

Flooding and health risk in selected urban poor communities in Accra, Ghana

Mumuni Abu
Regional Institute for Population Studies
University of Ghana
mabu@ug.edu.gh

Abstract

The relations between climate-related hazards and the health of populations residing in urban poor communities are unclear. In this study, emphasis was placed on the theory of Affect to understand the relations between household's exposure to flooding and health risk, especially diarrhoeal disease. Using data from the CCHEALTH project at RIPS, University of Ghana, the Ghana Meteorological Agency and the Centre for Health Information Management, the study employed mental model techniques and Granger causality test to examine whether diarrhoeal disease and other health-related problems are stressors of flooding in urban poor communities. The results suggest health-related problems are stressors of flooding in urban poor communities. Households' perceived risk of the consequences of a hazard determines how they measure the severity of the stressors of the hazard. These findings contribute to the discourse on the need to include social and psychological dynamics of the population in addressing health problems in communities.

Key words: Diarrheal disease, Flooding, Stressors, mental model, Granger causality

Introduction

Urban poor communities have numerous problems including health, crime, social, psychological and environmental issues. All these problems pose a lot of stressors to populations residing in urban poor communities. Recent increase in climate-related environmental stressors like flooding in urban poor communities has exacerbated the situation. Globally, flooding is correlated with increased incidence of diarrhea (Hashizume et al. 2007; de Magny et al. 2008; UNEP/OCHA 2011) and other health related conditions. However, the effect of flooding on diarrhea in urban poor communities in Africa remains the least understood both demographically and socio-environmentally (Songsore et al. 2006; Fobil and Atuguba 2004). Urban settlements south of the Sahara have high risk of instability due to their haphazard nature, which creates unpredictable changes in the environment that can fuel disease outbreaks. In Ghana, urban settlements are vulnerable to a number of environmental hazards and diseases due to the unplanned nature of settlements and inadequate infrastructure provision (Rain et al. 2011; Karley 2009; Afeku 2005). Whereas there have been some studies on perceived neighbourhood environmental problems and health in urban poor communities in Ghana (Songsore et al. 2008; ILGS & IWMI 2012; Codjoe et al. 2014), no study has examined the relations between households exposure to hazards and the perceived health outcomes as a stressor of the hazard. The perceived health

outcomes are critical in designing programmes to mitigate the health effects of hazards in communities. Thus, understanding people's perceived risk is critical to addressing complex issues in societies (Brikholz et al. 2014; Kellens et al. 2011) because humans act based on some perceived risk or information.

Generally, there is high risk of flooding in urban poor communities due to poor management of drainage systems, often clogged with household waste materials, and paving of open spaces, preventing water infiltration (Huq et al. 2007). The study will draw on the theory of affect to examine how the vulnerable nature of urban poor communities affect the perceptions of the population about their health. It has been demonstrated in some studies that flooding is a predictor of vector-borne diseases (Yanda et al. 2006; Taylor, 2006) and also negatively affects infrastructure. These compounded effects of hazards are what inform the kind of risk perceptions people develop about their vulnerability to the hazard and its associated consequences. Thus, to be able to address health issues in urban poor places requires a critical assessment of how health related issues are perceived as a stressor of hazard. It also important to understand how flooding is related to diarrhea in urban poor communities.

It is believed that flooding will exacerbate poor health conditions including diarrhoeal disease in low income communities (Hashizume et al. 2008). At the global level a lot of studies have been conducted in this area in both developed and developing countries aimed at addressing recent rise in gastrointestinal challenges and diarrhoea cases as a result of flooding (Hashimoto et al. 2014; Hashizume et al. 2007). At the national level, not much study has been done in this area even though, there is public health concern to curb the recent rise in cholera and non-cholera diarrhoea challenges in Ghana. There is no specific study in Ghana that focuses on the impacts of environmental hazards and the perceived health stressors of the affected population. Understanding the perceived health stressors of the affected population is critical to the development of interventions that affected populations will appreciate as the best remedy to their situation. This paper therefore investigates two main research questions: 1) What is the relationship between flooding and diarrhoeal disease in the Asheidu-Keteke sub-metropolitan area of Accra? 2) Do people in urban poor communities perceive health risk as a stressor of flooding?

This study will provide an opportunity to unearth the link between climate hazards and perceived health outcomes in urban poor communities for policy directions. Overall, the study intends to improve on community resilience to hazards through understanding of the stressors population's in urban poor settings relate to hazards to help inform policy directions.

Sources of Data and Method of analysis

Data for the study are from three main sources – rainfall data from the Ghana Meteorological Agency (GMA), diarrhoea data from the Centre for Health Information Management (CHIM) and Climate Change and Human Health data at the Regional Institute for Population Studies, University of Ghana. Firstly, rainfall data from the GMA for the period 1980-2010 and data on diarrhoea from the CHIM over the same period was used to examine the flood situation in the Ashiedu-Kete sub-metropolitan area over the period and also how flooding is correlated with diarrhoea in the area.

Secondly, the paper used the Climate Change and Human Health (CCHEALTH) project qualitative data collected from the *James Town and Agbogbloshie* communities in Accra to understand how households in urban poor communities perceived health as a stressor of flooding. The data was collected in 2011 and the author of the paper is part of the CCHEALTH team. A numbers of techniques were employed in the data collection. They are mental model techniques (Bostrom et al. 1992; Zaksek and Arvai 2004) to understand how people react to events happening around them, and participatory vulnerability assessment approach by Ford and Smit (2004), Lim et al. (2004), Sutherland et al. (2005), Vàsquez-León et al. (2003) and Quinn et al. (2003) was employed to assess vulnerability perceptions of households in the study communities to diseases as a result of flooding. This is a subjective approach of assessing risk using focus group discussions to collect information from households in the study communities. In all, three focus group discussions were conducted in each community. A total of 12 to 15 individuals from households were selected randomly to participate in this activity. The findings from this exercise provided information on how households in the community perceive their vulnerability to diseases as a result of flooding.

The focus group discussions were organized separately for youth less than 30 years, adult males and adult females. The language of communication used in communities is *Twi and Ga*, which are the dominant local languages in *Agbogbloshie* and *James Town* respectively. In all, 73 participants were involved in the focus group discussions in the two communities.¹ The age distribution of adult participants for the focus group discussions ranged from 32 years to 76 years in James Town and 33 to 70 years in Agbogbloshie. The selection of participants for the focus group discussions was based on nomination of an individual by other community members to represent the community during project meetings. The addresses of the selected individuals were collected and given to community facilitators who assisted in informing the people about meetings in the communities. The community facilitators were individuals who were also selected by their community to be trained at the Regional Institute for Population Studies (RIPS), University of Ghana, to lead in data collection in the communities. All the focus group discussions were facilitated by the researcher and the community facilitators who understand the local language of the people. Due to the high rate of illiteracy in the study communities, the responses to questions were written on large sheet of paper in the form of a drawing to enable all the participants to follow the discussion. However, reasons provided for such responses were written in note books. The information gathered were analysed using thematic and descriptive analysis.

¹ There were 11 adult males, 11 adult females, and 13 youth totaling 35 in Agbogbloshie; 13 adult males, 11 adult females, and 14 youth totaling 38 in Jame Town.

Findings

Relationship between flooding and diarrhea

Diarrhoeal disease in poor neighbourhoods in Accra has become a major public health concern to health practitioners over the years. Tables 1 and 2 present a detailed analysis of the relationship between flooding and diarrheal disease in the Ashiedu-Keteke sub-metropolitan area of Accra. Extreme rainfall was used as a proxy for measuring flooding at this level of the study. The analyses indicate that there is a correlation between extreme rainfall and diarrhoea. In Table 1, the spearman correlation analysis indicate that monthly extreme rainfall days were positively correlated with monthly cases of diarrhoea in the sub-metropolitan area throughout the study period (r^2 ranged from 0.34 to 0.35) with a strong lag effects on the relationship. There was a strong positive lag effect at zero and one month compared to two months lag. Table 2 indicates that extreme rainfall events in the Ashiedu-Keteke sub-metropolitan area Granger cause diarrheal disease.

[Please, insert Tables1&2 here]

Stressors of flooding in poor urban settings

The demographics of the study communities are characterized by low levels of education, large household sizes, low incomes and young households (ILGS &IWMI 2012). The populations of the study communities have been increasing over the years and the demand for accommodation in these areas have also increased. The *Agbogboshie* community which used to house workers of the Ghana Railway Company in the 1960s and few indigenous Ga residents is currently a dwelling site for rural-to-urban immigrants from all over the country. The housing conditions in *Agbogboshie* are in deplorable state and this exposes residents to the challenges of the climate. Generally, households in urban poor settings are faced with a number of challenges which ranges from social, health and environmental issues. In trying to understand how climate-related factors impact on the health problems of households in poor urban setting, information on all stressors that households experience in the study communities was analysed and also the severity of these problems on households was examined.

[Please, insert Figure 1 here]

Out of the six focus group discussions that were held in the study communities, five of them mentioned diarrhoeal disease as a stressor of flooding and rated it with a very high severity score (Score – 5). This implies that even though, not all sections of the community see diarrhoeal disease as a challenge, in neighbourhoods where it occurred the severity is very high and can lead to loss of lives. For instance, this is what a 34 year old man in *Agbogboshie* said about flooding and diarrhea.

“Flooding does bring a lot of debris into this community, which pollutes our environment. Those of us who have flood water entering our rooms are even more disadvantage because it pollutes our water and food. My wife had serious diarrhoea after the last flood because our food stuff got contaminated with flood water”

Also, four of the groups mentioned poor sanitation as a stressor of flooding and rated it with an average severity score of four (Figure 1). There were also other health challenges that were mentioned during the focus group discussions such as worm infestation among children and malaria. Worm infestation among children was mentioned in two of the focus group discussions and was rated with an average severity score of 4 indicating how the situation is critical among the groups that mentioned it. Malaria was mentioned as stressor by all the groups and was rated with an average severity score of 5. It is the number one cause of death among the population and the people believe that flood water exacerbate the incidence of malaria in the community.

“The standing water in some parts of the community serves as breeding grounds for mosquitoes and the situation is worse anytime in flood in the community. Usually, those who die as a result of the immediate flooding make news in media but those who die later as result of the other consequences of it are not reported any where. I have believe if the city authorities have the full report of the number of people who die as result of the frequent flooding and its associated consequences here, this community could have seem some intervention. No one seem to care about us.” (64 year old man in Agbogbloshie)

“There are some paved spaces in this community but the paving has not been done well and so we have standing water in these places anytime it rain. These places serve as breeding grounds for mosquitoes in addition to our choked and narrow drains in the community. We the adults are able to manage with the mosquito bites but our children are the serious victims. Some lose their lives as a result of malaria.” (41 year old woman in James Town)

There were other stressors that were mentioned that have an indirect influence on their health as a result of their exposure to flooding. These are the poor sanitation condition in the community after floods, damages to pipelines, pollution of household drinking water and stagnant water in the community.

Households perceived vulnerability to stressors of flooding

Based on the general stressors of flooding that were compiled from the communities, eight stressors were selected and used to examine household perceived vulnerability to flood-related stressors in the study communities. These stressors are diarrhoeal disease, destruction of property, malaria, disruption of economic activities, poor sanitation, difficulty with mobility in community, stagnant water and worm infestation among children. In each of the study communities, female members of households were perceived to be more vulnerable compared to males. Health related stressors such as malaria, diarrhoeal disease, and worm infestation among children affects women more than men in households. In terms of poor sanitation, women were more vulnerable than men in *Agbogbloshie* while in *James Town* both men and women rated their vulnerability to poor sanitation very high. This could be so because it is women who take care of the sick and also attend to sanitation issues in the household. Household vulnerability to diarrhoea as a result of flooding in both study communities was high for both men and women (Figures 2 and 3). Households in both communities however, believe that the vulnerability of their children in the future would be

less. They believe that a number of development activities will take place in the area and also current education efforts as well as current health interventions by government to curb the situation will result in a decrease in incidence of diarrhoea in the future.

[Please, insert Figures 2&3 here]

Conclusions

Urban poor communities have a lot of problems and climate-related hazards will add to the problems by exacerbating some of the already existing problems and introducing new ones. Extreme rainfall, which was used as a proxy for measuring flooding Granger causes incidence of diarrhoea in urban poor communities. Addressing high incidences of diarrhoea in urban poor communities will require adequate measures to curb the frequent flooding in such areas.

Perceived health stressors of flooding in urban poor communities can be categorized into two: direct and indirect. The direct relationships deal with health related effects like malaria, diarrhoea and worm infestation. The indirect effects are those that do not make mention of a disease but could be source disease outbreaks. The general perception of population living in urban poor places is that, flooding has an effect on their health. They see themselves as vulnerable to flooding today but they believe the situation will be addressed in the future. They are more reliant on what government will put in place to arrest the situation without talking much about what they can do. The impact of flooding affects women more than men because of the care-giving role women play in households when there are problems.

To effectively arrest the problem of flooding in urban poor communities, the study recommends the need to use educational messages that link the health of the people to the hazard. The health of every human being is seen as the most prioritise asset and anything that will affect it will be resisted with the maximum force. The behavior of the population, which sometimes creates conditions for flooding, could be changed when the education message is linked to the health of the people. Thus preventing the hazard or reducing the effect of the hazard is the best way of protecting the population from the health consequences of it, which usually results in higher mortality than the direct mortality effect of the hazard.

Tables and Figures

Table 1: Correlation between monthly extreme rainfall and diarrhoea in the AshieduKeteke sub-metropolitan area of Accra, 1985 – 2010

Monthly climate variables	Lag (months)	r ²	P-value
Monthly extreme rainfall days (> 59.2mm)	0	0.35	0.039
Monthly extreme rainfall days (> 59.2mm)	1	0.35	0.039
Monthly extreme rainfall days (> 59.2mm)	2	0.34	0.044

Table 2: Granger causality of the relationship between number of extreme rain days and incidence of diarrhoea in the study communities

Characteristics	Coefficient	S.E
Number of extreme rainy days	0.0009 *	0.00045
Constant	-0.0005	0.00009
Adjusted R2	0.12000	
F(1, 23)	4.21000 *	

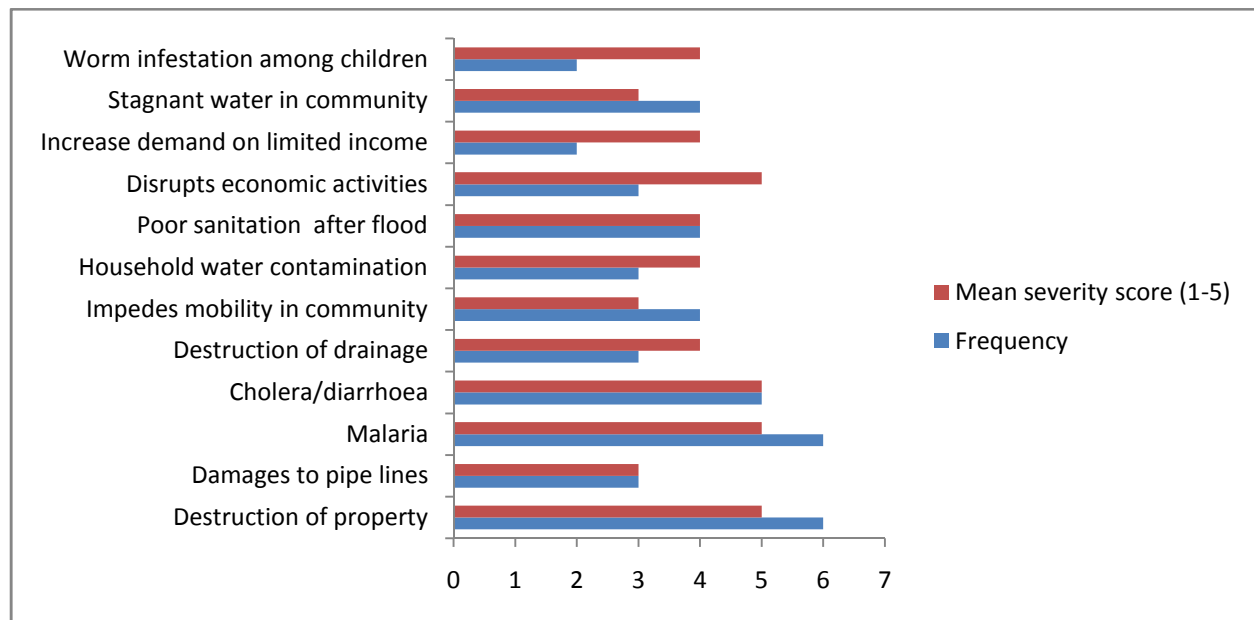


Figure 1: Stressors of flooding in study communities

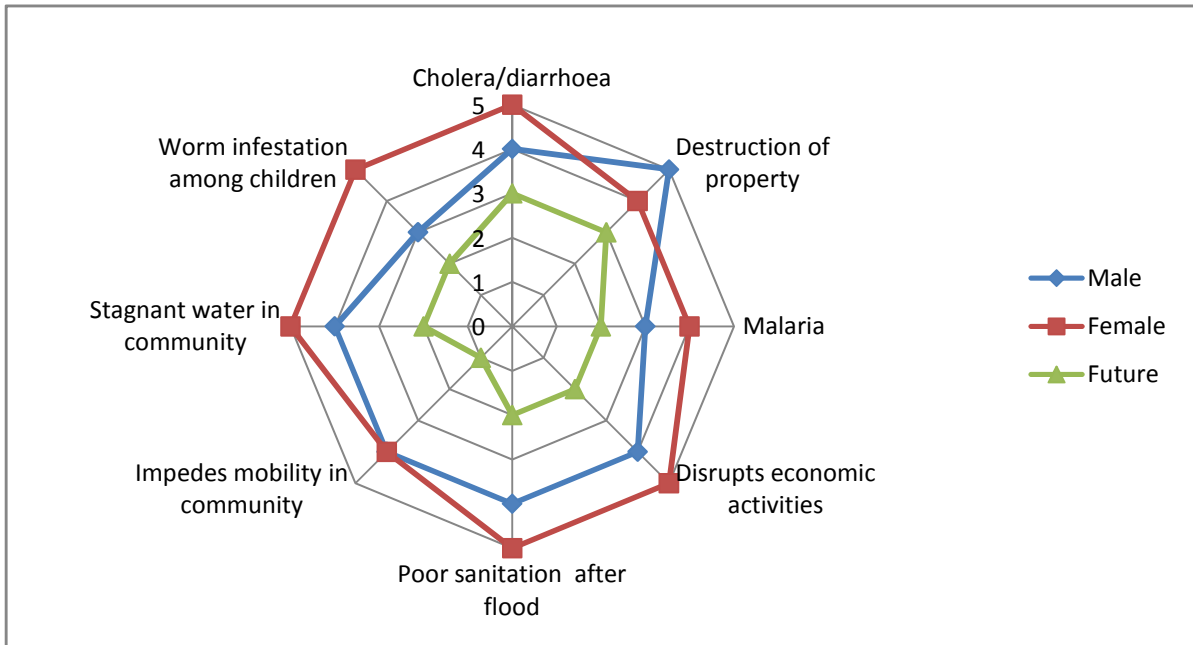


Figure 2: Household vulnerability to stressors of flooding in *Agbogbloshie*

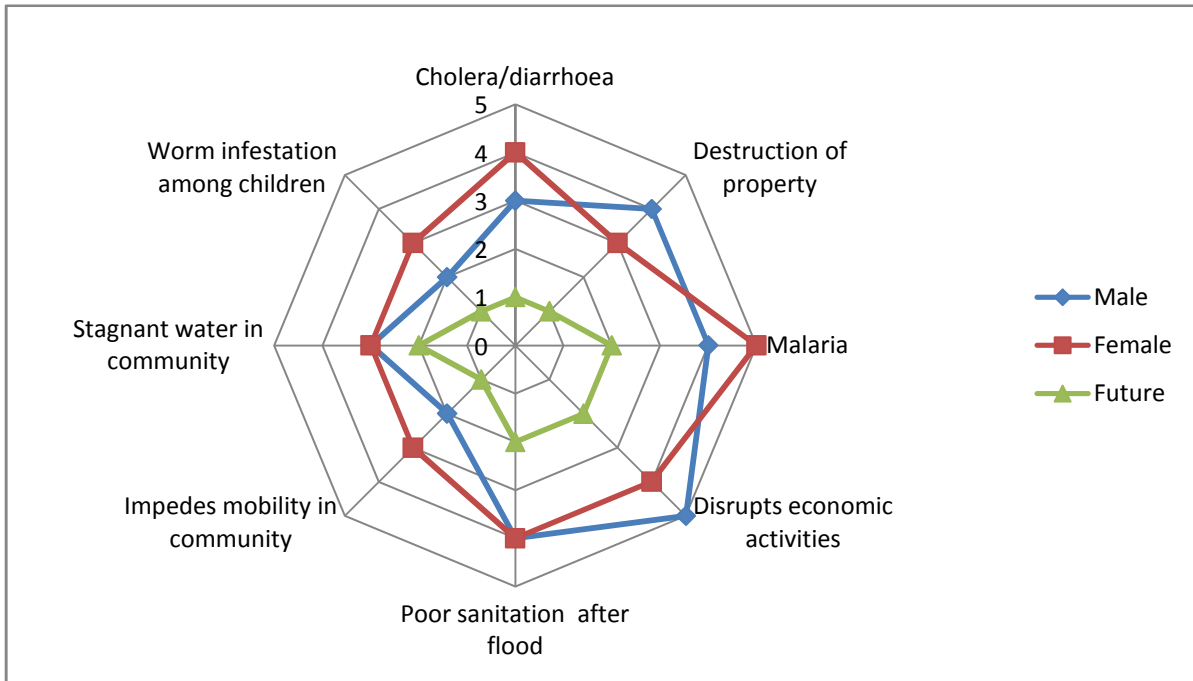


Figure 3. Household vulnerability to stressors of flooding in *James Town*

References

- Afeku, K. (2005). *Urbanization and Flooding in Accra, Ghana*. Master's Thesis, Department of Geography, Miami University.
- Bostrom, A., Fischhoff, B., Morgan, M.G.(1992). Characterizing mental models of hazardous processes: A methodology and an application to radon. *Journal of Social Issues*, 48 (4): 85-100.
- Brikholz, s., Muro, M., Jeffery, P., Smith, H.M. (2014). Rethinking the relationship between flood risk perception and flood management. *Science of the Total Environment*, 487, 12-20.
- Codjoe, S.N.A., Owusu, G.& Burkett, V. (2014). Perception, experience and indigenous knowledge of climate change and variability: The case of Accra, a sub-Saharan African city. *Regional Environmental Change*, 14 (1), 369-383.
- deMagny, G.C., Murtugudde, R., Sapiano, M.R.P., Nizam, A., Brown, C.W. (2008). Environmental signatures associated with cholera epidemics. *National Academy of Sciences*, 105(46): 17676-17681.
- Fobil, J.N., and Atuguba, R.A. (2004). Ghana: changing urban environmental ills in slum communities. *International Journal of environmental policy and law*, 34(4-5), 206-215.
- Ford, J.D., Smit B, 2004. A framework for assessing the vulnerability of communities in the Canadian Arctic to risks associated with climate change. *Arctic* 57, 389-400.
- Hashimoto, M., Suetsugi, T., Ichikawa, Y., Sunada, K., Nishida, K., Kondo, N., Ishidaira, H. (2014). Assessing the relationship between inundation and diarrhoeal cases by flood simulations in low-income communities of Dhaka City, Bangladesh. *Hydrological Research Letters*, 8(3): 96-102.
- Hashizume, M., Armstrong, B., Hajat S., Wagatsuma, Y., Faruque, S.G. A., Hayashi, T., & Sack D. (2008). Factors determining vulnerability to diarrhoea during and after severe floods in Bangladesh. *Journal of Water Health*, 6(3), 323-332.
- Hashizume M, Armstrong B, Hajat S, Wagatsuma Y, SG Faruque A, Hayashi T, Sack D.(2007). Association between climate variability and hospital visits for non-cholera diarrhoea in Bangladesh: effects and vulnerable groups. *International Journal of Epidemiology*; 36, 1030–1037.
- Huq, S., Kovats, S., Reid, H., and Satterthwaite, D. (2007). *Reducing risks to cities from climate change: An environmental or a development agenda?* Environment & Urbanization Brief no. 15, April.
- Institute of Local Government Studies (ILGS) and International Water Management Institute(IWMI).(2012). *Community adaptation to flooding risk and vulnerability. Final report*, Accra, Ghana.
- Kellens, W., Zaalberg, R., Neutens, T., Vanneuvile, W., De Maeyer, P. (2011). An analysis of public perception of flood risk on the Belgian Coast. *Risk Analysis*, 30(3): 501-511.
- Karley, K.N.,(2009). Flooding and Physical Planning in Urban Areas in West Africa: Situational Analysis of Accra, Ghana. *Theoretical and Empirical Urban Research in Urban Management*, 4(13):25-41.

- Quinn, C.H., Huby, M., Kiwasila, H., Lovett, J.C., 2003. Local perceptions of risk to livelihood in semi-arid Tanzania. *Journal of Environmental Management*, 68: 111-119
- Rain, D., Engstrom, R., Ludlow, C. and Antos, S. (2011). *Accra Ghana: A city vulnerable to flooding and drought-induced migration. Cities and Climate Change: Global Report on Human Settlements*. UN-HABITAT www.unhabitat.org/grhs/2011
- Sonsore, J., Nabila, J.S., Yangyouro, Y., Avle, S., Bosque-Hamilton, E.K., Amponsah, P.E., Alhassan, O. (2008). *Integrated disaster risk and environmental health monitoring*. Greater Accra Metropolitan Area, Ghana.
- Songsore, J., Nabila, J.S., Yangyouro, Y., Avle, S., Bosque-Hamilton, E.K., Amponsah, P.E., Alhassan, O., Satterthwaite, D. (2006). *Environmental health watch and disaster monitoring in the Greater Accra Metropolitan Area (GAMA), 2005*. University of Ghana, Legon.
- Taylor, M.A, Chen, A.A., Rawlins, S., Heslop-Thomas, C., Amarakoon, A., Bailey, W., Chadee, D., Huntley, S., Rhoden, C. and Stennett, R. (2006). *Adapting to Dengue risk-What to do?* AIACC Working Paper No. 33.
- UNEP/OCHA. (2011). *Rapid disaster waste management assessment of 26 October 2011 flash flooding, Central Accra, Ghana*. UNEP/OCHA Environmental Unit, Geneva, Switzerland.
- Yarnal, B. (2007). Vulnerability and all that Jazz: Addressing vulnerability in New Orleans after Hurricane Katrina. *Technology in society*, 29, 249-255.
- Zaksek, M., Arvai, J.L., 2004. Toward improved communication about wild land fire: Mental models research to identify information needs for natural resource management. *Risk Analysis*, 24 (6): 1503-1514.