Environmental Health Management in Evacuation Shelter

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- **Abstract:**

Impact from climate change is widespread all over the world. We have no time for mismanagement especially due to health of the people. Some experiences we can learn from others. Environmental health management during the severe floods in Thailand in 2011 was assessed. It is reported that 13.6 million people were affected, more than 180 died, sixty-five of 77 provinces were declared flood disaster zones, over 20,000 square kilometers of farmland damaged. It has been described as the worst flooding yet in terms of the amount of water and people affected. After the disaster, the Department of Health conducted a research project to collect data and identify practices to improvement environmental health disaster management. Researchers observed practices in ten shelters and interviewed persons who were responsible for each shelter. Issues included overall management system, drinking water and other consumption, solid waste, excreta, food sanitation, housing and insect and vector control. It was found that some shelters were well prepared, participation was a key success factor, and innovation can be created even during the tough time. Suggestions for further development are doing research for water and food inspection test kits, sharing knowledge among health and other sectors personnel, developing guidelines for technical officers and establishing minimum standard for evacuation shelters. In conclusion, the experiences of Thailand in environmental health disaster management can be shared among Impact Assessment practitioners. Disaster preparedness is an important issue for the next generation.

Keyword: evacuation shelter, flood, environmental health

• Introduction

Climate change has contributed to a rise in extreme weather events – including heat stress, drought, rainstorms, and severe floods. The Intergovernmental Panel on Climate Change (IPCC 2007) projected that climate change will increase in intensity and frequency of heavy rainstorms, putting many countries at risk for devastating floods. During the last decade, flooding had been reported to adversely effect in many countries such as China, India, Australia, including Thailand. Severe floods cause impacts to socio-economic development, destroy important infrastructure and environmental system, as well as health and well-being of the people (Figure 1).

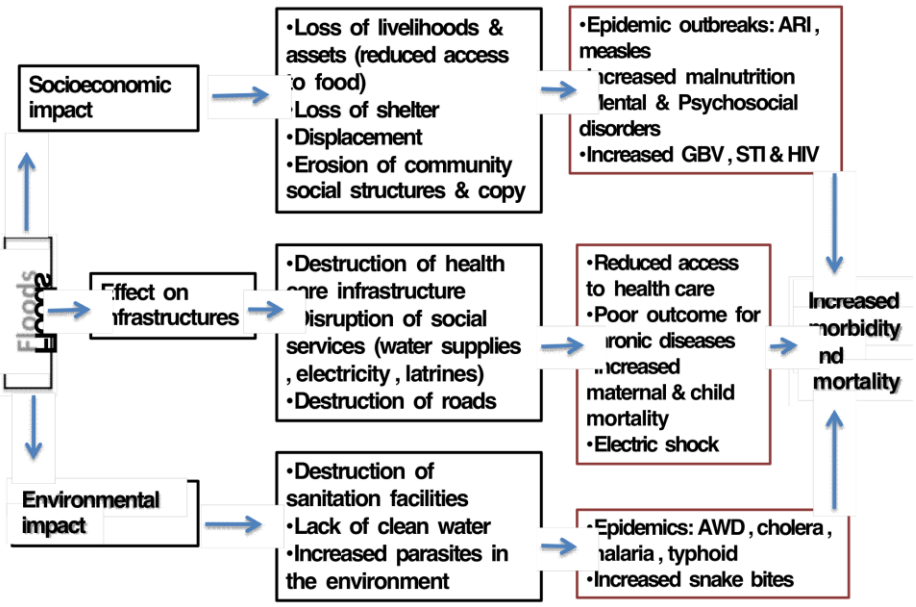

Figure 1: Public Health Impact of Floods (adapted from World Health Organization)

Flooding can cause a range of health impacts and risks, including: increase morbidity and mortality, injury, inadequate of water supply, contaminate drinking water, hazardous material spills, and community disruption and displacement (Council 2013). From a public health point of view, planning for floods during the inter-flood phase aims at enabling communities to effectively respond to the health consequences of floods and allows local and central authorities to organize and effectively coordinate relief activities. One of the importance activities during the inter-flood phase is environmental health management at evacuation shelters. There are urgent needs for environmental health and public health management such as food sanitation and hygiene, waste and excreta management, housing sanitation, as well as vector and insect control. This is very important for public health sector to encourage environmental health best management in order to reduce the impacts and protect the population health.

Thailand's flooding experiences 2011

Thailand has been affected by severe flooding during 2011 which resulted in a total of 815 deaths (with 3 missing and 155 died from electrical shock) and 13.6 million people affected. Sixty-five of Thailand's 77 provinces were declared flood disaster zones, and over 20,000 square kilometers (7,700 sq mi) of farmland was damaged [Figure 2] (Emergency Operation Center for Flood, Storm and Landslide, 2012, Bureau of Epidemiology 2012). The World Bank estimated Bt1.425 trillion (US$ 45.7 Bn) economic losses due to flooding of which seven times higher than the 2011 government budget (World Bank 2011,AP 2011). Moreover, seven major industrial estates were inundated by as much 3 meters during the floods (Mydans 2011). This disaster was ranked as the world's fourth costliest disaster as of 2011 surpassed only by the 2011 earthquake and tsunami in Japan, 1995 Kobe earthquake, and Hurricane Katrina in 2005 (Bo Zhang 2011).

Department of Health, Ministry of Public Health, Thailand was responsible for conducting a study on the environmental health management in shelters in the flooding areas. The aim of this study was to investigate the environmental health impact and to find good practice in managing environmental health in evacuated shelters during floods in Thailand, 2011. The results of this study were shared among Impact Assessment practitioners during IAIA 2013 for better preparation in the future.

- **Material and Method**

Descriptive study was conducted to study environmental health management in evacuation centers during the inter-phase floods. The evacuation shelter is a place where people live temporarily during a specific type of situation, such as natural or man-made disasters (Department of Social Development and Welfare 2012). During flooding in 2011, over 100 evacuated shelters were set up by private, public sectors including communities themselves (Department of Health 2011). Ten evacuation centers in Bangkok Metropolitan Area and nearby provinces were selected, by purposive sampling (3 for small size, 4 for medium size and 3 for large size), for investigation and to interview persons responsible for each shelter. The main questions were how did they perform environmental health management and how well they did performance in terms of overall management system, drinking water and other consumption, solid waste, excreta, food sanitation, housing and insect and vector control.

- **Results**

1. Environmental health problems in evacuated shelter

There were various environmental health problems in evacuated shelters such as large number of victims from floods, limitation in manpower, expansion of flooding areas, and nature of Thai people, who do not like to stay far from their homes. In terms of environmental health problems, some major problems were found. These included spoiled food and poor food sanitation, improper solid waste management and poor personal hygiene. Solid waste management problems are from a lot of garbage, (mainly plastic bags, water bottles, plastic or foam food containers) which required collection and disposal in sanitary landfilled; some disposal sites were flooded especially, Bangkok Metropolitan and it's vicinity. Food sanitation problems included food preparation and distribution within the evacuated shelters. Some shelters prepared and cooked on the ground or without protection from flies, while other shelters got food from outside for all meals or some meals. So, food could spoil according to time and storage conditions. Other environmental health issues such as overcrowding were found in some shelters. However, these environmental health management problems had been solved in short-time during the flood. Moreover, difficulties in transportation and communication made management worse.

2. Environmental health management

In order to cope with the above problems, the evacuation managers managed environmental health according to each phase as described below.

2.1 Preparedness phase

There was a time limitation to prepare and open the evacuation center. However, every center had been cooperating with related sectors including local authorities, government, private sectors and communities to prepare basic facilities for the flood victims. These included sleeping stuff, garbage bins and bags, toilets, drinking water and clean water, and containers for food preparing etc.

2.2 Response phase

Following a disaster, rapid and effective action is needed. The first priority for public health and environmental management was a screening step. All the victims were screened and investigated for communicable disease and health conditions. All of the 10 evacuation centres observed had various activities for environmental health management (Table 1).

It is found that all evacuation shelters set up committee and persons to responsible for each task. In terms of environmental health management, all shelters were quite well prepared. However, housing sanitation, waste management, food sanitation and drinking water were found poor condition. Two of ten shelters were overcrowded, inadequate refuse bin due to the number of residents were over carrying capacity of the shelter and a lot of garbage such as plastic bags, water bottle, or food containers were produced. Surveillance on food and drinking water were important, as they can cause double burden to the victims. Only three shelters conducted both water and food quality surveillance.

Responsibilities of health sector in environmental health management in evacuation shelters

According to Thailand's experience in 2011, environmental health practitioners performed many critical functions including;

1. Conducted shelter assessments by using environmental health management checklist and report the situation to relevant sectors.

2. Conducted environmental health surveillance including inspection of drinking water, food safety, and general safety and sanitation.
3. Provided basic environmental health education on management and personal hygiene practice to increase knowledge and change their behavior through display (or demonstrate), poster and regular announcement.
4. Provided necessary materials or lists of necessary materials for each shelter in order to prevent health problem that may occur in the shelter and prevent pollutants to community. For example: sodium hypochlorite, hand cleaner gel, garbage bags and aprons.

- **Key Success factors**

According to this study, the key success factors in flood management are clear policy, single commander, participation, coordination and collaboration and health education for shelter residents. The details of key factors are as follows;

1. Policy and incident commanders are important. Government must have a clear policy management. Incident commanders should be unique. Firm and responsible organizations should provide necessary knowledge in flood management to incident commanders.
2. Participation of people in evacuation shelter is important. It should exist at all stages ranging from decision making process to implementation of environmental health measures.
3. Coordination and collaboration of government organizations and other sectors at all levels. National level is required to make a formal organization to cope with flood problems and regional level assist to increase an effective in flood management by sharing and supporting knowledge and technology in each country.
4. Health and hygiene education related to water supply, sanitation, vector borne disease control and hygiene practices are particularly important for reducing the risk of communicable disease and its transmission. It is also an essential part of empowerment and building resilience**.**

- **Conclusions**

Environmental health is one of important problems in disaster management especially for establishing evacuated shelters. Environmental health practitioners should encourage persons who are responsible for each evacuated sites to be aware of health impacts that might occur during a disaster. According to the study, it was found that all shelters were concerned with environmental health issues and some shelters were well prepared and managed. Innovation can be created even during the tough time. The key factors for environmental health management in shelters are policy, incident commander, participation, coordination and collaboration and health education for people. The recommendations for environmental health adaptive capacity for flood and other disasters are:

1. Develop appropriate environmental health plans and actions, which clearly articulate the objectives, policies and procedures to deal with flood and other prioritized emergencies. These plans or actions should be multisectoral.
2. Enhancement of mechanism for coordination with international and national agencies for environmental management.
3. Develop environmental health checklists and guidelines for shelter managers and officers. Minimum requirements or standards of environmental health aspect for evacuation shelters should be set up such as number of toilets, amount of water supply per person, frequency of food and water quality surveillance.
4. Building capacity of stakeholders and persons responsible for evacuated shelter set up at all levels (i.e. community, government and shelter manager and officer).
5. Develop technology and knowledge for disaster management such as food inspection test kit, waste management and floating toilets.
6. Develop an effective surveillance and monitoring systems for environmental health for emergency situation.

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Table1. Activities for Environmental Health Management

Issue	Evacuation shelter										Best Practice / Innovation
	1	2	3	4	5	6	7	8	9	10	
Overall Management											
1. Determine operational roles, functions and accountability (i.e. committee)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
2. Outline safety and security measures	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Housing sanitation											
1. Not overcrowded (Restrict no. of people inside shelter/ room)	x	Y	Y	Y	Y	Y	Y	Y	x	Y	Screen and separate accommodation for children and ill people
2. Good ventilation (i.e. open window)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Excreta management											
1. Adequate toilet (at least 1 toilet per 20 people)	Y	Y	Y	x	Y	Y	Y	Y	Y	Y	1.Encourage the participation of residents for cleaning toilets 2. Educate a behavior for using toilets and personal hygiene
2. Clean regularly by arranging schedule	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Waste management											
1. Provide sanitary refuse bin	Y	Y	Y	x	Y	Y	x	Y	Y	Y	1. Reduce amount the waste by proving personal equipments (plate, spoon and other utensils) 2. Educate and raise awareness of residents in good waste disposal behaviour. 3. Separate refuse bin into 3 type of waste and attach picture for better understanding
2. Daily refuse collection	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
3. Appropriate disposal management (i.e. landfill, etc.)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Drinking water and other consumption											
1. Adequate water supply and drinking water	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
2. Monitor water supply and drinking water quality	X	Y	X	X	X	X	Y	X	Y	Y	
3. Disinfect water supply with chlorine compound.	Y	Y	X	Y	X	Y	Y	X	Y	Y	

Issue	Evacuation shelter										Best Practice / Innovation
	1	2	3	4	5	6	7	8	9	10	
Food sanitation											
1.Regularly inspect food quality and personal hygiene	X	X	Y	Y	Y	Y	Y	Y	Y	Y	1.Label cooked time or expired time (4 hrs after cooked) for donated or imported food 2. Regularly inspect food quality and personal hygiene. 3. Separate basins for washing, eating and cooking. 4.No smoking is allowed in food preparation, serving, and utensil washing areas
2. Keep kitchen surfaces clean and ensure solid kitchen wastes are disposed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
3. Appropriate food preparation (i.e. far from toilet , waste collection and accommodation)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
4.Prepare food for only one meal and serve food when it still hot	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
5. Store food wrapped or in closed container to protect food from insects, rodent and other animals and separate raw and cooked food to prevent a contamination.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Vector and insect control											
1.Survey the breeding places and regularly spray the breeding places	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	1. Set a measure to prevent or control vector such as prohibit food inside the accommodation.
2.Regularly cleaning of shelter	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
3. Preparing and Spraying of disinfectant and insecticidal chemical in order to control unpleasant odor and control vectors.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Health education											
Provide knowledge to raise the awareness and increase public participation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	- Knowledge include toilet use behavior, personal hygiene etc. - Media: Posters, announcements