

MOMBASA CITY RESIDENTS' PERCEPTION OF HEALTH RISKS OF CLIMATE CHANGE AND ITS IMPACT ON BEHAVIOUR CHANGE

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ABSTRACT

Climate change has proved to have adverse consequences on human health as well as exacerbates health risks. These effects on human health are diverse in nature and range from direct effects due to extreme weather events such as heat waves, floods and storms, to indirect effects such as those caused by water and food shortages. However, there have been relatively few studies on public awareness, understanding and concern on the health threat of climate change. Mombasa City has been identified as highly vulnerable concerning adverse effects of climate change due to its low altitude and high temperatures. This paper examines Mombasa City residents' perception of health risks of climate change and its impact on their behavior change. This study was a cross-sectional survey of respondents from three residential areas in Mombasa City, Kenya. A total of 300 households were selected through random and systematic sampling, however, of the 300 households selected, the researchers were able to retrieve 290 properly completed questionnaires. About 10 (3%) respondents were not aware of climate change and thus were left out of subsequent analysis. The questionnaire was supplemented with 9 focus group discussions (FGDs) and 9 key informant interviews (KIIs). Personal perceived susceptibility to the health threats of climate change was explored with the Health Belief Model (HBM) as a conceptual frame and analyzed through logistic regressions. The study found that over 90% of the respondents perceived that climate change poses a risk to their health. They identified the diseases that have increased in frequency and severity as a result of climate change as normal cold/cough/fever (83.8%), malaria (80.3%), headaches (72.4%), diarrhea (56.2%) and cholera (54.4%). New diseases identified to have emerged due to climate change were dengue and allergies. Up to 81.0% reported that there are barriers or obstacles to protecting themselves from negative health consequences of climate change. The major obstacles identified include lack of skills, lack of personal motivation to act, lack of money or resources, lack of help from others, lack of knowledge on the right steps to take, lack of time and the belief that the government will act to protect people from negative impacts of climate change. Finally, the study found that only a minority of the respondents (23.1%) have reduced energy consumption based on their knowledge of climate change as a human health risk. However, of those who have reduced their energy consumption, all are those who have perceived climate change as having serious consequences on their health. The study concludes that behavior change is dependent on perceived susceptibility to threats of climate change and having relevant information necessary to protect oneself against the health threat of climate change. These results support calls for framing climate change from a health perspective to motivate behavior change and the need to equip the public with skills to protect themselves from the negative health consequences of climate change.

Keywords: Mombasa City, urban residents, perception, climate change, health risks, behavior change

Introduction

There is scientific consensus that climate change is taking place (Ebi, Kovats and Menne, 2006; Frumkin, Hess, Luber, Mmalilay & McGeehin, 2008; IPCC, 2007; Omoruyi and Kunle, 2012; WHO Regional Office for Europe, 2003). This is evidenced by extreme weather events such as rising temperatures, melting ice, prolonged drought, increased incidences of flooding and storms among others (Frumki *et al.*, 2008; IPCC, 2007). Literature indicates that such changes generate various health risks to human (Bhandar, Gurung, Dhimal & Bhusal, 2012; Frumki *et al.* 2008). These include death and injuries from severe climate events such as flooding, heat waves and storms (Confalonieri, Akhtar, Ebi, Hauengue, Kovats & Woodward, 2007; Frumki *et al.* 2008; Nitschke, Tucker & Bi, 2007), changes in patterns, frequency and transmissibility of infectious diseases (Bambrick, Capon, Baernett, Beaty & John, 2011; Confalonieri *et al.*, 2007) and malnutrition due to food shortages arising from prolonged drought (Bambrick *et al.*, 2011 ; Confalonieri *et al.*, 2007; Ebi *et al.*, 2006). According to World Health Organization (WHO) (2009) climate change also brings new challenges particularly to the control of infectious diseases that are highly climate sensitive as regards temperature and rainfall including cholera and diarrheal diseases as well as malaria and dengue.

The indirect impacts include mental health consequences, trauma from violence associated with excessive heat, population dislocation, conflicts and amplification of HIV/Aids (Bambrick *et al.*, 2011 ; Confalonieri *et al.*, 2007; Ebi *et al.*, 2006; Frumkin *et al.*, 2008). Reuveny (2007) reckons that epidemiological research that until recently had only linked climate change to human injuries, deaths and illnesses resulting from heat waves and infectious diseases is beginning to be augmented by studies that show other potential stressors that may also impact population health, such as refugee migrations and increased vulnerability to poverty among others. According to WHO, “the greatest impacts may come from the gradual build-up of pressure on the natural, economic and social systems that sustain health. These gradual stresses include reductions and seasonal changes in the availability of fresh water, regional drops in food production and rising sea level. Each of these changes has the potential to force population displacement and increase the risks of civil conflicts” (WHO, 2009, p. 2). In addition, according to Epstein (2005), changes in the patterns of pests, parasites, and pathogens affecting wildlife, livestock, agriculture, forests, and coastal marine organisms can alter ecosystem composition and functions, and changes in these life-support systems carry implications for human health.

In Kenya one of the main impacts of climate change identified by the National Climate Change Response Strategy (NCCRS) is that diseases such as malaria, cholera, ebola, lyme disease, plague, tuberculosis, sleeping sickness, yellow fever, and Rift valley fever are expected to spread as temperatures rise and precipitation patterns change. In addition, during floods, diseases such as typhoid, amoeba, cholera, and bilharzias reach epidemic levels (Government of Kenya, 2010). In Mombasa Town, according to Awuor, Orindi & Adwera (2008) frequent occurrences of flooding have led to increased incidences of disease such as cholera and typhoid. While an increase in temperature and humidity could create health related problem such as heat stress.

In sum, “climate change threatens to slow, halt or reverse the progress that the global public health community is now making against many of these diseases” (WHO, 2009, p. 2). In Kenya in particular disease outbreaks as a result of the impacts of climate change will further burden the

already stretched public health infrastructure(Government of Kenya (GoK), 2010). It is therefore of paramount importance to interrogate public knowledge of climate change as a human health risk in order to understand their preparedness and strategies of mitigation. According to Frumkin *et al.* (2008) since climate change has become a certainty therefore there is need for all to anticipate and understand the health burdens it will impose and the likely response they will adapt. One way of doing so is to interrogate the public understanding of the health risks climate change will impose. Leiserowitz (2006) points out that social scientists have found that public risk perceptions strongly influence the way people respond to hazards. What the public perceives as a risk, why they perceive it that way, and how they will subsequently behave are thus vital questions for policy makers attempting to address global climate change.

In the theoretical debates over the role of perception in human behavior and its effect on decision-making (Fischhoff & Furby, 1983), it has been generally noted that if a community or government perceives a problem to be a very serious threat, as in the case of HIV and AIDS, then it is likely to initiate appropriate intervention measures(Garret, 2000; Sanders & Sambo, 1991). Weber (2006) and Lorenzoni & Pidgeon (2006) have shown that the perception of the risk of climate change on the part of a society may influence its decision as to whether it should do something about it, and subsequently how to adapt to the perceived threat. However, there has been relatively little research on public awareness and understanding of the human health impacts and risks associated with climate change (Akerlof *et al.*, 2010). This study undertook to address this gap by providing a study of the perception of climate change as a human health risk among urban residents of Mombasa City.

According to Toan *et al.* (2014), although the World Health Organization emphasized that climate change is a significant and emerging threat to public health, especially in lower income populations and tropical/subtropical countries, people in Asia and Africa were least likely to perceive global climate change as a threat, this calls for more studies in these areas with a view to increasing awareness. BBC World Service Trust (2010) reiterates that it is clear that there is a dearth of research on perception of climate change as a threat in Africa and therefore it is essential to address this problem if communication is to improve.

WH O (2009) points out that although all populations will be affected by climate change, the initial health risks vary greatly depending on where and how people live. Those living in small islands and other coastal regions and megacities are some of those that are particularly vulnerable. Mombasa City is one such area. Mombasa City in particular has a history of frequent natural disasters associated with extreme climatic events such as severe flooding, most recently the severe rain-induced flooding in October 2006(Awuor *et al.*, 2008; Kebede, Hanson, Nicholls, & Mokrech, 2010) and May 2015, that have caused serious damage to infrastructure and could further create significant health related problems such as water-borne diseases, diarrheal diseases and heat stress According to UN-HABITAT (2009) changes in sea level and storm surges are components of climate change which have the potential to further increasing the threats of flooding within the city and further expose the residents to the associated health risks. This calls for studies geared at assessing the residents' preparedness to climate change related disasters. This study was therefore designed to establish the city residents' perception of the health risks of climate change and its impact on behavior change.

Materials and Methods

The present study was a cross-sectional survey targeting Mombasa City residents. The city was selected because of its high vulnerability to climate change due to its low altitude, and high temperatures and humidity levels (Awuor *et al.*, 2008). An increase in temperatures and humidity could create health-related problems such as heat stress. The low altitude is susceptible to frequent floods that lead to outbreak of contagious diseases such as typhoid, amoeba, cholera, and bilharzias as well as occurrence of malaria (Kebede *et al.*, 2010). The study covered three residential areas in Mombasa City, that is, Moroto (low income), Tudor (middle income) and Nyalı (high income) based on information from Kenya National Bureau of Statistics office in Mombasa and housing division, Mombasa County. Stratified sampling was used to ensure that the three categories of residents are represented in the sample. After the residential areas were sampled, the next stage was to sample respondents. A total of 300 households were selected, 150 from low income 100 from middle income and 50 from high income based on the number of households and population density as well as representativeness to the target population. Random sampling was used to pick respondents from the high income area where the list of plots was available from the lands office, Mombasa County. From the 491 listed plots, the numbers were randomly run in the computer to pick 50 numbers. For the middle and low income areas systematic sampling method was used and it involved taking every *k*th household as per the number of households in the sampled residential estate. To pick on the starting point, numbers were assigned to the first 30 households in each category and written in pieces of papers, then one was drawn at random and this was taken as the starting point. In picking the direction of movement preliminary survey was done and specific paths or roads/streets that separate houses noted. The *k*th variable varied depending on the number of houses and the population density in the selected residential areas.

Primary data for the study were collected with questionnaires administered on 300 households. However, the researchers were able to retrieve 290 properly completed questionnaires. This represented 97% return rate. This percentage return rate was above the recommended 80% by Mmaduakonam (1998) and hence deemed adequate for the study. About 10 (3%) respondents were not aware of climate change and thus were left out of subsequent analysis. The questionnaire was prepared in consideration with previous works for reference (Haque *et al.*, 2012; Akerlof *et al.*, 2010; Semenza, Hall, Wislon, Bontempo, Sailor, & George, 2008) and in consultation with experts. The questionnaire was translated into Kiswahili language with back translation into English in order to ensure that the Kiswahili version corresponded in meaning with the English version. The questionnaire was supplemented with 9 focus group discussions (FGDs) and 9 key informant interviews (KIIs). The FGDs consisted of between 8 to 12 participants of mixed gender. The participants in the FGDs were selected purposively from those who had participated in the survey based on the analysis of their responses. Six key informants were drawn from health officials and three officers from meteorological departments located in Mombasa city. There were no inducements for participants to participate in the study.

A pilot study was conducted in June, 2014 on an original sample of 20 heads of households. Internal reliability testing of indices was carried out using Cronbach's α . A reliability coefficient of at least 0.7 is considered acceptable (Santos, & Reynolds, 1999). The reliability obtained was 0.86 which was adequate for the study. The data from the questionnaire were coded, entered and

analyzed using SPSS version 20. Quantitative analysis involved both descriptive and inferential statistics. Descriptive statistics generated frequencies, totals, percentages, and means. Tables were used to enhance data presentation. These data were further subjected to significance tests using Logit model to determine the dominant factors that influence behavior change such as reduced energy consumption at home (mitigation), having emergency kit at home and having emergency kit. All explanatory variables were significantly estimated at the 0.05 significance level.

Qualitative analysis considered the inferences that were made from the opinions of the respondents during the KIIs and FGDs (Mugenda & Mugenda, 1999). The qualitative data were transcribed and analyzed according to the themes. Matrices were used to summarize the data. The matrix contained three columns, the first column contained the raw data (e.g. views) obtained in the field, the second column the description that placed the data into some categories and the third column the memos that were made by the researcher such as relation with some other categories and suggestions for further action. This analysis was then thematically presented in narrative form and where possible chart and tabular forms. Direct quotes were used to demonstrate how the findings and interpretation had arisen. The study protocol was approved by the Institutional Research and Ethics Committee (IREC) at Moi Teaching and Referral Hospital, Moi University, Kenya. Permission for conducting the study was also obtained from the National Commission for Science, Technology and Innovation (NACOSTI), Kenya and the County Commissioner's Office, Mombasa County. We obtained written informed consent from each household head after explaining the rationale of the study. We ensured the confidentiality and anonymity of participants. Respondents were informed of the right not to answer any of the asked questions or leave the interview without reason. A few of the respondents could not read or write and provided verbal consent.

Results

Out of a total sample of 300 individuals, the researchers were able to retrieve only 290 properly completed questionnaires (96.7%). Out of the 290, 10 (3.4%) respondents indicated that they were not sure whether climate change was happening and thus apart from capturing their socio-economic characteristics they were excluded from subsequent analysis. Table 1 shows the demographic characteristics of the study population. A total of 54.8% were male and 45.2% were female. The dominant age bracket was 25-35 years, which had 48.6% of the respondents, followed by 36-45 years with 28.6% while the least was over 55 years at 2.8%. The mean age was 40 years for the sample. In regard to the marital status, 53.1% were married, 33.8% single, while 7.9% were either divorced or separated and the remaining 5.2% were widowed. With respect to educational level, 39.3% reported that they had attained secondary school education, 27.9% had university education while 21.7% and 9.3% had tertiary or middle college and primary level of education respectively. At least 1.7% had no formal education. Income levels of respondents ranged from Kshs. 1,500 (\$15) to the highest Ksh. 300,000 (\$3,000) however, about 17% did not respond or reported lack of steady income and hence did not indicate their monthly income. The dominant income category was below Kshs. 10,000 (\$100) (37.6%) followed by Kshs. 10,000 (\$100)-30,000 (\$300) (18.6%).

Most of the survey respondents (90.4%) perceived climate change as posing a threat to their health. In terms of education, those with middle college education (95.1%) and secondary level

(91.0%) had a higher proportion of those who perceived climate change as a health risk in comparison to those with primary or no formal education (88.9%) and those with university education (85.5%). In regard to other people's health, 95.7% of the respondents reported that climate change will affect other people's health as well

FGDs and KIIs also reported a rise in climate-variability induced diseases in Mombasa. Participants generally agreed that climate change has and will impact negatively on their health and well-being. One FGD participant opined that, "We are witnessing increased incidences of diseases and people are even dying younger. I don't know what will happen in future, but for sure we shall experience more severe occurrences of diseases due to climate change." On their overall observation of the frequency of climate change/variability induced diseases and health problems in their locality, 86.4% reported increased or highly increased frequency of diseases, this was especially during the cold (71.1%) and rainy seasons (74.8%) (Table 2). However they reported that it was lower during the hot season (47.9%). Among the diseases reported to have increased in frequency (Table 3) included normal cold or fever (85.0%), malaria (81.4%), headache (73.9%), diarrhea (56.8%), dysentery (44.3%) and typhoid (42.2%). Interview with health officials yielded almost the same results, the diseases mentioned included malaria, headaches, respiratory/breathing problems and allergies, diarrhea, cholera, measles and tuberculosis.

In response to emergence of new diseases attributable to climate change, participants in the FGDs complained of new disease outbreaks some of which are unknown to them. One female participant from the low income residential area lamented that, "these days this phenomenon of climate change has brought about many diseases that are unknown, at times you feel itchy and scratch yourself, the skin peels off and you get blisters, and also you get headaches every now and then. And even many people are complaining about high blood pressure and heatstroke".

Perceived susceptibility to health risk of climate change (Table 4) was further explored using the HBM. The perceived susceptibility was captured by asking respondents if climate change could affect their way of life or lifestyle; 88.1% of respondents recognized a certain level of susceptibility. Of the respondents, 87.1% reported that climate change could potentially endanger their lives and pose adverse personal effects (perceived severity). Further to this, it was noted that 71.8% believed that personal preparation could save their life from the impacts of climate change. However, about 83.2% saw obstacles or barriers to protecting themselves from negative consequences of climate change. These included lack of skills (66.2%), lack of personal motivation to act (64.1%), lack of money or resources (63.4%), lack of help from others (62.8%), lack of knowledge on the right steps to take (59.0%), lack of time (56.9%), belief that the government will act to protect people from negative impacts of climate change (54.8%) and the feeling that one's action won't make a difference anyway (37.6%). A minority (7.1%) of respondents felt that they have the necessary information to prepare for climate change impacts as well as the confidence and ability to protect themselves from dangerous events (4.3%).

Table 1: Characteristics of the Survey Participants

Socio-economic Characteristics	Frequency	%
Residential area		
Low	144	49.7
Middle	97	33.4
High	49	16.9
Sex		
Male	159	54.8
Female	131	45.2
Age Category (years)		
Below 25	40	13.8
25-35	141	48.6
36-45	83	28.6
46-55	18	6.2
Over 55	8	2.8
Marital Status		
Married	154	53.1
Single	98	33.8
Divorced/Separated	23	7.9
Widowed	15	5.2
Educational Attainment		
No formal education	5	1.7
Primary	27	9.3
Secondary	114	39.3
Tertiary	63	21.7
University	81	27.9
Monthly Income Level (Kshs)		
No steady income/No response	50	17.2
Below 10,000	109	37.9
10,000-30,000	54	18.3
30,001-50,000	36	12.4
50,001-70,000	18	6.2
70,001-90,000	9	3.1
Over 90,000	14	4.8
Number of Household Member		
One	52	17.9
2-5	201	69.3
6-9	36	12.4
10 and above	1	0.3

Table 2: Reported Changes in Frequency of Disease Occurrence Attributable to Climate Change

What your overall perception about disease due to climate/variability in your locality	f	%
Highly increased	77	27.5
Increased	165	58.9
Somewhat increased	27	9.6
Decreased	3	1.1
Highly decreased	4	1.4
Don't know	4	1.4
Total	280	100.0
What is the present frequency of disease in your locality during hot season compared to the past 5 to 10 years	f	%
Very high	5	1.7
High	106	36.6
Slightly high	31	10.7
Low	139	47.9
Very low	4	1.4
Don't know	5	1.7
Total	280	100.0
What is the present frequency of disease in your locality during cold season compared to the past 5 to 10 years	f	%
Very high	46	15.9
High	189	65.2
Slightly high	35	12.1
Low	12	4.1
Very low	2	0.7
Don't know	6	2.1
Total	280	100.0
What is the present frequency of disease in your locality during rainy season compared to the past 5 to 10 years	n	%
Very high	71	24.5
High	146	50.3
Slightly high	60	20.7
Low	9	3.1
Very low	0	0.0
Don't know	4	1.4
Total	280	100.0

Table 3: Diseases Reported to have increased in Frequency due to Climate Change

Diseases	Frequency	%
Normal cold/fever	238	85.0
Malaria	228	81.4
Headache	207	73.9
Diarrhea	159	56.8
Dysentery	124	44.3
Typhoid	118	42.2

Table 4: Assessment of Perceived Susceptibility to Climate Change

Category	Survey Question	Proportion
Perceived susceptibility	Do you believe climate change could affect your way of life or lifestyle if you don't prepare?	0.881
Perceived severity	Do you believe that climate change can endanger your life?	0.871
Perceived benefit	Can personal preparation for climate change save your life?	0.718
Perceived barriers	Are there serious obstacles and barriers to protecting yourself from negative consequences of climate change?	0.832
Cues for action	Do you think you have the information necessary to prepare for the impacts of climate change?	0.071
Self-efficacy	Do you think that you have the ability and power to protect yourself from dangerous events from climate change?	0.043
Mitigation	Have you reduced your energy consumption in response to what you have heard about global climate change?	0.244
Emergency plan	Does your household currently have a plan for what to do to protect yourself and your family in the event of a disaster or emergency?	0.039
Emergency kit	Does your household have emergency kit such as first aid kit that can be useful in the event of disaster or emergency	0.354

Based on these we explored whether the respondents were ready for behavior change. The findings showed that only 23.1% of the respondents reported to have reduced energy consumption at home based on what they have heard about climate change. Reported energy conservation steps included, conserved water (14.3%), reduction in use of paraffin or gas at home (1.4%), reduced energy consumption (2.2%), walking or cycling to work, to go shopping or other places (3.6%), use of renewable energy e.g. solar (1.5%). Among those who did not

report any energy conservation efforts, 57.1% cited lack of money to reduce energy consumption, 55.3% know what energy consumption to reduce but don't know how to change, 45.8% feel that reducing their energy consumption will not make a difference and that it is inconveniencing to walk, 42.9% don't have the capacity to conserve water, 27.3% don't have time to reduce energy consumption and 20.7% don't know what energy consumption to reduce. All the respondents who reported to have changed behavior at home also perceived climate change as posing a threat to their health, while none of those who had not perceived climate change as a threat had changed behavior.

A number of respondents affirmed autonomous adaptive behavior during adverse weather conditions. These steps included having flash light and batteries (86.1%), having sufficient clean water to last 3 days, having a first aid kit (35.4%), having a thermometer (10.4%). The respondents were also asked whether their household currently had a plan for what to do to protect themselves and their family in the event of a disaster or emergency such as how to evacuate the home or contact a disaster help centre, only 3.9% claimed having such a plan. Of those that did not have an emergency plan 96.7% said that they have never considered it.

With respect to the predictive power of HBM constructs as independent variables, three parallel logistic models were performed based on mitigation (reduced energy consumption), having emergency kit and having an emergency plan. Table 5 presents the odd ratios from the three models. According to the results, cue to action (having the information necessary to prepare for the health impacts of climate change) (OR= 2.954, 95% CI 1.169-7.489; $p < 0.05$) and gender (OR= 0.644, 95% CI 0.417-0.993; $p < 0.05$) are significant predictors of mitigation (reducing energy consumption). This means that those having necessary information are 2.954 times likely to reduce their energy consumption at home. Gender is negatively related to mitigation with women less likely to reduce energy consumption. As for having an emergency kit, the significant predictor was gender (OR= 0.488, 95% CI 0.324-0.735; $p < 0.05$). This means that gender is negatively related to having an emergency kit with women less likely to have an emergency kit at home. Finally, for having emergency plan, the significant predictors are cue to action (OR= 54.409, 95% CI 8.516-347.643; $p < 0.05$) and perceived barriers (i.e. belief that there are obstacles and barriers to protecting oneself from negative consequences of climate change) (OR= 0.110, 95% CI 0.19-0.634; $p < 0.05$). This means that those having necessary information are 54.409 times likely to have an emergency plan. While those who perceive that there are obstacles to protecting themselves against negative consequences are less likely to have an emergency plan

Discussions

Majority of the Mombasa City residents have clear perception of health risk of climate change. They reported that climate change will not only affect their own health but of other people and of the future generation. Most respondents also reported that diseases have increased in frequency, notably normal cold, malaria, headache, diarrhea and typhoid. These findings are in tandem with scientific health reports that show an upsurge in disease outbreak associated with climate events in Mombasa City (Snow *et al.*, 2015; Ellis, *et al.*, 2015). This shows that lay men's understanding of health risk of climate change in Mombasa City is quite high. This study is among the first to assess urban residents' perception of the health risks of climate change in Kenya and may constitute an indication of the current status of awareness.

Table 5: Logistic Model

HBM Constructs	Mitigation			Emergency Kit			Emergency Plan		
	B	Sig	OR	B	Sig	OR	B	Sig	OR
Severity	-0.485	0.075	0.616	-0.230	0.350	0.795	-0.047	0.944	0.955
Susceptibility	-0.500	0.114	0.606	-0.303	0.264	0.739	-0.497	0.548	0.608
Benefits	0.177	0.382	1.194	-0.089	0.692	0.915	0.694	0.365	2.002
Barriers	-0.361	0.277	0.697	0.543	1.103	1.721	-2.208	0.014	0.110
Cue to action	1.083	0.022	2.954	0.569	0.224	1.767	3.997	0.001	54.409
Self-efficacy	0.197	0.751	1.218	-0.364	0.552	0.695	1.258	0.243	3.517
Age	0.249	0.219	1.282	-0.096	0.601	0.908	-0.695	0.233	0.499
Education	-0.140	0.657	0.869	0.358	0.232	1.431	0.004	0.996	1.004
Gender	-0.441	0.046	0.644	-0.717	0.001	0.488	-0.851	0.147	0.427
Marital status	-0.057	0.749	0.945	-0.011	0.945	0.989	-0.731	0.149	0.481
Occupation	0.025	0.515	1.025	0.045	0.216	1.048	0.039	0.702	1.040
Residence area	0.041	0.883	1.042	0.394	0.131	1.483	-0.096	0.891	0.908
Number of members of household	0.086	0.775	1.090	-0.342	0.222	0.711	0.050	0.948	1.052

These findings echo those of Waiyaki, Owiti, Angwenyi & Muriuki (2012) in a study in the neighboring rural Faza Island who reported that majority of residents of the Island (66.7%) stated that over the past ten years there had been an increase in the occurrences of certain diseases, in particular malaria, Bilharzia and typhoid. Similarly Haque *et al.* (2012) in a study in a rural community in Bangladesh reported that a majority of community residents had clear perception that disease/health problems/sickness had increased due to climate induced variability over their locality with the most frequently reported diseases being reoccurring fever/cough/cold, dysentery, headaches, diarrhea, skin diseases, burning sensation, conjunctivitis, jaundice, blisters, asthma, pox, weight loss and pneumonia. In contrast Leiserowitz, Maibach, Roser-Renouf, Feinberg, Rosenthal, & Marlon, (2014) in their study in America reported that only one in three Americans (31%) think climate change is currently harming the health of people in the U.S. a “great deal” or a “moderate amount,” while one in six thinks their own health (17%) or the health of others in their household (17%) is being harmed to that degree. In another study in America, Semenza *et al.* (2011) reported that the most common perceived health consequences were air quality (82%), respiratory or breathing problems (78%), sun burn (73%), water quality (71%), heat stroke or heat exhaustion (69%) and stress and anxiety (64%). The difference may be attributed to overall level of concern and the major disease concern for a population. In overall, our study established that Mombasa City residents perceived the threat of climate change to their health as severe. According to Toan *et al.*, (2014) understanding people’s concerns about the health risks of climate change will assist policy makers to develop communication strategies to engage communities most effectively to deal with the consequences of climate change. A high level of awareness on the links between climate change and human health as has been established may help to increase the success of the National Climate Change Action Plan in Kenya.

On behavior change, the present study established that only about 2 in 10 residents of Mombasa City reported having reduced energy consumption at home based on their knowledge of climate change. However, only those who have perceived climate as posing a threat to their health have changed their behavior (over 25.0% of them). This implies a link between concern of climate change as a health risk and consequent behavior change. Those who have not changed their behavior cited main barriers as lack of appropriate skills and resources to institute behavior change. This underscores the need for both governmental and non-governmental agencies to focus on the two areas of providing skills (education) and resources to the public to improve mitigation actions. The stakeholders should ensure that messages designed to reach the public provide information and motivation necessary for individuals to make appropriate choices. According to Semenza *et al.* (2011), Stern *et al.* (1999) and Stern (2000), intentional reduction in energy consumption by individuals hinges on their state of awareness and concern about climate change, their willingness to act and their ability to change. In comparison to the current study, Semenza, *et al.*, (2011) in a study in America found that 8 in 10 had reduced energy consumption at home. The differences may be attributable to access to information and resources to institute the change in behavior.

Applying the predictive power of HBM constructs as independent variables, the present study established that cue to action (having the information necessary to prepare for the health impacts of climate change) and gender are significant predictors of mitigation (reducing energy consumption). These findings point to the need for more focus on the provision of information to build on mitigation actions and building the capacity of women to empower them to take necessary steps to mitigate against the health risks of climate change. In contrast to our findings however, Semenza *et al.*, (2011) in their study in the United States of America using the predictive power of HBM found that the respondents were more likely to report reduced energy consumption if they believed climate change could affect their way of life (perceived susceptibility), endanger their life (perceived severity), or saw serious barriers to protecting themselves from climate change. But like in the present study, they also found that gender was associated with mitigation, but with women more likely to take voluntary mitigation actions.

The current study further established that in relation to having an emergency kit at home, the significant predictor was gender, showing that gender is negatively related to having an emergency kit with women less likely to have an emergency kit at home. In similar study in America, Semenza *et al.*, (2011) arrived at similar findings in which they noted that gender was negatively associated with having an emergency kit with women being less likely to have an emergency kit at home. The findings underscores the need for stakeholders and other agencies tasked with tackling the problem of climate change in Kenya and specifically in Mombasa to focus on empowering women and educating them on the importance of keeping an emergency kit at home help in the event of disaster.

Finally, in relation to having emergency plan, the significant predictors were cue to action and perceived barriers (i.e. belief that there are obstacles and barriers to protecting oneself from negative consequences of climate change). With perceived barriers being negatively associated with having emergency plan. This means that without removing those barriers the necessary information (cues to action) may not result in the desired behavioural change which is needed for

successful adaptation. Having an emergency plan is hinged on having prerequisite skills which the government and other stakeholders should provide to the public. These findings are similar to those of Semenza *et al.*, (2011) in America where they reported that perceived barriers and cue to action were important predictors to having an emergency plan among Americans. In an earlier study among residents of Portland and Houston, Semenza *et al.*, (2008) found that residents of the two cities who would be likely to change their behavior were those with increasing levels of concern, those with a high level of education and younger people. However, these demographics did not have significant influence in the current study.

Our study has focused on urban residents' perception of health risks of climate change. Our findings address an important knowledge gap, with a focus on climate change and health in the context an urban setting and provide significant information to policy makers. The National Climate Change Action Plan in Kenya has embraced the African Plan of Action for Public Health Adaptation to climate change but has yet to devise its own national strategy for implementing the plan (Republic of Kenya, 2013). Our findings could be useful to the success of this plan.

Conclusion and Recommendation

Study participants had clear perception of health risk of climate change. They mentioned increased incidences and frequency of disease occurrence and outbreak of new diseases. Most local perceptions on the health impact of climate change were consistent with the scientific evidence regarding outbreak of diseases in Mombasa City. The findings also indicate that personal mitigation to behaviour change is dependent on the perception of health risk of climate change and more so on the availability of necessary information to protect oneself against threat of climate change. These results support calls for framing climate change from a health perspective to motivate behavior change and the need to equip the public with skills to protect themselves from the negative health consequences of climate change. Media advocacy campaigns should embrace the health context as a frame to increase public understanding and preparation to the health impacts of climate change. To reach the low income populations who are more vulnerable but less accessible to mainstream media, community campaigns should be adopted. Instead of relying mainly on the traditional media message, concerted efforts need to be put in place to include more effective communication frames and community organizing. As Semenza *et al.* (2010) observe, the most vulnerable populations, the low income, tend not to respond equally well to main stream media campaigns on health promotion compared to the general population.

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