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Influence of Floods on Education and Sanitation Sustainability in Nyando River Basin, Nyando Sub-County, Kenya

Moses Oduma Obiayo[1], Stanley Omuterema[2] and Charles Rambo[3]

[1]Masinde Muliro University of Science and Technology- Centre of Disaster Management and Humanitarian.

[2]Department of Disaster Management and Sustainable Development.

[3]School of Continuing and Distance Education, University of Nairobi.

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ABSTRACT

Education is basic and a basic requirement for every child, as it empowers the society to be self-sustaining and innovative. Water and sanitation determines the health potential of a given community. Environmental safety consciousness is paramount for any healthy community. This study investigated the influence of Floods on the Community Educational attainment and water, sanitation and health services. A cross-sectional design was applied to source data from 561 household heads and 22 officials of humanitarian agencies operating in the Basin. Descriptive statistics, cross-tabulation with Chi-square statistic and one-way analysis of variance were used to analyse data collected. The study area was divided into two zones - high-risk (within 2 kilometres) and low-risk (more than 2 kilometres).The results show that the floods on educational attainment (χ^2 = 46.458; df = 6 and p-value = 0.000). Besides, the proportion accessing drinking water from open sources increased significantly during the floods. The study concludes that: appropriate risk reduction interventions are likely to safeguard community livelihoods, while increased investments in education is likely to reduce community vulnerability to floods, in the long-term, the study recommends the need to: establish schools in higher grounds safe from floods, strengthen the constituency bursary kitty for children affected by floods; sustain health education to improve knowledge about the safety of drinking water and the need to equip households with the knowledge and skills of modern fishing technology for household food security.

1.0 Introduction

Flooding is a primary manifestation of climate change, affecting all parts of the world. It is one of the most hazardous, frequent and widespread natural disasters (Schanze, Evzen and Jiri, 2006; IPCC, 2007). Floods remain one of the most significant climate-change related natural disasters, affecting many countries in the Sub-Sahara African region. In Kenya, the most recent floods have been associated with the El Niño phenomenon, which is characterized by large scale weakening of trade winds and warming of surface layers in the Eastern and Central Equatorial Pacific Ocean. These conditions coupled with the warming of the Indian Ocean in areas adjacent to the East African coastline, increase the amount of rainfall in most parts of Kenya (ACT International, GoK, 2009; UNOCHA, 2010).

A study commissioned by the African Wildlife (2000) points out that the cumulative impact of human activities with little or no regard for nature has turned the recent floods from a natural phenomenon into a man-made disaster of epic proportions. The high rate of urban growth and expansion into flood-prone areas, as well as inadequate flood control measures are factors that increase the risk of floods and related impacts. Furthermore, Schanze, Evzen and Jiri (2006) note that human impacts on river catchments, particularly land use changes have a direct impact on the magnitude and behaviour of floods

1.1 Flooding risk and community vulnerability

The risk of flooding and community vulnerability is a subject that continues to attract empirical studies from all corners of the globe. Floods became a major natural hazard because of the high human population densities that inhabit flood plains (Nott, 2006). Vulnerability is perpetuated by factors such as poor living conditions, lack of power, exposure to risk as well as lack of the capacity to cope with shocks and adverse situations (Ariyabandu and Wickramasinghe, 2005; IPCC, 2007). Nott (2006), assessed that poverty does not equal to vulnerability, however, being poor makes people more vulnerable to disasters because poor people lack the resources to prepare for and respond to such threats as well as economic and psychological shocks arising due to flooding events.

Flooding has serious effects on the social, economic, environmental, physical and psychological wellbeing of people. Flooding exerts adverse socio-economic impact on the wellbeing of vulnerable communities inhabiting flood-prone settlements. Schanze, Evzen and Jiri, (2006), notes that flooding displaces people, destroys buildings and leads to loss of human life, leading to unplanned migration, starvation, disease and a host of other social challenges. Smith and Ward (1998) indicate that heavy precipitation results into recurrent flash floods and water logging in low lying areas, causing

Tele:

E-mail address: obiayomos@yahoo.com

varying impacts on various sectors, including infrastructure, agriculture, education, health, water, and sanitation.

1.2 Statement of the Problem

The Nyando River Basin is one of the key areas prone to flooding in Kenya, which suffered serious consequences due to the El Niño rains of December 2011 to April 2012. This brought spill-over effect on education and health concerns. The aftermath of the floods left many homes submerged and roads impassable. Education was hit where schools were closed or used as shelter to those who were displaced by the floods. There had been insufficient commitment in addressing educational matters as well as water, health and sanitation aspects in these areas. This study thus intended to generate information on the education potential and sanitation level of the Nyando River Basin that would provide viable information to the government planners and development agencies to support their programming, at improving education and sanitation levels of the study area.

1.3 Research objectives

The general objective of the study was to assess the influence of floods on education status in the communities. Specifically the study sought to examine the influence of floods on access to water, sanitation and healthcare services in the communities.

1.4 Research Questions

The study addressed the following questions: What is the influence of floods on the access to water, sanitation and healthcare services?

1.5 Significance of the Study

The findings of this will go a long way in enabling the government and humanitarian agencies in Nyando Sub-county to improve their projects designed to enhance community resilience against future flooding episodes on education and water, sanitation and health of the local community. It also improves the stock of existing literature on the floods and community livelihood sustainability, thus, making it a valuable resource material for disaster management scholars.

1.6 Scope and Limitations of the Study

The study was restrained to the lower Nyando River Basin covering, six administrative locations, including Wawidhi, Kakola and Onjiko in the high-risk zone, 2 kilometres from the river channel, as well as Awasi, Kochogo and East Kano in the low risk zone, more than 2 kilometres from the river channel.

1.7 Assumptions of the Study

The study was founded on the assumption that communities in the low-risk and high-risk zones were similar in terms of socio-economic indicators, such that whatever variations noted after the floods, were exclusively attributed to the floods.

2.0 Literature Review

2.1 Influence of Floods on Education Status in the Community

Floods have affected the status of education in vulnerable communities by destroying infrastructural facilities and hosting flood victims. Gwimbi (2004) found a significant correlation between the proportion of children dropping out of school, and the proximity to the river channel, as well as the frequency of absenteeism and flood duration. As noted by various scholars such as Boloz and Lincoln (1983) and Dekalb (1999), absenteeism is detrimental to students' learning achievement, promotion, self-esteem and employment potentials. Greene (1990) and Applegate (2004) have demonstrated that regardless of the social and economic factors, schools with higher attendance rates achieved higher test scores.

Mitigating floods or relocating to higher grounds is likely to improve learning continuity and learning achievements among children in communities frequented by floods (Gwimbi, 2004). The study commissioned by ILGS and IWMI (2012) found that the impact of flooding on children was mostly felt in their education, in terms of frequent and prolonged absenteeism, which in turn, impaired learning achievements. In 2006, Nyando Sub-county experienced floods that affected 30 educational institutions, in which 28 classrooms were destroyed and 11 latrines uprooted (FEWS-NET, 2006). Ochola et al, (2010) found that only 9 percent of the schools in Nyando River Basin were not vulnerable to floods; about 48 percent were classified as marginally vulnerable, while 43 percent were found to be very vulnerable, in terms of geographical location and sub-standard construction specifications.

In Pakistan, a report published by UNOCHA (2010), indicated that during the monsoon floods of 2010, up to 453 public schools in the affected communities were used as displacement centres, from where emergency relief services were provided to about 960,000 people thus affected learning activities.

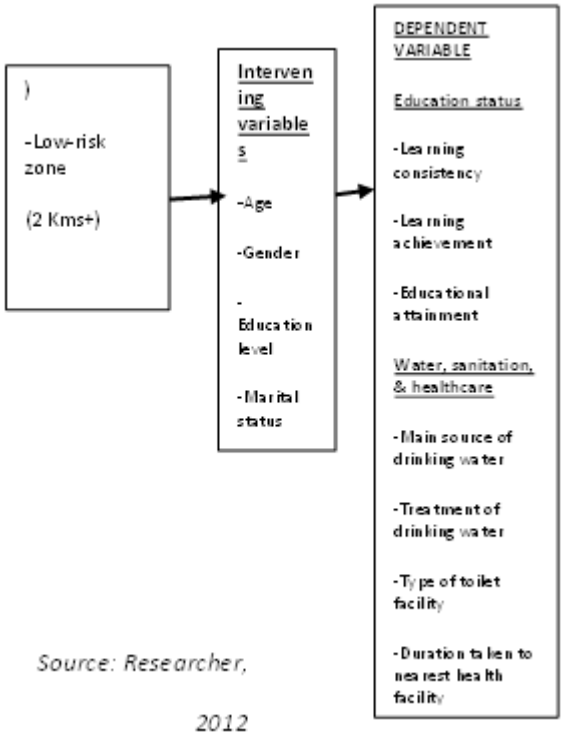
2.2 Influence of Floods on Water, Sanitation and Health Status

Gwimbi (2004) associated floods with increased prevalence of waterborne infections, destruction of health facilities and limited access to quality healthcare services, particularly during and immediately after floods. Gwimbi (2004) found a significant correlation between the episodes of flood-related illnesses such as malaria, typhoid, cholera and skin infections, and the proximity to the river channel. Community members residing within one mile from the river channel were about twice as likely to experience enteric infections as those residing outside the one-mile distance would. Gwimbi (2004)attributed disease outbreaks to the disruption of the clean water supply and stagnation of water in the low-lying areas, which created breeding grounds for mosquitoes.

Over half of all waterborne disease outbreaks in various parts of the world occur in the aftermath of heavy rains and floodwaters may contain over 100 types of disease causing bacteria, viruses and parasites (Batterman *et al*., 2009). Agricultural waste, chemical pollutants or raw sewage also contaminate floodwaters (ILGS & IWMI, 2012). Where contaminated floodwaters flow ubiquitously, they may render tap and well water unsafe for drinking and taint fishing spots (Domino *et al*, 2003). In Nyando River Basin, the 2006 floods were associated with one of the highest prevalence of human deaths from cholera, typhoid and malaria (Osbahr *et al*, 2008). The prevalence of flood related diarrhoeal infections is higher among poor populations in developing countries than in developed countries (IPCC, 2007).

According to Few *et al*. (2005), malaria was the single most reported flood-related disease. Even though malaria is endemic in the region, the study revealed that its prevalence increases significantly during and immediately after floods, particularly due to puddles and ponds left behind by receding waters (Few *et al*, 2005). In Pakistan, the study conducted UNOCHA (2010), found that the prevalence of various infections, including acute diarrhoea, acute respiratory infections, skin diseases and malaria increased significantly after the 2006 monsoon floods.

2.3 Conceptual framework



Source: Researcher, 2012

3.0 Research Methodology

The study area was divided into *high-risk zone* - households within two kilometres from the channel and *low-risk zone* - those lying beyond two kilometres from the Nyando River channel. 70.8% of household heads were sampled within the high-risk zone, while 29.2% were natives of the low-risk zone. The information obtained from respondents in the two zones was compared to determine the effect of floods on community livelihoods. 22 key informants were purposively sampled, including key officials or staff of CBOs, NGOs and the government.

This study applied the cross-sectional survey design, which allows the collection of requisite information from target population at a single point in time (Babbie, 1973; Fowler, 1993). It involved the application of two approaches, quantitative and qualitative. The study was conducted in the Nyando River Basin in Nyando Sub-county. The study area covers the lower parts of the basin, measuring approximately 248.3 square kilometres, with a total population of 79,711 people (GoK, 2009). The population density ranges between 158 persons per square kilometre in Katolo Sub-location to 982 per square kilometre in Tura Sub-location. The study population included community members in six administrative locations, these are, Awasi, East Kano, Kakola, Kochogo, Onjiko and Wawidhi. The study also targeted Community-Based Organizations (CBOs) and Non-Governmental Organizations (NGOs) operating in the district, government officials, as well as community leaders. The community was divided into two zones; high-risk and low-risk zones.

Three data collection instruments were applied in this study, including a household survey questionnaire, a key informant interview schedule and an observation checklist. The sample size was determined using the two pre-designated zones of high-risk and low-risk locations, using Fisher's formula for sample size determination from finite populations (Fisher *et al.*, 1983 cited in Mugenda and Mugenda, 1999) as stated below: -

$$n = Z^2pqD/d^2$$

Where: -

n = desired sample size (the target population is greater than 10,000 [**n=384]**).

Z = standard deviation at 95% confidence level.

p =proportion of population having the characteristics being measured

$q = 1 - p$ = probability of non-success

D = the level of statistical significance set

d = the degree of accuracy (acceptable margin of error) =0.05

4.0 Results and Discussion

4.1 Influence of Floods on Education Status

Access to education is the fundamental right and a crucial tool for sustained socio-economic development and hence an important exit route from poverty (GoK, 2005).

The study established that floods in Nyando River Basin had both direct effects - the floods incapacitating infrastructure supporting the education system; and indirect effects – the floods influenced poor performance and affected education morale by the school-going fellows; indirectly effect may encourage school dropout by majority of displaced people (Dekalb, 1999).

The study found that 90.9% of participants in the high-risk zone and 89.0% in the low-risk zone had children attending primary schools at the time of the study. The study focused on the disruption of learning consistency among students in standard eight because this was considered a critical point of transition to secondary schools. Figure 4.1 shows that 31.0% of respondents in the high-risk zone and 24.0% in the low-risk zone had children attending standard eight at the time of the study.

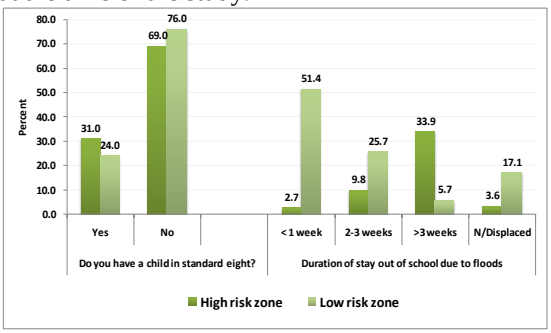


Figure 4.1. Duration of stay out of school due to floods

The analysis obtained a computed χ^2 value of 22.861, with 3 degrees of freedom and a p-value of 0.000, which was significant at 0.01 error margin. This suggests up to 99% chance that the high-risk and low-risk zones were significantly different in terms of the duration taken out of school by standard eight pupils due to floods. Besides, the findings suggest that pupils in the high-risk zone took longer to resume their studies than those in the low-risk zone due to variation in the intensity of floods between the two regions.

4.2 Influence of Floods on Water, Sanitation and Health Services

Floods often raise issues of access to clean drinking water and sanitation, mainly in two ways: firstly, when pit latrines are flooded, human waste overflow ubiquitously, thereby, contaminating open water sources; thus, exposing affected families to infections. Secondly, in displacement centres, over-crowding has serious sanitation implications, particularly where toilet facilities are either few or lacking.

Adequate access to safe drinking water refers to the ability of each household member to obtain at least 20 litres of water that is free from microbial, chemical and physical impurities that may harm human health, within a distance of less than 1 kilometre per day (WHO, 2007). Lack of access to

clean drinking significantly associates with various infections, including diarrhoea, cholera, and typhoid, among others. The results presented in Figure 4.2 show that before the floods, up to 40.1% households in the high-risk zone and 41.5% in the low-risk zone obtained their drinking water from rivers/streams, while 25.9% in the high-risk zone against 25.6% obtained drinking water from dams/ponds. Up to 9.6% respondents in the high-risk zone and 17.1% in the low-risk zone sourced their water from open wells.

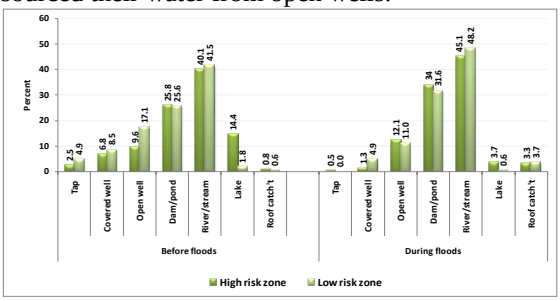


Figure 4.2. Main source of drinking water before and after floods.

During the floods, the proportion of households that accessed drinking water from rivers/streams increased from 40.1% to 45.1% in the high-risk zone and from 41.5% to 48.2% in the low-risk zone. Similarly, the proportion of households sourcing drinking water from dams/ponds increased from 25.8% to 34.0% in the high-risk zone and from 25.6% to 31.6% in the low-risk zone. Contrastingly, the proportion obtaining drinking water from taps decreased from 2.5% to 0.5% in the high-risk zone and from 4.9% to 0.0% in the low-risk zone. Those obtaining drinking water from covered wells also reduced from 6.8% to 12.1% in the high-risk zone and from 8.5% to 11.0% in the low-risk zone. Key informants also revealed that water-borne infections, such as typhoid and amoebiasis were endemic in the community.

The study established that flood survivors were supported by a number of relief agencies to access safe drinking water, including Kenya Red Cross Society, World Vision, NGOs and various government departments. Figure 4.3 shows that out of 333 displaced flood survivors, up to 42% cited water purifiers as the main form of support received from relief agencies, 30% mentioned training on water treatment methods, water handling as well as storage, while 15% said they were supported with clean drinking water.

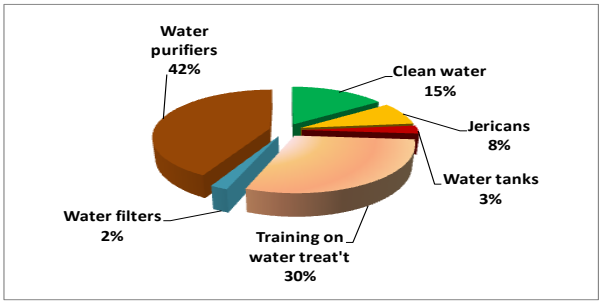


Figure 4.3. Support obtained to improve access to clean drinking water.

Community members were provided with skills in water treatment, handling and storage using the Participatory Hygiene and Sanitation Transformation for Emergency Relief (PHASTER) methodology. The aim of such training was to enable community members treat drinking water to reduce their vulnerability to water-borne infections, especially during floods.

Table 4.1 shows that before floods, 23.7% of participants in the high-risk zone against 34.1% in the low-risk zone were treating their drinking water. Although majority of participants were not treating drinking water in both zones, the findings suggest that a higher proportion of households in the low-risk zone than in the high-risk zone took some measures to make their drinking water safer. The analysis revealed a significant variation between households in the two zones regarding treatment of drinking water (computed χ^2 value = 8.162, df = 1, p-value = 0.051).

Table 4.1. Treatment of drinking water before and after floods.

Treating drinking water	High risk zone		Low risk zone	
	Frequency	Percent	Frequency	Percent
Before floods				
Yes	94	23.7	56	34.1
No	303	76.3	108	65.9
Total	397	100.0	164	100.0
During floods				
Yes	133	33.5	71	43.3
No	264	66.5	93	56.7
Total	397	100.0	164	100.0

During the floods, the proportion of households treating drinking water increased in both zones. In the high-risk zone, the proportion treating drinking water increased from 23.7% to 33.5%, while in the low-risk zone, the proportion increased from 34.1% to 43.3%. However, the analysis found that the high-risk and low-risk zones were not significantly different. This finding may be attributed to the intervention by relief agencies and the government through training, provision of water purifiers and storage containers.

The results in Figure 4.4 show that 36.8% households in the high-risk zone and 43.9% in the low-risk zone used pit latrines, while 1.0% participants in the high-risk zone against 3.0% in the low-risk zone mentioned septic tanks.

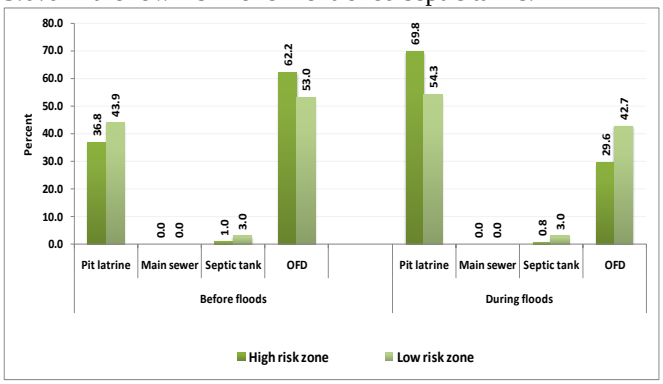


Figure 4.4. Type of toilet facility used before and after floods.

62.2% in the high-risk compared to 53.0% in the low-risk zone practiced Open Field Defecation (OFD). Based on this, a computed χ^2 value of 5.199, with 3 degrees of freedom and a p-value of 0.228 were obtained. This implies that the two zones were homogenous in terms of the type of toilet facility used prior to the floods.

These findings suggest that latrine coverage was below 50% in both the high-risk and low-risk zones well before the onset of the floods, making the entire community vulnerable to water-borne infections. Periodical project reports by KRCS, confirm that latrine coverage in the community remains low, particularly in the rural areas. The main reasons for this challenge include ignorance and high poverty levels, which was partly associated with low incomes, and poor agricultural yields. Due to the high poverty levels, majority of community members were unable to afford construction materials.

During the floods, the results presented in Figure 4.4 show that in the high-risk zone, the proportion of households using pit latrines increased from 36.8% to 69.8%, while in the

low-risk zone, it increased from 43.9% to 54.3%. Once again, the analysis found that the high-risk and low-risk zones were not significantly different in terms of the type of toilet facility used during the floods (computed $\chi^2 = 4.375$, df = 3, p-value = 0.159).

The study found that active humanitarian relief agencies such as KRCS supported the community members by constructing pit latrines, providing slabs for latrines and imparting skills on latrine construction, consistent use and hygiene practices. Although such training was provided to community members whenever flood-related disasters were experienced, key informant interviews indicated that ignorance on sanitation issues and high poverty levels remain key challenges to the proper disposal of human waste in the study area.

Access to quality healthcare is a crucial determinant of population health and an essential component of strategies for the realization of the Millennium Development Goals (WHO, 2007). The geographical distance from the nearest health facility is one of the factors determining access to healthcare in a community; consequently, the government policy has been to take facilities closer to communities to improve access. However, floods often constrain access to healthcare services by displacing people to areas far away from health facilities, cutting off road networks and bridges, and destroying health facilities, equipment, as well as medical and non-medical supplies.

Figure 4.5 shows that before the floods, 26.7% of participants in the high-risk zone, and 22.0% in the low-risk zone dwelt within a distance of less than 30 minutes travel by foot to the nearest healthcare facility. Besides 45.8% of the respondents in the high-risk zone and 47.0% in the low-risk zone lived within a distance of 30-59 minutes, while 17.8% in the high-risk zone against 23.8% in the low-risk zone said the distance between their residence and nearest health facility was a 1-2 hours walk.

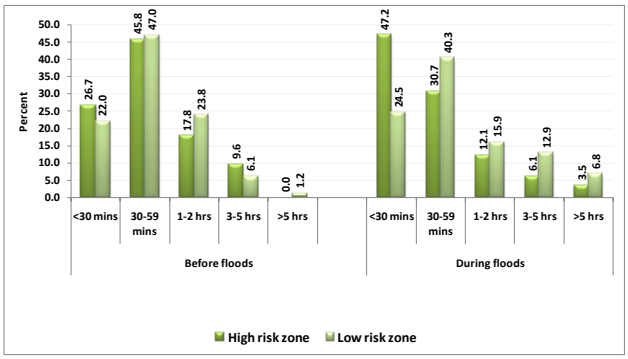


Figure 4.5. Duration taken to nearest facility before and after floods.

Based on this, the analysis yielded a computed χ^2 value of 1.942, with 4 degrees of freedom and a p-value of 0.118, which was not significant. This implies that the high-risk and low-risk zones were not significantly different in terms of the duration taken to the nearest health facility prior to the floods. The results presented in Figure 4.3 further suggest that during the floods, the proportion accessing healthcare services within a distance of less than 30 minutes' walk increased in both zones, while the proportion accessing health facilities at a distance of more than 30 minutes reduced.

The proportion of people dwelling within a distance of less than 30 minutes increased from 26.7% to 47.2% in the high-risk zone and from 22.0% to 24.5% in the low-risk zone. The analysis obtained a computed χ^2 value of 14.663, with 4 degrees of freedom and a p-value of 0.029, which was significant at 0.05 error margin.

The increase in the proportion accessing health facilities in less than 30 minutes was attributed to the interventions by relief agencies, particularly, KRCS and the Ministry of Health (MoH), who teamed up to provide medical services to flood survivors by organizing medical camps and using mobile medical clinics.

The purpose of this intervention was to take healthcare services close to those affected by floods in the displacement camps and in the community. Mobile clinics were initiated within displacement camps in areas where survivors experienced challenges in accessing public health facilities due to one or a combination of the following factors: long distance, collapsed bridges, impassable roads or lack of transportation means. Improving access to healthcare services was intended to minimize the risk of mortality, especially among the most vulnerable groups such as children below 5 years, pregnant women, and the elderly in the area of study.

Notwithstanding the support from relief agencies and the MoH, the study found that access to healthcare services was hampered by various challenges. Table 4.2 shows that challenges to access to health services at the time of the study included financial constraints, stated by 48.6% of respondents in the high-risk zone and 51.8% in the low-risk zone; followed by long distance to health facilities, according to 23.4% people in the high-risk zone and 39.0% in the low-risk zone.

Table 4.2. Challenges to the access to healthcare services in the community.

Valid responses	High risk zone		Low risk zone	
	Frequency	Percent of cases	Frequency	Percent of cases
Long distance to health facilities	93	23.4	64	39.0
Financial constraints	193	48.6	85	51.8
Understaffing of health facilities	32	8.1	19	11.6
Shortage of drugs	69	17.4	33	20.1
Insecurity	13	3.3	23	14.0
Health facility shut down	36	9.1	8	4.9
Bridge washed away	9	2.3	0	0.0
Total	**445**	**112.1**	**232**	**141.5**

Other factors constraining access to healthcare services in the community included shortage of drugs (17.4% and 20.1% in the high-risk and low-risk zones, respectively); shutting down of facilities that were damaged by the floods (9.1% against 4.9%); as well as understaffing of health facilities (8.1% compared to 11.6%).

Frequent rehabilitation of destroyed health facilities remains a costly initiative, especially where mitigation measures are inadequate. Based on this, participants emphasized the need for the District Health Management Team (DHMT) to maintain mobile clinics, as well as organize medical camps in high-risk zones to ensure sustainable access to healthcare services. This may be successful through collaboration with development partners. However, a permanent solution shall be achieved through construction of new health facilities on higher grounds.

5.0 Conclusion and Recommendation

5.1 Conclusion

Frequent and prolonged disruptions of learning may discourage schooling interests, resulting to high dropout rates. Majority of the pupils and students in Nyando River Basin their education is highly affected during floods peak season. Most of this school goers come from poor families based on

the socio-economic structure of the families. Most schools as per the study, were constructed in floodplains hence exposure to flood disasters. The study established that there were consumption of untreated drinking water attributed to lack of appropriate knowledge on water treatment, handling and storage. Proper hygiene was lacking in the area of study. Health facilities were located very far from the communities. Many residents of Nyando River Basin, have had immense challenges in accessing medical services thus exposing the residents to many risks and increasing their vulnerabilities to floods.

5.2 Recommendations

In order to provide long-term solution on educational disruptions and water, sanitation and health problems experienced in the Nyando River Basin. The government need to: establish schools on higher grounds to mitigate against education disruptions, strengthen the constituency bursary kitty by the government institutions.

Sanitation need to be managed by initiating an OVC kitty at the Nyando River Basin to complement existing funding opportunities and ensure that all sectors share in the responsibility of educating OVCs up to university level. Initiate and sustain hygiene promotion in the community to improve knowledge about the safety of drinking water and the importance of safe disposal of human excreta; thus, reduce the risk of disease outbreak.

Distance covered to health facilities need to be solved through improving access to healthcare services in the community to ensure sustainable access to healthcare services by constructing new health centres to address the challenge of long distance.

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