

Potential Behavioral and Societal Responses to Human Health Risks Resulting from Climate Change in Kawaala, Kampala Suburb in Uganda

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Abstract

Climate change poses greater human health risks associated with its impacts, bringing urban and peri-urban populations into disarray. The study investigated (a) the relationship between climate change impacts and human health risks, (b) gender aspects associated with human health risks, and (c) the survival tactics and response mechanisms to human health risks resulting from climate change impacts. It targeted a population of 1500 residents of Kawaala and randomly selected 234 respondents. The findings show that there is a significant relationship between climate change impacts, and human health risks, with $[r(189) = 0.67]$, $P < 0.05$. Erratic heavy rains posed more human health risks [Mean = 1.500, SD .50107] accompanied by prolonged dry spells [Mean = 1.4316, SD = .49636] followed by floods [Mean = 1.1368, SD = .34432] which had serious effects on children, women and the elderly. These result in building wooden bridges and using flying toilets while respondents preferred to stay indoors during flooding as opposed to moving to higher grounds immediately. Significant variations existed between residents who preferred staying out of floodwaters, avoiding driving through flooded areas, staying away from power lines and electrical wires and turning off electricity and gas during flooding. Climate change impacts were viewed as significant predictors for reduced availability of water for drinking, cooking and hygiene evidenced by the (R square = .618, adjusted R, = .792, F= 62.386) while rising temperatures increased the spread of malaria in some locations. A high regression value of 33.217 compared to the residual 19.700 was obtained, meaning that climate change impacts explain at least 79% of the variation of the risk of water stress in the area.

Keywords: Human Health Risks, Climate Change Impacts, Behavioral and Societal Responses

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Introduction

The paper reports on the findings of a study that was carried out in Kawaala which is a peri-urban area in Kampala. Kawaala was originally a wetland area with natural supportive ecosystems to the surrounding areas but has become increasingly inhabited to the point that the wetland is extinct. The climate change impacts are already manifesting in the form of floods, erratic rains, hailstones, among others with direct and indirect impacts on the health of people. This paper reports on the outcomes of the study objectives that were investigated, namely; (i) the relationship between climate change impacts and the human health risks, (ii) the gender aspects associated with human health risks, and (iii) the survival tactics and response mechanisms to human health risks resulting from climate change impacts.

Meehl (2007) observed that when more extreme weather events such as floods, heatwaves, el-niños and lamina, occur in an area, they propel the spread of infectious diseases and detrimental impacts on air and water, and human health. Evidence has proven that as global weather patterns become increasingly altered, they change the nature of global rainfall, evaporation, snow, streamflow and other factors that affect water supply and quality. Specific impacts include warmer water temperatures which affect water quality and accelerate water pollution. The effects of climate change include warming temperatures, changes in precipitation, increases in the frequency or intensity of some extreme weather events, and rising sea levels. These threaten human health by contaminating food, water, and air. Scientists have argued that the severity of these health risks depends on the ability of public healthcare and safety systems to address or prepare for these changing threats, as well as factors such as an individual's behaviour, age, gender, and economic status. Impacts will vary based on where a person stays, how sensitive they are to health threats, how much they are exposed to climate change impacts, and how well they and their community can adapt to change. People in developing countries may be the most vulnerable to health risks, but climate change poses significant health threats even in wealthy nations (Berry, 2009). Children, pregnant women, older adults, and people with low incomes face increased risks.

Methodology

This study adopted a mixed-methods design and used questionnaires and an interview guide as research tools. It used frequency, percentages, mean, standard deviation, collinearity, correlation and regression as statistical analysis tools, while the content validity index (CVI) was used to test the validity and reliability of the research findings. The selection of the sample size was based on a scientific formula given by Michael Slovin in 1960; $n = N / (1 + Ne^2)$ where n = number of samples, N = total population and e = error or tolerance level. It targeted a population of 1500 residents of Kawaala and randomly selected 234 male and female respondents. Slovin's formula was preferred because the study population was not known at the start of the research.

Literature review

Meehl et al. (2007) noted that climate change causes both direct and indirect impacts on human health and society. Direct impacts on mental health occur when a community experiences extreme weather and a changing environment. Direct impacts like landscape changes, impaired place attachment, and psychological trauma are all immediate and localized problems resulting from extreme weather events and environmental changes.

Meehl et al. (2007) further noted that extreme weather events cause negative changes to landscape and agriculture. This exposes persons to economic risks especially those that depend on agriculture for income. Communities exposed to extreme weather events face the risk of losing livelihoods and poverty. Many communities also face isolation, alienation, grief, bereavement, and displacement from these effects.

Davenport (2016) observed that the effects of global warming include its effects on human health and the severity of climate-related impacts further exacerbate the effects on human health if remedial responses are not undertaken.

Berry et al (2009) also argued that individuals are more likely to have increased rates of anxiety and emotional stress resulting from the effects of climate change, and its effects on mental health increases in already vulnerable communities.

Doherty and Clayton (2011) reinforce the view that the more powerful and frequent the extreme weather events are, the severe the damage to mental health. Some of the extreme weather events responsible for these mental health changes include wildfires, earthquakes, hurricanes, floods, and extreme heat, El Nino and La Nina.

Indirect impacts on mental health occur via impacts on physical health and community wellbeing. Physical health and mental health have a reciprocal relationship (Berry & Helen, 2009). If the physical health of an individual is negatively impacted, the decline in mental health soon follows. These impacts are more gradual and cumulative. They are threats to emotional wellbeing through concern and uncertainty about future risks.

Doherty et al. (2011) noted that there are also large-scale community and social effects, like conflicts related to migration and subsequent shortages or adjustment after a disaster. Extreme weather events play a major role here. Their impacts can be indirect. This is due to the effect on physical health from extreme weather events. Each extreme weather event affects humans in different ways, but they all lead to the decline of mental health. Heat indirectly causes mental health issues through physical health challenges. The World Health Organization reports that extreme heat is directly related to certain ailments like cardiovascular disease, respiratory disease, and asthma. One piece of their evidence is that in the summer of 2003, during Europe's big heatwave, there were 70,000 recorded deaths related to the heat.

According to the World Health Organization (2018), heat exhaustion also occurs during extreme heat. As climate change continues, temperatures will continue to rise and these problems will exacerbate. These physical problems lead to mental health problems. As physical health worsens and is less curable, mental stability starts to deteriorate. As extreme heat makes landscapes dry, nature is more prone to fire. Research shows that rising heat due to climate change has caused an increase in fires around the United States. Smoke inhalation from wildfires leads to a decline in physical health, which in turn leads to mental health problems. The death of a family member or a friend can cause individuals to suffer from stress and other conditions. Some people hurting due to the loss of family and friends may internalize their emotions, feel extreme guilt and helplessness, and become paranoid. Others may develop a fear of future loss and have an overall displacement of feelings that could last for years.

Anderson (2001) published research in the American Psychological Association that shows the increase in murders in the United States directly correlates with the temperature increase. For every one-degree Fahrenheit, there will be nine more murders in the country, which leads to an additional 24,000 murders or assaults per year in the United States.

There is also an increased risk of suicide in communities that suffer from extreme weather events. Studies show that suicide rates increase after extreme weather events. This is evidence of a decline in mental health. For example, in the Australian countryside where drought has resulted in crop failure, farmers were left with almost nothing. They were forced to sell their belongings, reduce their stock, and borrow large sums of money to plant crops at the start of the next season. These consequences caused a surge in depression, domestic violence, and suicide. More than one hundred farmers in the Australian countryside had committed suicide by 2007. The suicide of a person often leads to mental health problems for loved ones. They face grief, sadness, anger, paranoia, among others.

Lorna and Bowlby (1983) showed that some impacts pertaining to mental health are more gradual and cumulative than others, for instance, social interaction, media, and communication. The social interaction between communities and within communities is greatly affected by migration. Communities choose to migrate or are forced to migrate due to stress on limited resources. This is worsened by extreme weather events caused by climate change. Common mental health conditions associated indirectly with these extreme weather events include acute traumatic stress, post-traumatic stress disorder, depression, complicated grief, anxiety disorders, sleep difficulties, and sexual dysfunction. Drug and alcohol abuse are also common aftereffects and can lead to both physical and mental health issues, addiction and substance dependency.

The effects of Hurricane Katrina, an extreme weather event that occurred in New Orleans, led to a variety of mental health problems due to the destruction of resources (Epstein et al., 2011). Many people impacted by Hurricane Katrina were left homeless, disenfranchised, stressed, and suffering physical illness—imposing a strain on the public healthcare system and decreasing

access to and availability of medical resources. Some climate change adaptation measures may prevent the need for displacement. However, some communities may be unable to implement adaptation strategies, and this will create added stress, further exacerbating already existing mental health issues. Extreme weather events and population displacement lead to limited availability of medications, one of the primary resources required to meet the psychological and physical needs of those affected by such events. Less medication and medical resources mean fewer people can get the help they need to recover. Slowed recovery and lack of recovery worsen overall mental health.

The world disaster report recognizes the widespread concern that women and girls are at higher risk of sexual exploitation and abuse by trafficking and domestic violence in the aftermath of disasters (IFRC, 2007). In a study conducted by the WHO (2005), it was noted that women who were subjected to violence are more likely to experience increased violence after a disaster or may become separated from family, friends, and other potential support and protective systems. The WHO further noted that after a natural disaster, women are more likely to become victims of domestic and sexual violence and may shun their shelter as a result of fear (Ariyabandu, 2005; IFRC, 2007).

Wilbanks et al. (2012) observed that the amount of future climate change will largely be determined by choices society makes about emissions. Lower emissions of heat-trapping gases and particles mean less future warming and less severe impacts; higher emissions mean more warming and more severe impacts. Efforts to limit emissions or increase carbon uptake fall into a category of response options known as “mitigation” (WHO, 2002).

Carbon dioxide accounted for 84% of total U.S. greenhouse gas emissions in 2011. The vast majority (97%) of this CO₂ comes from energy use. Thus, the most direct way to reduce future climate change is to reduce emissions from the energy sector by using energy more efficiently and switching to lower-carbon energy sources. In 2011, 41% of U.S. carbon dioxide emissions were attributable to liquid fuels (petroleum), followed closely by solid fuels (principally, coal in electric generation), and to a lesser extent by natural gas. Electric power generation (coal and gas) and transportation (petroleum) are the sectors predominantly responsible.

Conceptual Framework

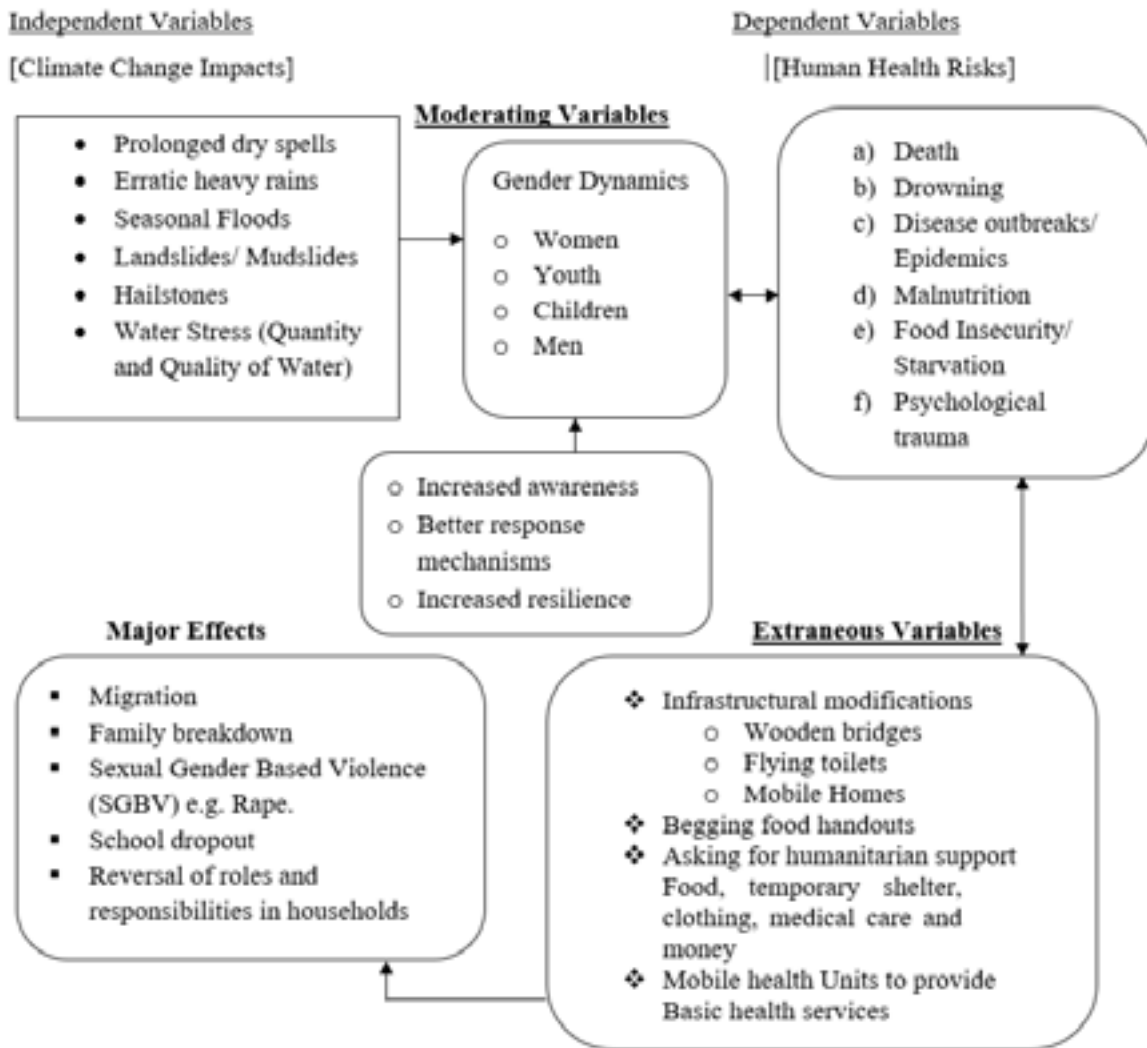


Figure 1: Relationship Between Climate Change Impacts, gender aspects and response mechanisms.
(Source: Adapted and Modified from Maria Magher (2001))

The conceptual framework (Figure 1) was adopted from the views of Maria Magher (2001) in which it tried to explain the relationship between the dependent, independent and extraneous variables. Magher (2001) suggested that when all the variables are analyzed, the dependent variables are the ones that inform the outcomes of the study.

Results and Discussions

The results are discussed in tables, charts, plates and so on.

Table 1: Gender of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	103	44.0	44.0	44.0
Female	131	56.0	56.0	100.0
Total	234	100.0	100.0	

Table 1 shows the number and percentages of participants who provided primary data by gender. The study engaged 234 respondents.

Age of respondents

The females were more than the males by a slight difference of respondents to this study.

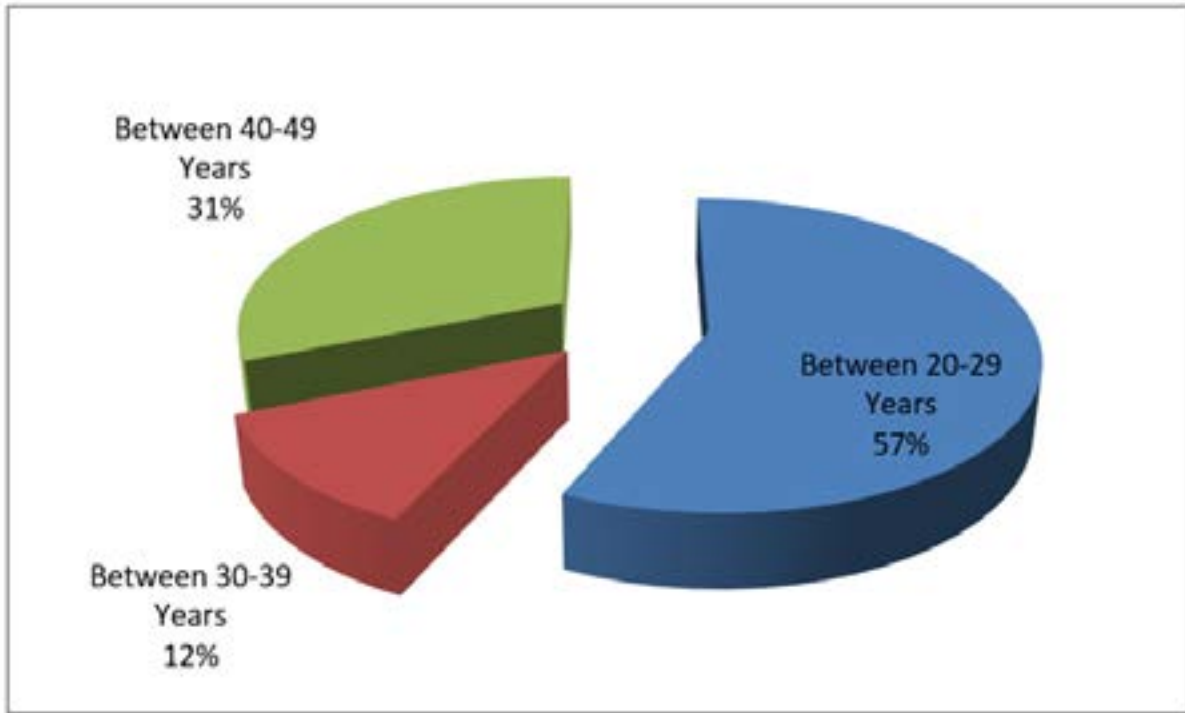


Figure 2: Age of the Respondents

There was a variation in the age brackets of the respondents who participated in this study with the majority (57%) being young adults within the age bracket of between 20-29 years as seen in figure 2. This was followed by respondents in the age category of between 40-49 years (31%) while the rest (12%) were in the middle age group of between 30-39 years.

Table 2: Education level of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Primary Level	1	0.4	0.4	0.4
Secondary Level	97	41.5	41.5	41.9
Tertiary/ University Level	120	51.3	51.3	93.2
Have'nt gone to school at all	16	6.8	6.8	100
Total	234	100.0	100.0	

As shown in Table 2, three levels of education of the respondents who participated in the study were sought, and 120 of them had reached tertiary and or university. A relatively big number of respondents (97) had only reached or attained secondary school education while only one

individual, which is an insignificant number, had attained primary level education. Some respondents had not gone to school at all but were also heavily affected by the factors which were being investigated in the study. The choice of the participants with varied education levels had a significant impact on the outcome of the results because choosing the majority of the tertiary/university graduates and those who studied up to secondary school meant that these participants were well informed and would provide genuine and meaningful opinions which again contributed to the reliability of the results.

Table 3: Employment Status of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Formal	118	50.4	50.4	50.4
Informal	116	49.6	49.6	100.0
Total	234	100	100	

It can be seen from Table 3 that the study took an almost equal number of respondents from those employed in the formal and casual labour jobs. This particular aspect informed the study about how people of different categories of employment categories perceive climate change impacts relating to human health risks. The study revealed that individuals who were employed in the informal sector (casual jobs) were significantly affected by the climate change impacts such as flooding, prolonged drought and erratic heavy rains as compared to their counterparts in the formal sector. The people in the informal sector were prone to experiencing more human health risks most especially in times of flooding than those in the formal sector. It was revealed that if there was a heavy downpour or a flood, for example, more people in the informal sector would be hospitalized than would their counterparts in the formal sector, as a result of easily contracting waterborne infections such as cholera, typhoid, and dysentery as well as urinary tract infections most especially for the female gender.

This is because the majority of the people in this vulnerable group can not afford to buy bottled water every day, and their literacy levels, coupled with low incomes, meant that they cannot as well afford decent housing, cannot dispose of human waste in proper facilities. However, some individuals in the formal sector would also get affected by human health risks such as drowning, most especially if driving and cars got washed away by flash floods, or due to heatwaves or, although in rare cases, if they contracted a waterborne infection.

Table 4: Descriptive Statistics on the Magnitude of Climate Change Impacts

	Prolonged dry spells	Erratic heavy rains	Seasonal floods
Mean	1.4316	1.5000	1.1368
Std. Deviation	.49636	.50107	.34432
Variance	.246	.251	.119

From Table 4, the study analyzed the magnitude of major climatic impacts which cause serious

human health risks in Kawaala, a Kampala suburb and the findings show that erratic heavy rains posed more human health risks [Mean = 1.500, SD .50107] accompanied by prolonged dry spells [Mean = 1.4316, SD = .49636] followed by floods [Mean = 1.1368, SD = .34432]. In-depth interviews and Focus Group Discussions with the respondents showed that prolonged dry spells, erratic heavy rains and floods were identified as the greatest threats leading to water scarcity in the area. It was revealed that the area flooded, many residents were unable to access water collection points. Latrines got submerged and other waterborne sanitary systems in some places overflowed, which aggravated the spread of water-borne infections and reduced the availability of clean water for drinking, cooking and personal hygiene.

Flooding also caused serious consequences for the people of Kawaala areas such as school-going children, young girls, older persons and at times men would drown and eventually die. It was revealed that prolonged dry spells caused serious food insecurity leading to hunger and starvation for some individuals.

Table 5: Model Summary for Climate Change Impacts

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate
1		.792 ^a	.628	.618	.29789

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	33.217	6	5.536	62.386	.000 ^b
	Residual	19.700	222	.089		
	Total	52.917	228			

- a. Dependent Variable: Reduced availability of water for drinking, cooking and hygiene
- b. Predictors: (Constant), Prolonged dry spells, Erratic heavy rains, Seasonal Floods, Disruption of agricultural and other supportive ecosystems, Landslides/ Mudslides, Hailstones.

The measure of the relationship between climate change impacts and human health risks is shown in table 5. The results indicate that climate change impacts are significant predictors for reduced availability of water for drinking, cooking and personal hygiene. This is evidenced by $R = .792$ which accounts for 79% indicating that climate change impacts and reduction in water for drinking, cooking and hygiene are strongly positively correlated.

Table 6: Regression to Predict Water Availability. Coefficients.

Regression Model		Standardized		Unstandardized coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.356	.603		11.712	.000
	Prolonged dry spells	.827	.071	.852	4.288	.000
	Erratic heavy rains	-.271	.063	-.282	-4.851	.000
	Seasonal Floods	-.398	.082	-.287	1.808	.072
	Landslides/ Mudslides	.560	.309	.077	3.838	.000
	Hailstones	.257	.067	.223	-4.605	.000
	Disruption of agricultural and other supportive ecosystems	-.331	.072	-.241		

a. Dependent Variable: Reduced availability of water for drinking, cooking and hygiene

It can be seen from Table 6 that the risk of water stress was largely dependent on prolonged dry spells than the rest of the other predictors in the model. Statistical analysis of this result yielded the unstandardized positive beta value of .827 and its equivalent t-value of 4.288 which is also positive.

Table 7: ANOVA^a. Relationship between Drowning and Climate Change Impacts

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	21.271	4	5.318	35.255	.000 ^b
Residual	30.469	202	.151		
Total	51.739	206			

Regression Model		Standardized		Unstandardized coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.493	.280		-1.762	.080
	Erratic heavy rains	.358	.055	.359	6.536	.000
	Seasonal Floods	.209	.082	.143	2.540	.012
	Landslides/ Mudslides	.073	.112	.035	.651	.516
	Hailstones	.598	.070	.490	8.559	.000
	(Constant)	-.493	.280		-1.762	.080

a. Dependent Variable: Drowning

b. Predictors: (Constant), Hailstones, Landslides/ Mudslides, Erratic heavy rains, Seasonal Floods.

In determining which climate change impacts would lead to drowning, four possible variables were analyzed together and the results are shown in Table 7. The model reveals that although a statistically calculated p-value = 0.000, $P < .05$ shows that the results were significant, the

F- statistic ($F = 35.25$) was too low meaning that in the event of a climatic impact such as those mentioned in table 7, the occurrence of drowning would only be by chance. The study further reveals that only three variables yielded P-values less than 0.05 i.e. erratic heavy rains; $\beta = .358$, $P = .000$, seasonal floods $\beta = .209$ $P = .012$ and hailstones; $\beta = .598$, $P = .000$. Out of the three variables tested, it can be seen that the chance of one getting drowned was largely dependent on heavy rains, floods and hailstones.

Table 8: Coefficients. Predicting the Occurrence of Waterborne Infections

Model	Un-standardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
Constant	1.000	.098		10.173	.000
Erratic heavy rains	.282	.062	.285	4.537	.000

a. Dependent Variable: Increase in waterborne infections

The study investigated the contribution of erratic heavy rains towards an increase in waterborne infections and it can be seen that the un-standardized beta coefficient value of 0.282 positive and its equivalent t-value ($t = 4.537$, with $P < 0.05$) was statistically significant. This means that whenever there was an occurrence of erratic heavy rains, there was also a 28% chance of increasing the spread of waterborne infections in Kawaala, a Kampala suburb.

Table 9: Excluded Variable

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
.Seasonal Floods	.44 ^b	.697	.486	.46	.999

a. Dependent Variable: Increase in waterborne infections

b. Predictors in the Model: (Constant), Erratic heavy rains

The collinearity statistic was run and the results indicate that there is a strong positive relationship of 0.999 between erratic heavy rains and increases in waterborne infections. This, therefore, implies that the occurrence of erratic heavy rains is a predictor ($\text{Beta} = 0.44$) of an increase in waterborne infections.

Table 10: Analysis of Gender Aspects with Occurrence of Human Health Risks

Human Health Risks	Gender Aspects					Total
	Women	Youth	Children	Men	Elderly	
Death	50	17	50	17	51	83
Drowning	67	17	67	17	68	117
Increase in waterborne infections	67	17	85	17	51	135
Rising temperatures increase the spread of malaria in some locations	67	17	68	17	51	101
Malnutrition	35	17	34	17	34	35
Food insecurity	82	49	82	49	66	115
Reduced availability of water for drinking, cooking and hygiene	67	32	83	32	32	84
Psychological trauma	18	17	17	17	17	18
Total	116	49	167	49	100	234

Table 10 shows the results of the cross-tabulation between human health risks and the gender aspects. The study considered women, youth, children, men, and the elderly. The respondents cited that human health risks resulting from climate change affected all aspects of gender. It was found that the risk of drowning and subsequent death most especially due to heavy rains and flooding affected mostly the elderly, women and children while an increase in waterborne infections was prominent among the children and women. Rising temperatures were reported to increase the spread of malaria in some locations, but children were the most affected by the disease. A high number of respondents (83) cited that reduced availability of water for drinking, cooking and hygiene is also a major health risk affecting mostly children and women. It was revealed that while the youth have sufficient energy to run up and down to search for drinking water, the children have to rely on their parents in times of water stress. It was observed that the risk of psychological trauma seems not to have any significant impact on the residents of Kawaala suburb.

Table 11: Effects of Climate Change and Human Health risks on Gender Aspects

	N	Percent	Percent of Cases
Abandon homes and migrate permanently	134	19.1%	57.5%
Family breakdown	133	19.0%	57.1%
Sexual Gender-Based Violence such as rape	102	14.6%	43.8%
School dropout for school going children	182	26.0%	78.1%
Reversal of roles and responsibilities in households	150	21.4%	64.4%

Table 11 shows the general effects of climate change in relation to human health risks. Key

among the major findings was that a high number of children dropped out of school and flocked to the streets in the city to beg, as a result of not being able to cope with the harsh environmental conditions. Many people have ended up abandoning homes for new areas. Some respondents revealed that there were cases of sexual harassment such as rape, while in many households, men neglected their responsibilities and left them to their wives, resulting in some cases in family breakdown.

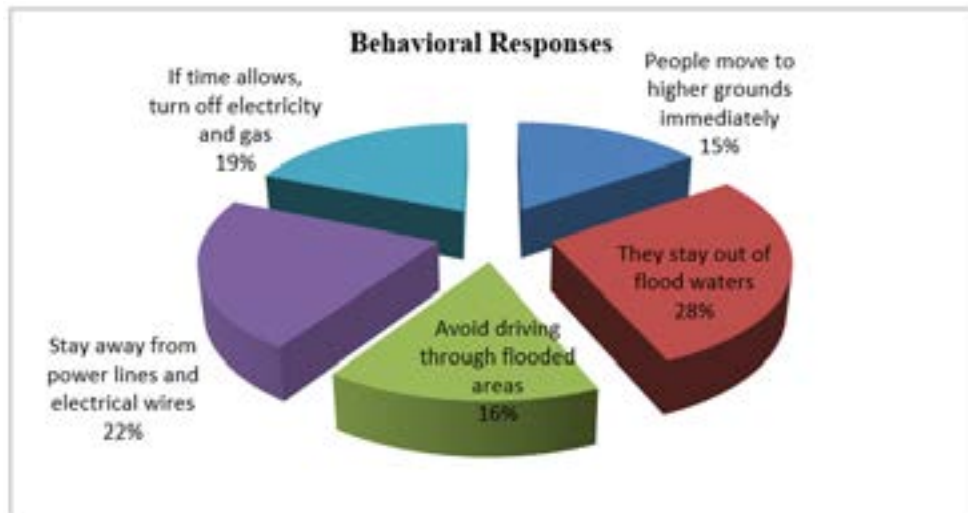


Figure 3: Behavioral Responses

Some behavioural responses were statistically analyzed and the study showed that there were significant variations between respondents who preferred to stay indoors during a flood and those who moved and sought raised ground immediately. Some respondents said that when floods came, they turned off electricity and gas while others said that they stay away from power lines and electrical wires because they understand the danger of being electrocuted while walking in the floodwaters.

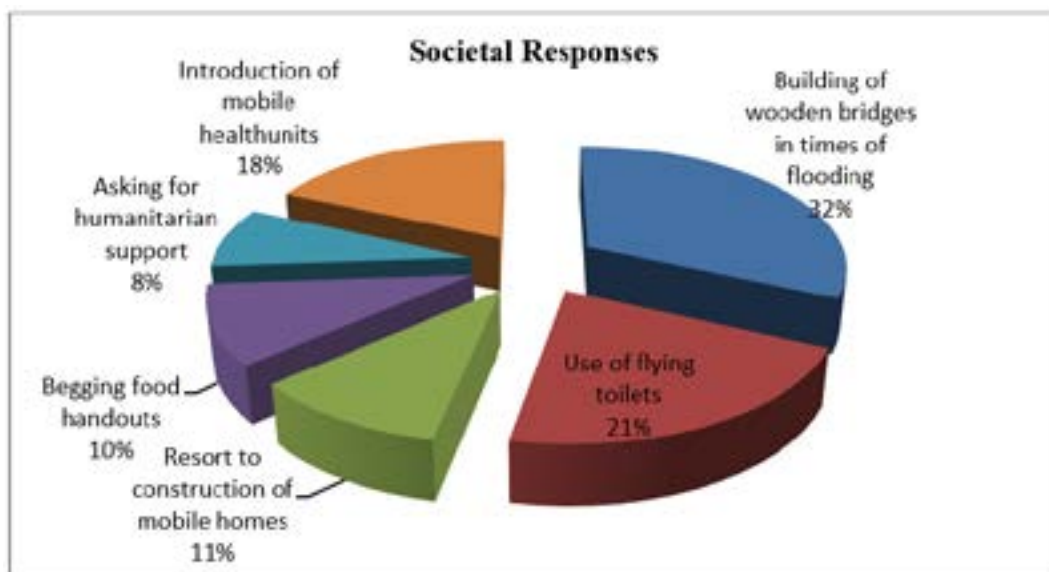


Figure 4: Societal Responses to Climate Change Impacts

Societal responses to human health risks were studied and the results showed the following. Individuals built wooden bridges (32%), used flying toilets (21%), resorted to the construction of mobile homes (11%), begged for food handouts (10%), and asked for humanitarian support (8%) while others resorted to the introduction of mobile health units (18%). As seen in figure 4, the biggest percentage (32%) of the respondents reported that it was very common for the people of Kawaala to construct wooden bridges before and after a flood has occurred. The study found that these wooden bridges were the leading cause of drowning for some individuals. Several individuals were reported to have lost their lives due to drowning as their bodies were found floating on running water in open water channels and trenches. This study further revealed that these cases of lost lives as a result of drowning point to individuals who insist and walking in floodwaters during heavy rains and those who use wooden bridges and fall in the water when the structures collapse. It was further established that individuals defecated in polythene bags and threw them on other people's rooftops because they feared to get out of their houses when the area flooded. This particular problem was reported to be the leading cause of many hospitalizations due to the spread of waterborne infections such as cholera, typhoid and dysentery in many parts of Kawaala.

Reliability Statistics

The statistical package for social scientists (SPSS version 20) was used to establish the reliability of the results.

Table 12: Rule of Thumb for Cronbach's Alpha (Coefficient Value)

Alpha ($\bar{\alpha}$) Coefficient Range	Strength of Association
<0.60	Poor
0.60 to < 0.70	Moderate
0.70 to < 0.80	Good
0.80 to < 0.90	Very Good
0.90	Excellent

Source: Adapted from Lund Research Ltd © 2018

Sekaran and Bougie (2010) suggested that using Cronbach's alpha which is the reliability coefficient (most common measure of internal consistency), is a good measure of determining how well the items in a set are positively correlated to one another. Their argument is based on the rule of thumb for Cronbach's alpha coefficient values which give the strength of association of the studied variables against the standard of 0.70 as given in table 12.

Table 13: Summary of Reliability Statistics on Human Health Risks

No	Constructs	Cronbach's Alpha	Number of Items	Number of Respondents
1	Death	.662	14	234
2	Drowning	.673	14	234
3	Increase in waterborne infections	.748	14	234
4	Rising temperatures increase the spread of malaria in some locations	.710	14	234
5	Malnutrition	.702	14	234
6	Food insecurity	.681	14	234
7	Reduced availability of water for drinking, cooking and hygiene	.742	14	234
8	Psychological trauma	.704	14	234
	Average	.724		

Source: Primary Data © 2019

The variables were tested as seen in table 13 above. Death, drowning and food insecurity as dependent variables scored poorly during the reliability test with values ranging from 0.662, 0.673 and 0.681 respectively which are slightly below the standard Cronbach's coefficient of 0.70, meaning that their strength of association was moderately reliable. However, the rest of the variables under investigation are in good reliability since their Cronbach's alpha is equal or slightly exceeds the standard coefficient value of 0.7. It can, therefore, be concluded that most of the variables fall under reliability scores and are, therefore, in agreement with the rule of thumb which indicates that a Cronbach's alpha value which falls within the coefficient range of between 0.7- 0.8 is good while that between 0.80 to < 0.90 is very good as seen in the table. This means, therefore, that the 234 respondents in various age groups and gender were in a position to provide good results to this study.

Conclusions and recommendation

There is a strong positive relationship between climate change impacts and the occurrence of human health risks. An increase in climate change impacts potentially led to an increase in health risks which confirms the findings of Davenport (2016) and Meehl et al. (2007) in the literature review. Prolonged dry spells directly affected food security and led to a reduction in the quality of water for domestic consumption, while erratic heavy rains and floods led to an increase in waterborne infections, drowning and death for some individuals. An increase in temperatures on the other hand led to the spread of malaria in some locations because mosquitos larvae hatch in warmer temperatures quickly and spread to many areas. During inundation, individuals

resorted to building wooden bridges which further added to the chances of drowning for school-going children, women and the elderly. The study further revealed that due to the low incomes of individuals, several resorted to begging for food handouts, asking for humanitarian support while others end up constructing makeshift shelters.

Therefore, the National Environmental Management Authority together with the Ministry of Water and Environment and Ministry of Health, should not only spend government resources on curative approaches but should also put in more resources on mitigation measures and building resilience against the impacts of climate change. The study further recommends that people should conserve the environment both in the rural, urban, and peri-urban areas and they should learn to co-exist with supportive natural ecosystems so that climate change impacts do not continue to cause aggravated human health risks such as those covered under this study.

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