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Proper Dissemination of Information to Improve People Awareness on Flood Disaster: A Case Study of 2011 Flood in Thailand

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Abstract

The study aims are to investigate the people perception on flood response, flood awareness and information dissemination during 2011 flood, to discuss the proper information needed for flood preparedness, and to understand drinking water preferences during emergency periods. A questionnaire survey was conducted to collect information on flood awareness and preparedness from the people residing in a suburb of Bangkok that was one of the most severely affected areas. Results showed that more than 90% of public realized the necessity of flood awareness. Flood risk perception level was positively correlated with age. There were gender differrences in priority flood responses; males were more concerned about electrocution while women were more concerned over damage to household property. More than 40% of respondents gave lower priority to electricity cutoffs during the flood. This perception of knowledge could lead to life-threatening damage. Television was found to be the most effective channel for disseminating flood information (58%) due to its reliability, transparency, and promptness. However, its popularity was slightly reduced during flood, most likely due to electricity shortages. For the younger generation, TV and internet are the most powerful tools, while older people rely on many channels including radio and pamphlet, so that messages need to be disseminated through many channels in combination. Information on flood severity, asset protection, water supply, food supply, health information, and shelter was concerned before and during flood. Bottled water was the main alternate water source (70%). The findings of this study provide basic guidance to the authorities concerned to assist in developing effective policies and plans to minimize the impacts of future floods.

Keywords: Emergency drinking water supply; Flood preparedness and response; Information dissemination; People awareness; Thailand Flood 2011

Introduction

Flooding is the most frequently occurring disaster in both developed and developing countries, accounting for approximately 40% of all natural disasters [1]. Among the Association of Southeast Asian Nations, Thailand is especially prone to frequent and severe natural disasters including floods [2]. In 2011, the accumulated rainfall in Thailand increased to 1,781 cubic meters by the end of November, 35% higher than the average annual rainfall. This was atrributed to a combination of many factors including Lanina, tropical storms (Haima and Haitang), typhoons (Nockten, Nasat, and Nalgae) and many regular monsoon troughs during June to September [3]. The flood has been labeled the worst flood in over 60 years by the National Disaster Management Committee of Thailand [4]. It ranked number seven in the world's costliest natural disasters worldwide since 1980, with losses estimated at USD 43 billion and 813 deaths [5]. Sixty-five of the country's 77 provinces were declared flood disaster zones, covering 20,000 square kilometers (7,700 sq mi) [6].

Despite the fact that the 2011 flood was regarded as a predictable flood, it nevertheless lasted for 3 months, causing enormous and widespread devastation. The damage was exacerbated by poor flood management, attributed partly to failures in communication due to the complex social dynamics between government, responsible authorities, and the public [7]. Insufficient information was disseminated to the public [7]. In addition, many urban and sub-urban areas had not experienced a major flood event for over 10-15 years, in contrast to people living in rural areas and along the urban riverfront [8]. Those who lack such experience are more vulnerable to flood damage due to lack of awareness or understanding.

Flood risk communication is listed as the golden rule in modern flood risk management [9] as risk awareness leads to the flood preparedness [10]. In the 2011 flood, low levels of both awareness and preparedness were reported [7]. The Ministry of Finance and the World Bank recommended strengthening both communication and risk awareness in order to enhance the effectiveness of flood risk management [8]. It is therefore important to evaluate current levels of flood risk awareness among risk prone populations including suburbs of Bangkok. Previous literature indicates that women are more risk-averse than men, and that age is positively correlated with risk perception for a number of natural hazards [11, 12, 13]. It is therefore necessary to establish whether this also holds true for risk perceptions among Bangkok residents, in order to develop a realistic and practical flood risk management plan for the city and its environment.

Dissemination of flood information including flood preparedness and warning messages should be maximized. Effective communication will translate into effective damage mitigation and the mass media play a crucial role in this regard. Previous studies report that 95% of respondents received flood warning information from television, while 50% relied on newspaper and internet [7]. However, instability in electrical supply during flooding would weaken the effectiveness of TV and electronic media once a flood event is already present. We hypothesized that the ratio of TV, radio, and internet news consumers would be reduced and shifted to newspaper or word of month during the flood event. Analysis of citizen behavior in different stages of flood disaster (pre-, trans-, and post-) would provide valuable information for flood management and mitigation program.

In addition, health and sanitation concerns also need to be addressed during flood events. Lack of access to safe drinking water and sanitation increases the risk of communicable diseases [14]. Drinking water supply is a prime issue in flood management. Bottled water is generally delivered to the affected population as an immediate response [15]. To continue supply water to affected populations, other emergency/ onsite water treatment systems should be pre-

pared. At present, the extent of each water supply system during the flood period was not well documented and the hypothesis that the ratio of bottled water consumption would be elevated has not been confirmed clearly. More research needs to investigate these aspects as they are crucial for future flood preparedness.

Most studies of flood risk perception and response behavior to date have been conducted in either the United State or Europe, with very different socio-demographic, cultural, and environmental contexts from Southeast Asia. Empirical research in this region is needed in order to cope with problems of flood that tend to be exacerbated by the impacts of climate change. The objectives of this study are to understand people's perception and responses to the 2011 Thailand flood and to address the effective flood risk communication media and required information for affected people. The hypothesis about impact of gender and age on flood awareness and response was also tested. Steps required to improve information dissemination were also explored, and relative shifts in reliance on different media channels ere also investigated. Finally, sources of drinking water supplies during flooding were also investigated, together with investigation of the hypothesis of elevated bottled water consumption. This information will contribute to the development of people's awareness and flood preparedness to minimize impacts of future flood events.

Materials and Methods

1) Study area and respondents

A Thai language questionnaire survey was conducted in a shopping center to the north of Bangkok, in Pathum Thani Province (Figure 1). The province located in the Chao Phraya river basin. This entire area was severely damaged by the 2011 floods, with flood levels in some locations reaching as high as 3 meters above ground level.

2) Questionnaire Design

The questionnaire consisted of 23 questions. All questions were described in short, simple and objective language. The subjective format minimized ambiguity so as to minimize potential misunderstanding of the questions by respondents. The questionnaires were divided into three parts. The first part concerned information about the respondent, including age, gender, occupation, address, flood situation, evacuation response, and major problems encountered during the flood. The second part was related to receiving flood information, requested information, and preferred media for delivering flood information. The third part was designed for evaluating awareness of people and responses to mitigate impacts in more detail. A multiple choice format was used except for the questions on required flood information, where a 1-3 rating scale was applied to indicate the level of significance from low to high. In this question respondents chose up to 3 kinds of information from a choice of 6, and ranked them from 1-3 in order of significance.

3) Questionnaire survey and data analysis

Within the study area, the questionnaires were disseminated randomly in August 2013. In total, 100 people participated in the survey. Participants responded freely, assisted by the enumerator. Because some respondents did not answered all questions, data analysis was computed based on the exact responding number to each question. For questions related to impacts, respondents who had not experienced flood were excluded. For the 1-3 rating scale question, numbers 1, 2, and 3 were input into the calculation as a weighting.

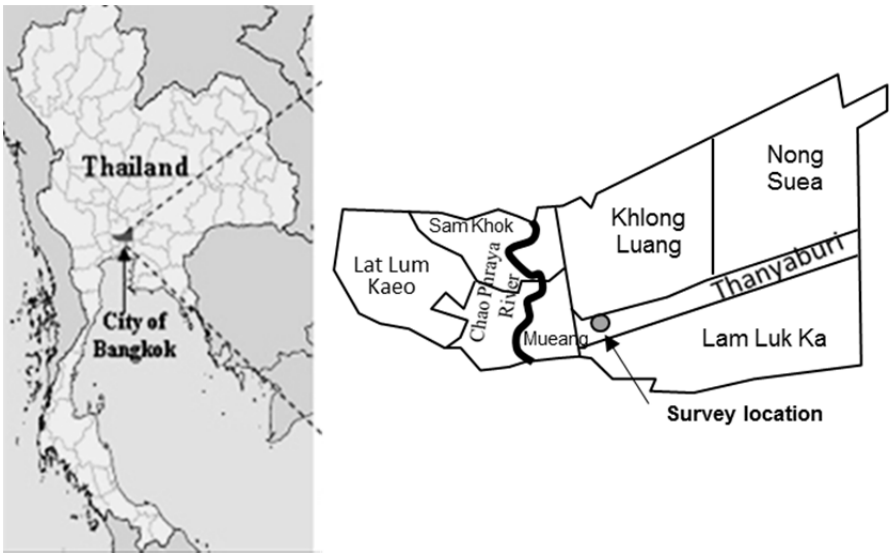

Figure 1 Map of the study area in Pathumthani province

Based on independent variables including age, gender, and flood experience, the correlation with other possible dependent variables such as flood risk awareness, decision on priority flood response, and preferable media were determined. Statistical analysis was performed using chi square test or Fisher's exact test. The tests are suitable for analyzing nominal data where the gap between items could not be estimated and the information was classifiable into categories. Basically chi square was applied unless it was invalid. Fisher's exact test was employed only in cases where the number of answers was below 5 for more than 20% of total data or became zero in some category. The statistical analyses were performed using SPSS software v. 16.0 (IBM, USA) and Microsoft Excel 2013 (Microsoft, USA).

Results and Discussion

1) Descriptions of respondents

Among 100 respondents, 51% were male and 49% female which were consistent with 48% and 52% of the 2015 data of the Department of the Provincial Administration [16]. Number of respondents in the age range < 20 years was the largest (32%) followed by age 20-30 (31%), 30-40 (17%), 40-50 (11%), and >50 (8%), while the official data reported that the population distribution was 14%, 28%, 19%, 19%, and 20%, respectively, for the same five age groups.

In terms of respondent occupations, 49% of respondents were students, 27% were employees, and 15% were doing business. Only 2% was unemployed. The results of this study are derived mainly from the responses of younger respondents, which might be useful for predicting proper preparedness for future flood events.

Most of the respondents in our study (80%) had personally experienced the flood situation in 2011, and 65% of affected people had evacuated to other regions, but not to government shelters. The reported inundation period suffered by respondents ranged from 20 days to 4-5 months, with an average of 2 months; the reported depth of floodwater ranged from 0.1 to 5 m, with an average of 1.5 m.

2) Flood risk awareness

In order to assess awareness of flood risk, enumerators asked respondents about the necessity of flood awareness information to mitigate damage. As shown in Figure 2, 93.6 % of respondents agreed on the importance of flood awareness information. Older respondents attached higher levels of significance than younger respondents, with 85% of the < 20 years group agreeing, and 100% of the > 40 years agreeing

on the necessity of flood awareness information. Concern over mitigation of flood risk was also greater among older respondents at the 90% confidence level ($p = 0.085$), supporting our hypothesis of a positive correlation between age and perceptions of flood risk. Personal experience strongly influences perceptions of risk [17]. Inexperienced people have a lower tendency to make necessary preparations for a future flood, while experienced people take up previously ignored efforts at disaster prevention.

In investigating gender differences in awareness of flood risks, female respondents reported a slightly higher perception, yet the difference was not statistically significant ($p = 0.44$).

In the Bangkok Metropolitan Area, many residents would have experience or at least remember the impacts of a previous devastating flood in 1995. Hence, the age group > 40 years could be expected to have greater awareness and concern over flood risk mitigation compared to younger people.

3) Priority response in flood event

Questionnaire respondents were asked to choose from four priority actions: (1) move your belongings; (2) cut off electricity; (3) move out from the home; and (4) other. The results (Figure 3) show that 52% of female respondents reported prioritizing moving their belongings, 43% gave priority to cutting off electricity, and 5% on moving out of their home. In contrast, 60% of male respondents gave priority to cutting off electricity; 34% to moving their belongings, and 6% on moving out of their home. Males seemed to be more concerned over the risk of electrocution (a risk to the wider community), while women gave more attention to saving their own property. This result supports a previous study, which found that males prefer to work on community initiatives, while women tended to focus on home interiors and family needs [13]. However, the gender differences in priority observed in this study were not statistically significant ($p = 0.19$), possibly due to the limited sample number.

A total of 140 of the 779 deaths caused by the 2011 floods died from electrocution [19]. However, the risks posed by electrocution during flood event might be underestimated, as reported by another study, which found that moving valuables and other belongings was regarded as the most important action to reduce flood damage [17]. The benefit of moving belongings is explicitly visible and immediate, whilst this is clearly not the case with cutting off the electricity supply. In interpreting complex risks and prioritizing actions, people consider multiple characteristics, including not only severity or magnitude of potential consequences, but also their ability to do something about the risk, based on their personal experience [18]. The survey results showed that more than 40% of respondents gave lower priority to cutting off electricity during flooding. This underestimation of the risks posed by electrocution could be life-threatening in its consequences.

According to the age group, we found 63% of the respondents in the >20 years age group gave priority to cutting off the electricity, while 42% chose to move their belongings first. 54% of respondents in the <20 years age group prioritized moving their belongings, while only 31% prioritized cutting off the electricity.

Moreover, no respondents in the age group >30 years considered evacuating from their home as a priority action, while 4-15% of people in the group <30 years considered evacuation. The results imply that older people, who might have past exposure to flood events, may have differrent responses than younger people without such experience. However, this observation was not statistically significant ($p = 0.227$).

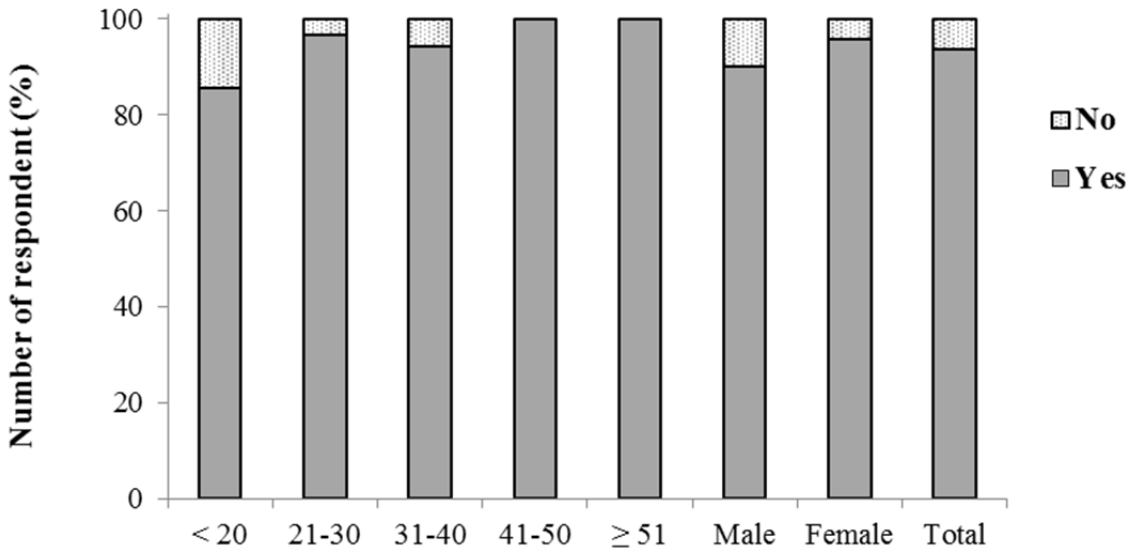

Figure 2 Flood risk awareness according to age group (N = 94)

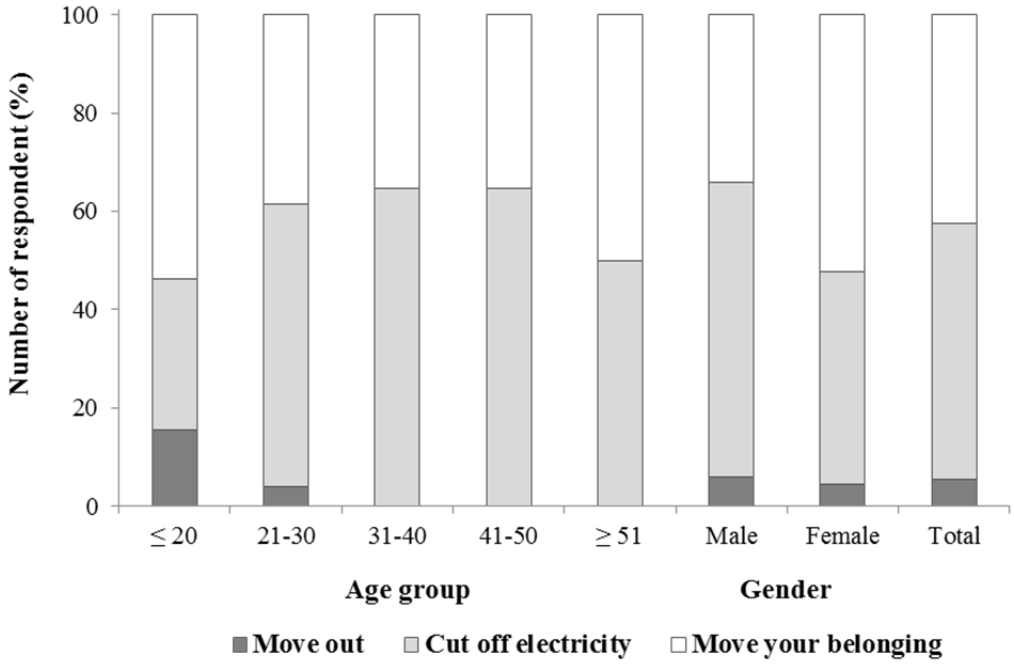

Figure 3 Priority action during flood event, by age and gender groups (N = 94)

4) Required information in flood event

To be effective in its aim, key information must be disseminated to vulnerable groups in time to take necessary action. The questionnaire survey was conducted to see the required information for pre-impact and trans-impact periods (before and during the flood event). The required information was separated into six categories: health information, flood severity, asset protection, water supply, food supply, and information on the nearest shelter. These categories were modified from those used in a previous study of residents' responses to flood warnings [20]. Only flood-experienced people were asked to choose the required information using a rating score of 1 to 3, based on their level of concern.

The results shown in Figure 4 demonstrate that the most important concerns before a flood

event were flood severity and asset protection (30% and 18% of weighted result). During the flood event itself, the major required information shifted slightly to flood severity (25%), food supply (18%), health information (18%), and water supply (17%). Concern over asset protection was reduced. Thus, information on flood severity and asset protection should mainly be provided before flood occurs, while information on health and supplies of food and water should be given greater emphasis during the flood period.

The results showed low attention to shelter information. This should be explained by the fact that 65% of flood-affected families had evacuated their residences and moved to other districts.

The study found that 15% of evacuees left their home before or one day after inundation. In our survey, only one person stayed in a government shelter for 3 months. Shelter campaigns should be advertised more effectively. According to Chandanachulaka and Bussarangsri [6] there were sanitation problems in shelters, which were reported to be overcrowded, with limited trained manpower, spoiled food, improper solid waste management, and poor personal hygiene. This kind of rumor might dissuade residents from considering a temporary stay in a government shelter.

5) Information dissemination

The media play an important role in reduce flood damage, whilst false media hype could adversely affect the flood response and relief efforts. The study explored the effectiveness of various media channels in communicating flood information, considering factors such as reliability, transparency, and timely dissemination. Flood-experienced respondents could select several options and the percentage was calculated based on the number of people selecting that choice compared to the number of people answering that question.

Before the 2011 flood event, 75% of flood-experienced respondents received flood information through television, followed by the internet (22%), word of mouth (17%), newspapers (15%), and radio (12%), as shown in Figure 5. After flooding had begun, the ratios of television and newspaper shifted to 59% and 6%, respectively. Internet and radio slightly increased in importance, but word of mouth was slightly reduced. Our previous assumption that news consumption through electrical devices, i.e. television, internet, and radio, would be reduced due to electricity cut-off seemed to be correct only for television, while delivery problems would certainly reduce the effectiveness of newspapers in flood situations.

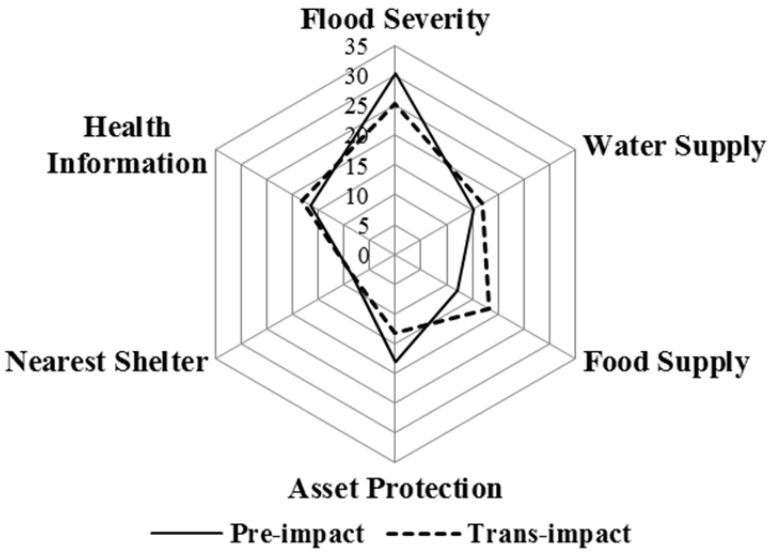

Figure 4 Pre-impact and trans-impact information requirement. (N = 80)

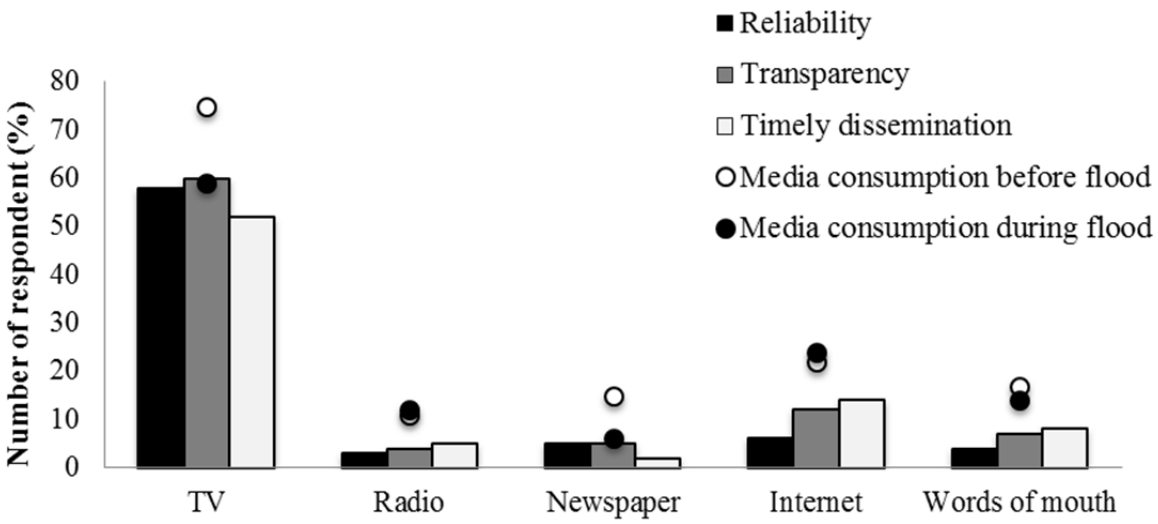

Figure 5 Media consumption before and during flooding, and media preference (Number of flood-experienced respondents to this question = 80, multiple answers)

Television was always ranked highest as a source of both pre-flood and trans-flood information. Respondents described television as reliable (58%), transparent (60%), and timely (52%). Internet sources (websites and social media) were ranked second. Internet was attractive in terms of time (1%), though its reliability was questionable (66%). The reliability and credibility of information from the internet should be improved in order to serve as an effective medium for timely distribution of flood information. Newspapers enjoyed the advantages of reliability and transparency; however, newspapers suffered from poor perception in regard to timeliness (in contrast to radio and word of mouth).

Television was reported as the most preferred source for disaster information, corroborating other studies [7, 21, 22]. However, Kittipongvises et al. [7] reported higher ratio of news acquiring media as 95% television, 51% newspaper, 50% internet, and 23% radio. In the previous study 68% of interviewers were in age 20–39 years or working age whereas in this study only 47% was in such age and 33% was < 20 years.

6) Media preference for awareness building

People will respond to protect themselves, their pets, or belongings when exposed to floods or receive a flood warning. However, simply providing information about flood risk or warning is insufficient [18]; it is vital that people react and respond effectively to such information received. Awareness is precursor to preparedness; awareness building is thus of fundamental importance to ensure a deeper understanding of flood risks and effective actions to mitigate damage to health and property.

Media preferences for awareness building was investigated as part of the questionnaire survey. Among respondents answering to this question, 57% reported preference for receiving flood information by television, with 33% preferring the internet as a source of flood information (Figure 6). Training programs were also desired by 8% of respondents. The order of preferential media for female and male were same as they like to get information from television > internet > training and > pamphlet. However, the proportion requesting training program was much higher among female respondents. Gender carried a statistically significant influence on media preference ($p = 0.018$).

In terms of age, at least 44% of respondents within each age group preferred television as their major source of information. 66% of respondents ≤ 20 years preferred television, while those of working age (31 to 40 years) had less interest with only 44% preference. Internet plays an important role second to television in disseminating information, and was preferred by 32-39% of respondents in the ≤ 20 age group and 31-40 years group; this finding is consistent with those of Hayden et al. [21]. Some respondents aged above 20 preferred training programs, while a small number preferred pamphlets. Age was correlated with media preference at $p = 0.029$. In conclusion, for younger people, TV and internet are the most powerful media channels, while for the older generation, all the four channels need to be implemented in combination.

7) Emergency drinking water supply

Aside from drowning and electrocution, waterborne disease is a major threat to life during flood events [23]. Waterborne disease outbreaks might result from disruption of water treatment facilities, as occurred in 2011 that flood water intruded into the water supply system. Drinking water supply is therefore one a prime priority in flood management. Normally, the main sources of drinking water in the study area were bottled water (50%), filtered water (40%), tap water (6%), boiled water (4%), and rain water (1%) (Figure 7). During flooding events, bottled water became more important, representing 69% of potable water consumed; filtered water was used by 21% of respondents, with boiled water, tap water and rain water at 6%, 5% and 1%, respectively. Drinking water sources depended on the stage of the flood, at more than 90% significance ($p = 0.08$). Use of bottled water increased during flood, while use of filtered water dwindled. This result was similar to another study [24] that (not unexpectedly) confirmed an increase in bottled water consumption following an announcement of contamination of the water supply by the city's waterworks authority. Our hypothesis about the increase of bottled water was confirmed.

In our study, twenty percent of respondents answered that the reason for choosing bottled water during floods was associated with the damage to water treatment facilities, the long distance to distribution points, and insufficiency of the water supply. Some also reflected a high and well-grounded concern over water quality. During the flood period, there were reports of inundation of raw water canal dikes and a municipal water treatment plant [25]. A main pumping station detected unusual turbidity and color in tap water, exceeding WHO's guidelines [26]. Nevertheless, there were relatively few waterborne cases related to the flood, including an increase in cases of diarrhea, haemorrhagic conjunctivitis, and meliodosis [19]. Food poisoning which generally peaks during the month of January (2002-2011) recurred in November 2011 at the end of the peak flood. One case of acute diarrhea was found resulting from drinking water from a filtration unit. Chatutongkasumrit et al. [11] reported that most filtered tap water, tap water, and flood samples in their study areas were contaminated with *Vibrio cholera,* though they did not contain the virulence cassette but could nevertheless cause morbidity. One tap water and one filtered tap water sample were also positive for *Shigella* sp. These reasons might lead to the increasing tendency of bottled water use. A second problem resulting from the use of bottled water at this time was the disposal of large quantities of discarded empty bottles. Hence, it is necessary to find an alternative water source and properly managing the bottle waste during flood. Generally, bottled water and/or water tankers were delivered to the affected population as an immediate response. However, setting up onsite water technology (WT) is more sustainable than frequently delivering water from remote areas.

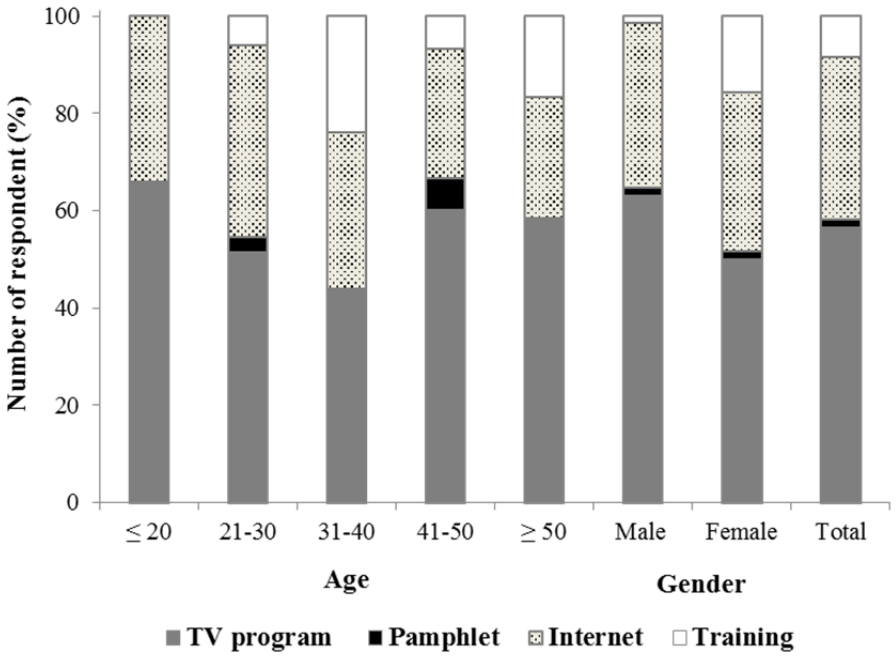

Figure 6 Media preference for flood prevention-awareness among different age-groups (N=96)

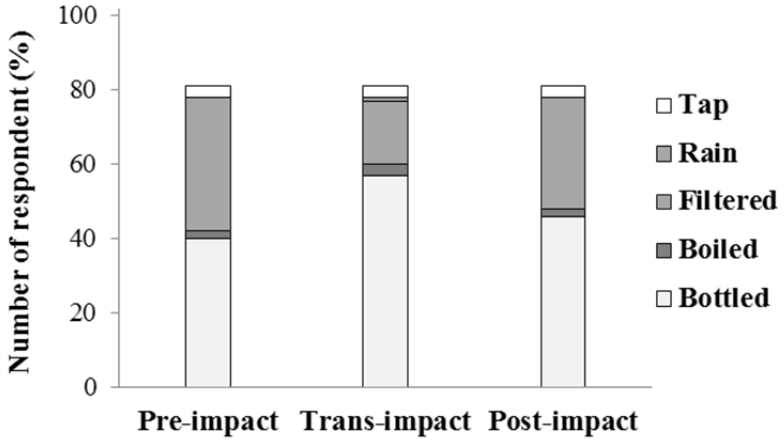

Figure 7 Drinking water source before, during and after flood (N=100)

Conclusions

A questionnaire survey was undertaken for 2011 flood affected Bangkok metropolitan area. Flood risk perception tended to increase with age ($p = 0.085$) but was not gender-related ($p = 0.44$). No significant gender differences among priority responses in flood event between males and females were observed ($p = 0.19$) or among age groups ($p = 0.23$). Males prioritized cutoff of electricity more than females (60%), whereas moving out household belongings were the first priority for 52% of females and for both males and females in the <20 age group (54%).

Knowledge transfer through education is a prime necessity, especially for the younger generation who may not have past experience of flooding events. Among the categories of information needed ahead of a flood event, information related to flood severity and asset protection was in greatest demand by the study respondents (30 and 18%, respectively). During the actual flood period, respondents' need for information on flood severity was high (25%) while concerns over supplies of food and water, and health information increased to around 18% of respondents.

Up to 57% of respondents expressed a preference for television as an information dissemination medium, due to perceptions of reliability, transparency, and immediacy in news delivery. However, these preferences differed by age group. Among younger respondents, TV and the internet were the dominant channels, whereas older respondents preferred to rely upon training programs in addition to the TV and internet.

During the flood period, consumption of bottled water increased by approximately 20%. Further research should focus on efficient delivery of potable water to inundated communities, and in preventing water borne infections. The outcome of this study contributes to a greater awareness of the needs and perceptions of at-risk communities, which will assist in optimizing emergency preparedness and response planning by responsible agencies.

Acknowledgements

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