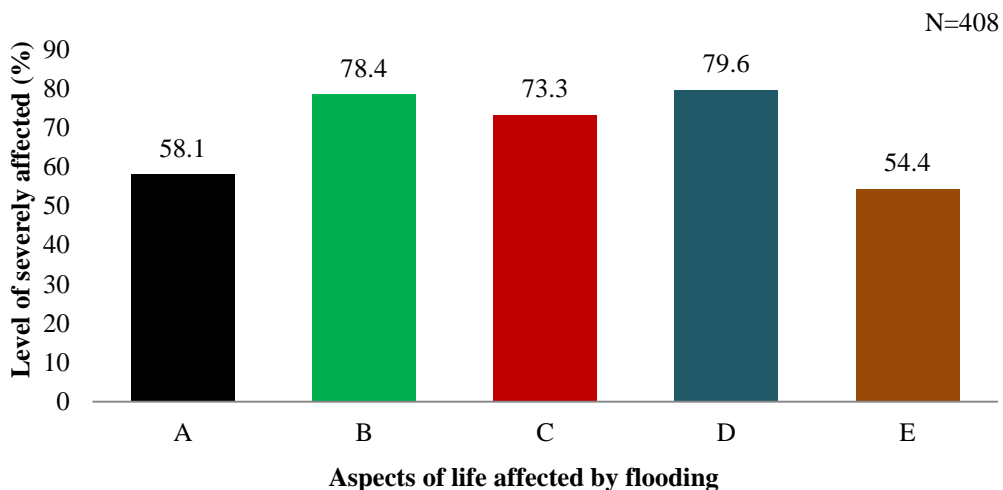


Figure 4: Effect of flooding on aspects of life in Mavoko, Nairobi, Kenya

KEY:

- A: Access to work and livelihood opportunities
- B: Access to clean drinking water supply
- C: Access to safe sanitation and toilet facilities
- D: Children’ access to school
- E: Access to recreation and entertainment

A Pearson Chi-square test was done to check on the effect of flooding on each aspects of life and the results summarised in Table 1.

Table 3: Pearson Chi-squares for the effect of flooding on different aspects of life in Mavoko, Nairobi, Kenya

Variables	Chi-squares for the effect of flooding
Access to work and livelihood opportunities	$\chi^2_{4,0.033} = 22.043^{**}$
Access to clean drinking water supply	$\chi^2_{4,0.01} = 35.961^*$
Access to safe sanitation and toilet facilities	$\chi^2_{4,0.01} = 209.774^*$
Children’s access to school	$\chi^2_{4,0.01} = 39.094^*$
Access to recreational/ entertainment facilities	$\chi^2_{4,0.01} = 32.524^*$

KEY: * = Highly significant at $p < 0.01$

** = Highly significant at $p < 0.05$

From the tabulation, it was observed that flooding had a significant effect ($p > 0.05$) on all the investigated aspects of life in Mavoko. The Chi-square test values ($\chi^2_{4,0.01} > 13.28$) revealed that flooding had a highly significant effect ($p < 0.01$) on the victim’s access to safe sanitation and toilet facilities; access to clean drinking water supply; and access to recreational/ entertainment facilities; as well as the children’s access to school. The Chi-square test values ($\chi^2_{4,0.01} > 9.488$) also revealed that flooding had a statistically significant effect ($p < 0.05$) on the victim’s access to work and livelihood opportunities.

4.3 Effect of flooding on the different segments of the human population:

About the effect of flooding on the different segments of the human population, document analysis revealed that flooding affected: Children below 12 years, the youth, women, men, the aged (70+) and the disabled. When the respondents were asked to indicate how they rated the disruption level for each segment of their community, the responses obtained were analysed and the results tabulated as shown in Figure 5.

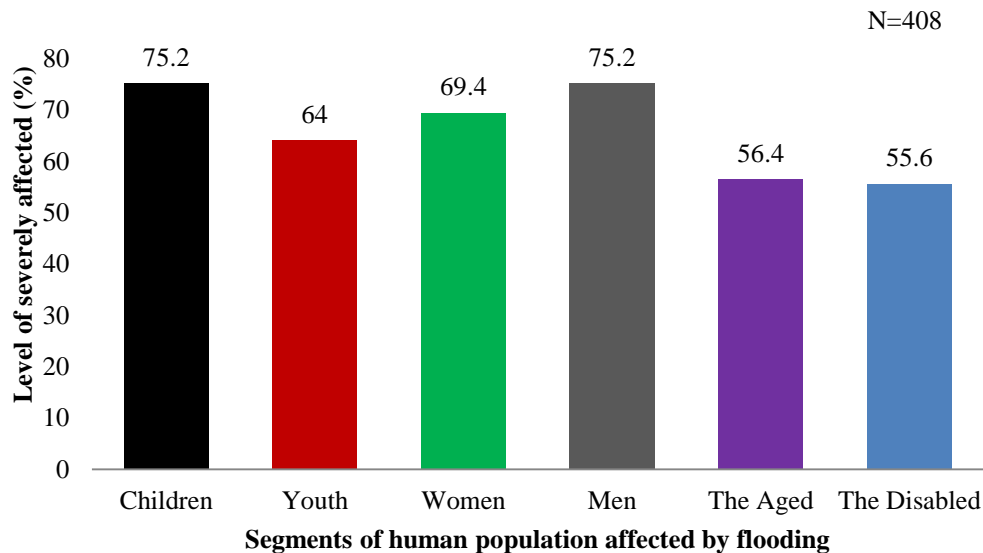


Figure 5: Effect of flooding on segments of human population in Mavoko, Nairobi, Kenya

From the bar graph, it was observed that 307 (75.2%) of the respondents said that flooding ‘severely’ affected children below the age of 12 years; another 307 (75.2%) said it ‘severely’ affected men; while 283 (69.4%) of them indicated that flooding ‘severely’ affected women. It was also observed that 261 (64.0%) of the respondents said that flooding ‘severely’ affected the youth; 230 (56.4%) said it ‘severely’ affected people aged over 70 years; while 226 (55.5%) of them indicated that flooding ‘severely’ affected the disabled.

A Pearson Chi-square test was done to check on the effect of flooding on members of each segment of the human population in Mavoko and the results summarised as shown in Table 2.

Table 4: Pearson Chi-square values for the effect of flooding on different segments of the Mavoko community, Nairobi, Kenya

Segment of human populatuon	Chi-squares for the effect of flooding
Children ≤ 12	$\chi^2_{2,0.037} = 46.653^{**}$
Youth	$\chi^2_{2,0.026} = 44.881^{**}$
Women	$\chi^2_{2,0.01} = 747.185^*$
Men	$\chi^2_{2,0.01} = 195.641^*$
The Aged (70+)	$\chi^2_{2,0.041} = 16.353^{**}$
The Disabled	$\chi^2_{2,0.01} = 13.632^*$

KEY: * = Highly significant at $p < 0.01$
 ** = Highly significant at $p < 0.05$

From the tabulation, it was observed that flooding had a significant effect ($p > 0.05$) on all segments of the human population in Mavoko as investigated. The Chi-square test values ($\chi^2_{2,0.01} > 9.210$) revealed that the occurrence of flooding had a highly significant effect ($p > 0.01$) on women, men and the disabled. The Chi-square test values ($\chi^2_{2,0.05} > 5.991$) revealed that the occurrence of flooding had also highly significant effect ($p > 0.05$) on children, the youth and the aged.

4.4 Factors that influence effect of flooding on households:

Regarding the environmental attitude, Panyako et al (2015) reported that the residents of Mavoko had a high affinity for tendencies considered negative towards the environment such as: blockage of drains and natural waterways; occupying wetlands/riparian areas; lack of exchange of information with neighbours; lack of concern for each others' welfare; and lethargy towards estate meetings. The respondents were asked how they rated each of the tendencies as contributory to the effect of flooding on households in Mavoko.

The responses were processed and summarised as shown in Figure 6, from which it was observed that 325 (79.6%) of the respondents indicated that construction and occupation of houses in wetlands/riparian areas contributed to the effect of flooding on households; while 322 (78.9%) of them said that blockage of drains and natural waterways contributed to the effect of flooding. It was also observed that 310 (76.0%) of the respondents indicated that lack of exchange of information with neighbours increased the effect of flooding on households; 296 (72.5%) indicated that their lack of concern for each others' welfare did; while 293 (71.9%) of them indicated that their lethargy towards estate meetings increased the effect of flooding.

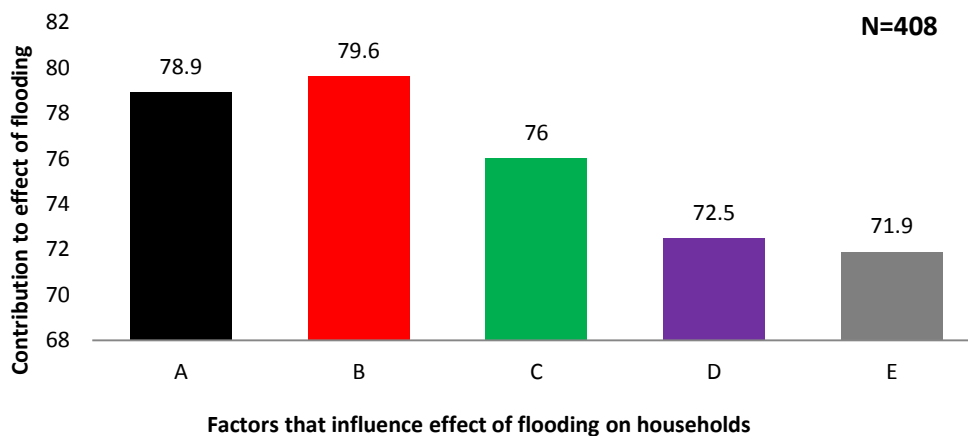


Figure 6: Factors that influence effect of flooding on households in Mavoko, Nairobi, Kenya

KEY:

- A: Tendency towards blockage of drains and natural waterways
- B: Tendency towards occupying wetlands/repairman areas
- C: Lethargy to exchange of information with neighbours
- D: Lack of concern for each others' welfare
- E: Lethargy to estate meetings

4.5 Environmental attitude and effect of flooding on different aspects of life in Mavoko:

A Cramer's V analysis was done to check on the correlation between the homeowners': tendency to block drains and natural waterways; tendency to occupy wetlands/riparian areas; lethargy towards exchange of information with neighbours; Lack of concern for each others' welfare; and lethargy towards estate meetings and the effect of flooding on the victims' access to work and livelihoods, access to clean drinking water, access to sanitation and toilet facilities, children's access to school, and access to recreational facilities. The results were tabulated as shown in Table 3 from which it was observed that environmental attitude was a strong determinant of the effect of flooding on the aspects of life in the studied area.

Table 5: Cross tabs of correlation (Cramer's V) between attitude factors and aspect of life affected by flooding in Mavoko, Nairobi, Kenya

Attitude factor \ Effect of flooding on	Tendency to block drains and natural waterways	Tendency to occupy wetlands/ riparian areas	Lethargy towards information exchange	Lack of concern for each other's' welfare	Lethargy towards estate meetings
Access to work and livelihoods	0.254	0.641	0.439	0.403	0.362
Access to clean drinking water	0.340	0.404	0.399	0.905	0.723
Access to sanitation and toilet facilities	0.353	0.406	0.241	0.297	0.420
Children's access to school	0.494	0.244	0.237	0.379	0.242
Recreational facilities	0.190	0.210	0.111	0.253	0.214

KEY: > 0.5 = High correlation; 0.3 to 0.5 = Moderate correlation
 0.1 to 0.3 = Low correlation; 0 to 0.1 = Little (if any) correlation
 (Garson, 2012)

4.5.1 Environmental attitude and effect of flooding on access to work and livelihoods:

The analysis revealed that there was a significant relationship between the environmental tendencies by respondents and the effect of flooding on their access to work and livelihood sources in Mavoko. The value (Cramer's V = 0.641) showed that there was a high correlation between the respondents' tendency to occupying wetlands/ riparian areas and the effect of flooding on their access to work and livelihood sources. The value (Cramer's V = 0.439) showed that there was a moderate correlation between the respondents' lethargy towards exchange of information and the effect of flooding on their access to work and livelihoods sources; as another value (Cramer's V = 0.403) revealed that there was also a moderate correlation between the respondents' lack of concern for each others' welfare and the effect of flooding on their access to work and livelihoods sources.

Similarly, the value (Cramer's V = 0.362) showed that there was a moderate correlation between the respondents' lethargy towards estate meetings and the effect of flooding on their access to work and livelihoods sources; while the value (Cramer's V = 0.254) showed that there was a low correlation between respondents' tendency to block drains and natural waterways and the effect of flooding on their access to work and livelihoods sources when floods occurred. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on their access to work and livelihoods sources. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on their access to work and livelihoods sources also increased.

Multiple data sources revealed that indeed there was a significant relationship between environmental attitude and the effect of flooding on the victim's access to work and livelihoods sources. Proceedings at FGDs and key informant interviews revealed that majority of the respondents were either employed or in self-employment working in different parts of Nairobi metropolis. They revealed that they had problems getting out of their houses when flooding occurred; and went to work late or failed to go to work as some people with personal cars seldom gave them a lift. Some businesses

such as motor bicycle operators and construction sites also failed to open when the area flooded. This led to low business returns for the self-employed; and formal warning from employers as expressed by one participant at a FGD in Syokimau:

“Movement is usually very difficult. People have to stay indoors and sometimes it is not possible to get to work ... I once got a warning and my pay deducted for failing to get to work after it rained heavily in Syokimau, but West lands (in Nairobi) was dry...”

Some self-employed respondents disclosed that it becomes increasingly difficult to do business whenever floods occurred. As one participant (a supplier of cooking gas) indicated that he is unable to service orders for his customers whenever floods render roads impassable, a situation that makes him lose out on business. Another business person added that:

“Personally, a customer made her order for a Christmas dress late, I could not do the work for about three a week when the area was flooded and I could not get materials....”

Some traders and shop owners participant in the FGDs reported that whenever floods occurred, flood waters enter their work stations and destroy their stocks and hampering their operation. As one shop operator in Athi River said he went to his shop one morning only to find his fridge and radio submerged in the flood waters and other items destroyed as well, another one lamented that:

“...the the floods at times wash away the makeshift barriers in front of my shop and water freely flows into the shop... one time I got all my stock of rice, sugar, soap, match boxes, cigarettes and tissue paper ruined. I could not salvage anything and I lost about Kshs. 20,000/=.”

An operator at the Athi River open market said that the market place becomes muddy and very few people go there to buy from them whereby making business owners lose interest in doing business as expressed by one participant at a FGD:

“... sometimes, the flood water carries away our wares away we make losses. There is also low patronage of our wares during such times... Do you expect me to invest more money in business when I don't know the next effect of the floods?”

A transporter and supplier of building materials expressed his experience that:

“--- we are unable to deliver stones since the road become impassable... Although floods do not destroy stones, getting them from the quarries and delivering them to our customers becomes a challenge. We lose lots of money during the flooding period because we have to spend the whole day either at home or trying to find alternative sources of income. At times we also find our rooms flooded and we have to find somewhere else to sleep which is burdensome to other people”

Secondary data from reviewed documents also revealed that when flooding occurs, it often damages public infrastructure making it difficult for the users to access their work and livelihood sources. For instance, whenever it rains in Accra, just like it happens in Nairobi, economic activities come to a standstill as businesses are halted and roads are rendered impassable in most cases (Karley, 2009). ILGS and IWMI (2012) also reported that when flooding occurs, most shops do not open and workers are unable to go to work because the under-developed roads become impassable, slowing down businesses and making the victims' lose livelihoods.

4.5.2 Environmental attitude and effect of flooding on access to clean drinking water:

The analysis revealed that there was a significant relationship between the environmental tendencies by the respondent and the effect of flooding on their access to clean drinking water in Mavoko. The value (Cramer's $V = 0.905$) showed that there was a high correlation between the respondents' lack of concern for each others' welfare and the effect of flooding on their access to clean drinking water; and a value (Cramer's $V = 0.723$) showed that there was also a high correlation between the respondents' lethargy towards estate meetings and the effect of flooding on their access to clean drinking water. The value (Cramer's $V = 0.404$) showed that there was also a moderate correlation between the respondents' tendency to occupy wetlands/ riparian areas and the effect of flooding on their access to clean drinking water; as another value (Cramer's $V = 0.399$) showed there was a moderate correlation between the respondents' lethargy towards exchange of information and the effect of flooding on their access to clean drinking water.

Similarly, the value (Cramer's $V = 0.340$) showed that there was a moderate correlation between the respondents' tendency to block drains and natural waterways and the effect of flooding on their access to clean drinking water. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on their access to clean

drinking water. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on their access to clean drinking water also increased.

Different data sources confirmed that there was a significant relationship between environmental attitude and the effect of flooding on the victim's access to clean drinking water. The study revealed that over 70% of the households relied on water sources notably borehole and river/ stream, which were highly susceptible to contamination during flooding. Data from direct observation reveals that Mavoko peri-urban settlement is susceptible to water pollution due to the poor waste disposal as well as the traffic intensity along the Mombasa and Kangundo Roads. During flooding, the Athi River and other streams that flow through the settlement usually emerge with a heavy pollution load, ranging from raw sewage to household refuse and a mix of industrial and chemical effluent some of which could be controlled carefully handled.

Data from key informant interviews and proceedings at FGDs revealed that public water supply system in Mavoko is under-developed, hence the households' reliance on private water sources. Water vendors in the area obtained it by making illegal connections or directly from the water bodies without much care about its quality; and also charged more than the tariff paid by those directly connected to the water supply. As expressed by one participant at a FGD in Syokimau:

"...pit latrines fill up and burst with flood water where the dirt enters boreholes contaminating the water. ...we rely on water from vendors whose safety we are not assured of."

Proceedings of the discussions at the FGDs also revealed that the price of water was driven even higher during flooding when the underground water sources and tanks are contaminated during flooding leaving households without safe drinking water.

Secondary data from reviewed documents also revealed that the supply was diminished during floods leading to increased prevalence of water-related diseases among people who relied on underground water sources and tanks as earlier reported by IGAD (2006). The inadequacy of regulations and enforcement to avoid such contamination arises out of environmental attitude factors such as: naked corporate self-interest, inadequate allocation of resources and capacity by government, and corruption of enforcement officials (Simon, 2008). Peri-urban residents who rely on such sources are thus forced to drink and utilize water whose contamination levels are higher than the WHO limits; and are forced to seek alternative sources that are often more expensive (Douglas, 2006; Thompson et al., 2001).

4.5.3 Environmental attitude and effect of flooding on access to sanitation and toilet facilities:

The analysis revealed that there was a significant relationship between the environmental tendencies by respondents and the effect of flooding on their access to sanitation and toilet facilities in Mavoko. The value (Cramer's $V = 0.420$) showed that there was a moderate correlation between the respondents' lethargy towards estate meetings and effect of flooding on their access to sanitation and toilet facilities; as the value (Cramer's $V = 0.406$) showed that there was a moderate correlation between the respondents' tendency to occupy wetlands/ riparian areas and the effect of flooding on their access to sanitation and toilet facilities. The value (Cramer's $V = 0.353$) showed revealed that there was a moderate correlation between the respondents' tendency to block drains and natural waterways and the effect of flooding on their access to sanitation and toilet facilities.

However, the value (Cramer's $V = 0.297$) showed that there was a low correlation between the respondents' lack of concern for each other's welfare and effect of flooding on their access to sanitation and toilet facilities; and another value (Cramer's $V = 0.241$) showed that there was a low correlation between the respondents' lethargy towards exchange of information and effect of flooding on their access to safe sanitation and toilet facilities. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on their access to safe sanitation and toilet facilities. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on their access to safe sanitation and toilet facilities also increased.

Multiple data sources revealed that indeed there was a significant relationship between environmental attitude and the effect of flooding on the victim's access to access to safe sanitation and toilet facilities during flooding. Data from direct observation and key informant interviews revealed that most homeowners initially pay little attention to the construction of toilet and sanitary facilities. The priority for most homeowners was to have main house completed to some habitable level with the construction of the toilets coming last when the borrowed funds are exhausted, hence the unsafe construction of the toilet and sanitary facilities. Where the homeowners start with construction of the toilet, they often

wish to spend the least possible amount on this item, they use inferior the construction materials on shallow pits considered temporary but which they end up using for a long time and which easily burst when flooding occurs.

Proceedings at FGDs also revealed that water pooling encouraged breeding of vectors like mosquitoes which transmit malaria; and it also resulted into dampness leading to increased cases of diseases like coughs, flues, diarrhoea, pneumonia and skin rashes that were difficult to treat. This was avidly captured by one participant who observed:

“--- many children are affected by diseases like coughs and skin rashes that are difficult to cure. I had one of my children admitted to hospital after she fell ill, but the cough remained persistent for almost three months.”

Data from the reviewed literature also revealed that flooding led filling up and bursting of pit latrines, hence the need for the excreta to be contained in the quickest time possible to prevent the spread of infections (IFRC, 2010). Lora-Suarez et al., (2002) reported that the poorly constructed shallow pit latrines used on construction sites fill up quickly and become hazardous during flooding. The situation is exacerbated in urban and peri-urban areas where the concrete sites or lack of permission compromises the construction of VIP toilets as the case was during the 2009 floods in Manila, Philippines (Johannessen, 2011; Bastable & Lamb, 2012).

4.5.4 Environmental attitude and effect of flooding on children's access to school:

The analysis revealed that there was a significant relationship between the respondents' environmental tendencies and the effect of flooding on children's access to school in Mavoko. The value (Cramer's $V = 0.494$) showed analysis revealed that there was a moderate correlation between respondents' tendency towards blockage of drains and natural waterways and the effect of flooding on their children's access to school; as a value (Cramer's $V = 0.379$) showed that there was moderate correlation between the respondents' lack of concern for each others' welfare and the effect of flooding on the Children's access to school. The value (Cramer's $V = 0.244$) showed that there was a low correlation between the respondents' tendency to occupy wetlands/ riparian areas and effect of flooding on the children's access to school; as a value (Cramer's $V = 0.242$) showed that there was a low correlation between lethargy towards estate meetings and effect of flooding on the children's access to school.

Further, (Cramer's $V = 0.237$) also showed that there was a low correlation between the respondents' lethargy towards exchange of information and effect of flooding on the children's access to school. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on the children's access to school. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on the children's access to school also increased.

Multiple data sources also revealed that flooding prevented children from attending school in a variety of ways. From direct observation, the study noted that children, especially those from poorer family backgrounds, often crossed river beds and makeshift bridges to attend the cheap public schools in the peri-urban settlements where infrastructure is not developed. It becomes difficult for these children to attend school when flooding occurred. This challenge was also captured from key informant interviews and FGD proceedings where data revealed that whenever flooding occurred in Mavoko, children sometimes stayed at home for the floods to subside; and when schooling resumes; they find the school books and equipment damaged. This disruption of the children's school attendance was expressed by one participant who said that:

“--- during the major flood incidence in 2012, the school compound and roads to school became flooded to the extent that the school had to be closed for three days. The floods destroyed some text books and documents in the office --- some children also end up losing school items like bags and books when they are swept away by the floods.”

Data from the reviewed literature also revealed that school going children were the most vulnerable group to flooding in peri-urban settlements. ILGS and IWMI (2012) reported that flooding prevented children from attending school because their school uniforms and books get soiled in the flood, while parents prevented the children from going to school for their safety against the dangers of the excess mud, open drains are rendered invisible in storm water and some bridges are also washed away by the floods. Data from the secondary sources further revealed that the upsurge in the prevalence of water-borne diseases among flood-affected children greatly compromised their school attendance (ALNAP & ProVention, 2008). Where children did attend school in such conditions, there was reported a rapid spread of the infections, particularly in rapidly expanding and poor peri-urban environmental conditions where these infections are considered minor and are given little attention leading to chronic infections that disrupt the learning process of the children.

4.5.5 Environmental attitude and effect of flooding on recreational facilities:

The analysis revealed that there was a significant relationship between the respondents' environmental tendencies and the effect of flooding on their access to recreation and recreational facilities. The value (Cramer's $V = 0.253$) showed that there was a low correlation between the respondents' lack of concern for each others' welfare and effects of flooding on their access to recreation and recreational facilities; as a value (Cramer's $V = 0.214$) showed that there was a low correlation between the respondents' lethargy towards estate meetings and effects of flooding on their access to recreational facilities. The value (Cramer's $V = 0.210$) showed that there was a low correlation between the respondents' tendency to occupy wetlands/riparian areas and effects of flooding on their access to recreation and recreational facilities; as a value (Cramer's $V = 0.190$) showed that there was also a low correlation between the respondents' tendency to block drains and natural waterways and the effect of flooding on their access to recreation and recreational facilities.

Further, a value (Cramer's $V = 0.111$) showed that there was a low correlation between the respondents' lethargy towards information exchange and the effect of flooding on their access to recreational facilities. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on their access to recreation and recreational facilities. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on their access to recreation and recreational facilities also increased.

Multiple data sources revealed that indeed there was a significant relationship between environmental attitude and the effect of flooding on the victim's access to recreation and recreational facilities when flooding occurred. Data from key informant interviews revealed that there were no defined outdoor recreational facilities in Mavoko peri-urban settlement, but there were numerous entertainment joints in Athi River and Mulolongo townships as well as in the numerous shopping centres. Except for the play ground in Athi River Township and the neighbouring Machakos town, there were no other spaces set aside for recreational activities, leaving the active youth to play and recreate in the undeveloped plots in the neighbourhoods and some school playgrounds. When flooding occurred, and because no specific steps are taken to maintain these as recreational facilities, the grounds become inaccessible for this purpose.

Proceedings at the FGDs also revealed that some homeowners choose to purchase plots and construct their houses in dry river beds and riparian areas which they consider as cheaper at the time of buying, but are highly susceptible to flooding which renders the open fields inaccessible. Entertainment joints also suffer low patronage at times of flooding arising from poor choice of the location of the business because due environmental consideration was not taken. As one participant painfully lamented:

"Movement is restricted.....people have to stay indoors and sometimes even no customer comes into the pub. Floods come after it rains in the evening when bar business is supposed to be active. We make losses when we record no sales the whole evening."

Data from direct observation revealed three issues regarding recreational facilities in the study area. One, it was individual homeowners who provided play grounds and other green spaces in their neighbourhoods for recreational purposes, especially where the owners had not started construction. Two, most compounds were still under construction and therefore such compounds were littered with construction materials. Another observation was that where homeowners had their compounds complete, some were enclosed in perimeter walls without adequate drainage. Consequently, when it rains, storm water gets trapped in the compounds even long after the flood is over and the ground gets muddy rendering it inaccessible for recreational purposes, hence household members are confined indoors without recreation outside.

Data from the reviewed literature also revealed that there was a significant relationship between people's environmental attitude and the provision for recreational and entertainment facilities. Peacock et al. (2005) demonstrated that an individual's self esteem can be enhanced if they spend longer exercising within the green environment, leading to a variety of health benefits, hence the need for outdoor recreation. However, these spaces could be affected by environmental issues like flooding where burst sewage and storm water may ruin their hygiene and physical state at times out of pure negligence and poor management of the environment (Whitmarsh, 2005). The occurrence of floods exacerbate the poor hygienic conditions leading to reported health problems such as body rashes and itches associated with the recreational environment (Macintyre et al., 2003).

4.6 Environmental attitude and effect of flooding on different segments of the human population in Mavoko:

A Cramer’s V analysis was done and the results tabulated as shown in Table 5.4 from which different observations made regarding the correlation between the homeowners’ negative environmental tendencies and the affect of flooding on the various segments of the human population.

Table 6: Cross tabs of correlation (Cramer's V) between attitude factors and segments of community

Effect of flooding on	Tendency to block drains and natural waterways	Tendency to occupy wetlands/ riparian areas	Lethargy towards information exchange	Lack of concern for others' welfare	Lethargy towards estate meetings
Children	0.181	0.208	0.111	0.102	0.087
Youth	0.087	0.097	0.079	0.128	0.095
Women	0.139	0.103	0.155	0.065	0.207
Men	0.123	0.122	0.106	0.089	0.125
The aged	0.051	0.076	0.086	0.078	0.099
The Disabled	0.182	0.160	0.213	0.373	0.267

KEY: > 0.5 = High correlation; 0.3 to 0.5 = Moderate correlation

0.1 to 0.3 = Low correlation; 0 to 0.1 = Little (if any) correlation (Garson, 2012)

4.6.1 Environmental attitude and the effect of flooding on children:

The analysis revealed that there was a significant relationship between the respondents’ environmental tendencies and the effect of flooding on children in Mavoko. The value (Cramer’s V = 0.208) showed that there was a low correlation between the respondents’ tendency to occupy wetlands/ riparian areas and the effect of flooding on children; and as a value (Cramer’s V = 0.181) showed that there was also a low correlation between the respondents’ tendency to block drains and natural waterways and the effect of flooding on children. Similarly, the value (Cramer’s V = 0.111) showed that there was a low correlation between the respondents’ lethargy towards information exchange and the effect of flooding on children; while a value (Cramer’s V = 0.102) showed there was also a low correlation between the respondents’ lack of concern for each others' welfare and the effect of flooding on children.

However, the value (Cramer’s V = 0.087) showed that there was little (if any) correlation between the respondents’ lethargy towards estate meetings and the effect of flooding on children. The Cramer’s V values and the positive Spearman’s correlation values obtained revealed that there was a direct relationship between the respondents’ negative tendencies towards the environment and the effect of flooding on children. This meant that as the respondents’ negative tendencies towards the environment increased, the effect of flooding on children also increased.

Multiple data sources revealed that the impact of flooding on children was significantly influenced by the residents’ environmental attitude. Data from direct observation revealed that children generally like adventure and playing within the compounds and outdoor in the open fields. In four instances of compounds enclosed in perimeter walls, the study observed that storm water stagnated long after the rains subsided; and the open fields got muddy and unhygienic on flooding. The contaminated compound and fields increased exposure of the children to diseases and reduced access to playing facilities negatively affecting their development. This observation was collaborated with data from key informant interviews and FGD proceedings which revealed that the way homeowners made and maintained their environments determined the way flooding affected children’s play and activities.

Data from the reviewed literature also revealed that children become most susceptible to water and vector borne diseases to overcome which, children have to depend on their parents, elder siblings or well wishers who at times find it burdensome (LGS and IWMI, 2012). The data further revealed that when floods occur in the peri-urban settlements, children of parents with little disposable income are forced to stay out of school for the entire period of flooding because they have no alternative means of reaching school because their neighbours with personal cars or the available school buses seldom gave them a lift (Karley, 2009).

4.6.2 Environmental attitude and effect of flooding on the youth:

The analysis revealed that there was no significant relationship between the respondents' environmental tendencies and the effect of flooding on the youth in Mavoko. The value (Cramer's $V = 0.097$) showed that there was little (if any) correlation between the respondents' tendency to occupy wetlands/ riparian areas and effect of flooding on the youth; as a value (Cramer's $V = 0.095$) showed that was also little correlation between the respondents' lethargy towards estate meetings and effect of flooding on the youth. Similarly, the value (Cramer's $V = 0.087$) showed that there was little correlation between the respondents' tendency to block drains and natural waterways and effect of flooding on the youth; while a value (Cramer's $V = 0.079$) showed that there was little correlation between the respondents' lethargy towards information exchange and effect of flooding on the youth.

However, the value (Cramer's $V = 0.128$) showed that there was a low correlation between the respondents' lack of concern for each other's welfare and effect of flooding on the youth. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on the youth. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on the youth also increased.

Proceedings at one of the FGDs revealed that the occurrence of flooding did not seem to bother the youth as much, but it was evident that they knew what needed to be done to reduce effect of flooding. One participant argued that:

"It's the responsibility of government to conduct civil education and provide the information...improve on the road drainage, and ensure that encroachment on riverbeds and riparian areas is stopped."

The youth also argued that some of the information received from the local administrators was considered common knowledge and the methods of floods forecasting were outdated and misleading. However, data from direct observation revealed that there was a sense of unity among the youth who quickly mobilised to join efforts of emergency operations and humanitarian assistance during flooding.

Secondary data from the reviewed literature also revealed that there was a significant relationship between people's environmental attitude and the effect of flooding on the youth. Peacock et al. (2005) demonstrated that recreation and entertainment boosted the youth's health and self esteem, which is greatly affected by the occurrence of floods. In addition, the occurrence of floods exacerbate the poor hygienic conditions leading to reported health problems such as body rashes and itches associated with playgrounds (Macintyre et al., 2003). The data further revealed that when floods occur in the peri-urban settlements where infrastructure is not yet well developed, the youth fail to attend to their daily demands like attending college and going to work as they are forced to stay out of school for the entire period of flooding because they have no alternative means of reaching schools and other points of engagement (Karley, 2009).

4.6.3 Environmental attitude and effect of flooding on women

The analysis revealed that there was a significant correlation between the respondents' environmental tendencies and the effect of flooding on women in Mavoko. The value (Cramer's $V = 0.207$) showed that there was a low correlation between respondents' lethargy towards estate meetings and effect of flooding on women; while a value (Cramer's $V = 0.155$) also showed that there was a low correlation between respondents' lethargy towards information exchange and the effect of flooding on women. Similarly, the value (Cramer's $V = 0.139$) showed that there was a low correlation between respondents' tendency to block drains and natural waterways and effect of flooding on women; and a value (Cramer's $V = 0.103$) showed that there also a low correlation between respondents' tendency to occupy wetlands/ riparian areas and effect of flooding on women.

However, the value (Cramer's $V = 0.065$) showed that there was little (if any) correlation between the respondents' lack of concern for each others' welfare and the effect of flooding on women. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on women. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on women also increased.

Multiple data sources revealed that the impact of flooding on women was significantly influenced by the residents' environmental attitude. Data from key informant interviews and FGDs proceedings revealed that, the traditional gender roles in the family put women at the forefront in managing flood risks at home. It was observed that women's domestic workload increased during flooding because they had to work harder to feed their families and to protect the young, the

sick and the elderly as they directed and carried the floodwater from the rooms, which reduced their opportunities to engage in income generating opportunities leading to further vulnerabilities. One participant at the FGD in Syokimau said:

".....women really overwork during flooding and they really get exposed to more risks as they struggle to ensure members of their households are protected and fed."

Data from the reviewed literature revealed that women are one of the most vulnerable groups to be impacted by flooding in peri-urban settlements because they face special conditions. The more vulnerable a woman is prior to flooding, the more she suffers in the aftermath because women have different social roles and responsibilities (Musoke & Sjöling, 2011; Gingie et al., 2010). The societal restrictions, activities and responsibilities surrounding the home and family are women's concern making them more likely to engage in rescue operations following the flood, which makes women to suffer implications that relate to their biased gender roles (Musoke & Sjöling, 2011). This means that women Mavoko are more vulnerable to disasters than men because the biased gender roles in the society.

4.6.4 Environmental attitude and effect of flooding on men:

The analysis revealed that there was a significant relationship between the respondents' environmental tendencies and the effect of flooding on men in Mavoko. The value (Cramer's $V = 0.125$) showed that there was a low correlation between the respondents' lethargy towards estate meetings and effect of flooding on men; while a value (Cramer's $V = 0.123$) showed that there was a low correlation between the respondents' tendency to block drains and natural waterways and the effect of flooding on men. Similarly, the value (Cramer's $V = 0.122$) showed that there was a low correlation between the respondents' tendency to occupy wetlands/ riparian areas and effect of flooding on men; and a value (Cramer's $V = 0.106$) showed that there was a low correlation between the respondents' lethargy towards information exchange and effect of flooding on men.

However, the value (Cramer's $V = 0.089$) showed that there was little (if any) correlation between the respondents' lack of concern for each others' welfare and effect of flooding on men. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on men. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on men also increased.

Multiple data sources revealed that the residents' environmental attitude had a significant influence on the impact of flooding on men. Data from key informant interviews and FGD proceedings revealed that the traditional gender roles of men as protectors and providers for the family put them on the frontline of managing flood disasters both at home and at the community level. Men were reported to be responsible for mobilising and pooling both financial, material and human resources for confronting floods whenever they occurred. Men were reported to be more vulnerable because their men workload increased beyond the domestic to the community level during flooding because they had to work harder to provide safe shelter and participate in the rescue operations whenever required.

Secondary data from the reviewed literature also revealed that men were quite vulnerable to the impact of flooding in peri-urban settlements because they take up the crucial roles of operations during flooding. The societal expectations of and responsibilities for men at both the family and community levels expose them more as they engage in rescue operations during flooding (Musoke & Sjöling, 2011). The reviewed literature also revealed that because of the position of the man as the provider for the family, it was men who readily ventured out and also migrated during flooding to look for livelihood opportunities (Gingie et al., 2010).

4.6.5 Environmental attitude and effect of flooding on the aged:

This analysis revealed that there was no significant correlation between the respondents' environmental tendencies and the effect of flooding on the aged persons. The value (Cramer's $V = 0.099$) showed that there was little (if any) correlation between the respondents' lethargy towards estate meetings and effect of flooding on the aged; while a value (Cramer's $V = 0.086$) showed that there was little correlation between lethargy towards information exchange and effect of flooding on the aged. Similarly, the value (Cramer's $V = 0.078$) showed that there was little correlation between the respondents' lack of concern for each others' welfare and effect of flooding on the aged; as the value (Cramer's $V = 0.076$) showed that there was little correlation between the respondents' tendency to occupy wetlands/ riparian areas and effect of flooding on the aged.

Further, the value (Cramer's $V = 0.051$) also showed that there was little correlation between the respondents' tendency to block drains and natural waterways and effect of flooding on the aged. However, the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on men. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on men also increased.

Multiple data sources revealed that there was no consistent finding regarding the relationship between the residents' environmental attitude and the impact of flooding on the aged people. On the one hand, FGD proceedings revealed that this segment of the human population had high risk aversion because they had stayed in the study area for more than ten years and were therefore held in high regard since they were equipped with traditional flood knowledge derive from the experience of a life spent in flood prone areas of Mavoko. On the other hand, data from key informant interviews revealed that the elders were highly susceptible to the knock-on effect of flooding on everyday aspects of life due to their diminished physical, financial and emotional capability to cope with the disruption. The interviews further revealed that as people age, their biological strength declines and they get susceptible to age-related chronic diseases, reduced strength for mobility and failed sensory faculties making them height reliant on external support from people who may not be that friendly and caring. These difficulties were reported to be compounded by loss of income, as well as loss of a spouse, friends or family, which makes them feel lonely and isolated at such times of need.

Data from the reviewed literature also revealed mixed findings regarding the effect of environmental attitude and effect of flooding on the aged population. For instance, after studying on the flood victims of the 2002 Melde Flood in Eilenburgh, Kuhlicke (2006) reported that elders with extensive local flood knowledge survived because they keenly observe the warning signs and send out early emergency calls for evacuation. However, López (2008) reported that during flooding, most fatalities occur in vulnerable aged populations developing in countries that lack the appropriate policies and frameworks to address the special needs of the senior citizens who face social neglect.

4.6.6 Environmental attitude and effect of flooding on the disabled persons:

The analysis revealed that there was a significant relationship between the respondents' environmental tendencies and the effect of flooding on the disabled persons in Mavoko. The value (Cramer's $V = 0.373$) showed that there was moderate correlation between the respondents' lack of concern for each others' welfare and effect of flooding on the disabled. The value (Cramer's $V = 0.267$) showed that there was also a low correlation between the respondents' lethargy towards estate meetings and effect of flooding on the disabled people; while a value (Cramer's $V = 0.213$) showed that there was a low correlation between the respondents' lethargy towards information exchange and effect of flooding on the disabled people.

Similarly, the value (Cramer's $V = 0.182$) showed that there was a low correlation between the respondents' tendency to block drains and natural waterways and effect of flooding on the disabled; as a value (Cramer's $V = 0.160$) showed that there was a low correlation between the respondents' tendency to occupy wetlands/ riparian areas and effect of flooding on the disabled. The Cramer's V values and the positive Spearman's correlation values obtained revealed that there was a direct relationship between the respondents' negative tendencies towards the environment and the effect of flooding on the disabled people. This meant that as the respondents' negative tendencies towards the environment increased, the effect of flooding on the disabled people also increased.

Multiple data sources revealed that there was no consistent finding regarding the relationship between the residents' environmental attitude and the impact of flooding on the aged people. Data from key informant interviews and FGD proceedings revealed that there was a general agreement among participants that disabled persons experienced 'major challenges' at the time of flooding due to paucity of information arising from the lack of knowledge and statistics on people with disabilities and where they lived. In addition, data from direct observation also revealed that there were no adequate preparedness measures with most of the physical infrastructure, such as buildings, toilet facilities and roads not taking care of the special needs of the physically challenged persons during emergencies.

Data from reviewed literature revealed that was increased vulnerability to flood hazards arising from disability-related challenges. Due to poor information sharing and at times stigma, the number of persons with disabilities and their special needs remains unknown, making them to go unnoticed or being treated as one group (Kett et al., 2005). In addition, Wisner et al. (2004) reported that because of the barriers faced by persons with disabilities in accessing services like early warning and emergency response, this category of persons relied on other people in the wake of emergencies, which calls for goodwill and commitment from the care giver.

5. CONCLUSIONS

The objective of this study was to determine the correlation between homeowners' environmental attitude and the effect of flooding on households in the Mavoko peri-urban settlement. Analyses of the data revealed there was a significant, positive correlation between the participants' negative tendencies towards the environment and the effect of floods on all aspects of life in Mavoko as investigated. The data analyses also revealed there was a significant, positive correlation between the participants' negative tendencies towards the environment and the effect of floods on all categories of the human population in Mavoko as investigated. The study concluded that there is a significant relationship between the homeowners' environmental attitude and the effect of flooding on the effect of flooding on households in the Mavoko peri-urban settlements of Nairobi metropolis, Kenya.

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