Study on Public Flood Risk Cognition and Behavioral Response Based on IEC Strategy

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Abstract: In order to disseminate knowledge and information on flood risks in flood-prone areas, raise public awareness of flood risks and reduce possible damage to the public, a questionnaire survey was conducted among 260 residents of nine selected communities in Jiaozhou City to learn the public awareness and behavioral response to flood risks at different early warning levels. IEC key information of flood risk awareness was modified and formulated through group discussions, in-depth individual interviews and on-site observation. The awareness of residents in the project area was enhanced through the public participation, environmental management and flood management training, which plays a very important role in reducing flood losses.

1. Introduction

From the perspective of flood prevention and reduction of property loss caused by the floods, the enhancement of public awareness of flood control and mitigation has been considered as an effective strategy for flood control management [¹]. Also, public emergency measures against flood disasters are an important means to reduce the casualties [²]. At present, the popularization of flood control knowledge at the grassroots level is not sufficient, there remain certain gaps, and some work is still at an exploratory stage; besides, residents at flood-risk areas are lacking in disaster relief habits and legal consciousness, all of which pose obstacles for the flood control and rescue work [³].

It lies in the core of flood control management work to change the public behavior and lifestyle [⁴]. In the development of key information of IEC strategy for flood control and mitigation, it is required to comply with marketing principles, examine the vital information developed from the perspective of the target population while the immediate interests of the receivers are considered, and common experience range are increased and common language are sought, so as to ensure that the key information developed can be accepted by the public [⁵]. In addition, it is also required to guide the receivers for a shift in behavior model, i.e, from passive to active when confronted with the key information.

2. Construction of IEC Strategy in Flood Control Management

IEC (Information, Education, Communication) [⁶] has been widely used in various fields. When it comes to flood control and mitigation, IEC refers to planned, organized and systematic education activities among communities and a variety of publicity means employed to enhance public knowledge about early warnings and individual abilities to avoid disasters, to facilitate conscious adoption of behaviors and lifestyles suitable for flood control management, to increase individual and social involvement in flood control and mitigation and to improve the response to a flood warning, all
of which will contribute to an ultimate improvement in overall awareness and means against floods and disasters.

2.1 Objects
A questionnaire was designed under expert guidance to investigate residents' awareness of flood disasters and their responses to early warnings.

The questionnaire survey was carried out among 260 residents in communities all over Jiaozhou, which was selected as IEC strategy pilot implementation area, covering Shinan Community, Jia Le Jia Supermarket, Nantan Community, Shengli Community, Sanlihe Community, Sanguanmiao Village, Nanwolong Village, Heteuyuan Village and the Thermal Power Plant; the residents, age from 14 to 65 (mean age being 39), were selected according to stratified cluster random sampling method. Respondents for an in-depth discussion: Eight respondents responsible for flood control, five for early warning in communities and five from flood-danger zones.

2.2 Methodology
In January 2017, data was collected in nine communities in Jiaozhou City, Qingdao in the research method combining qualitative and quantitative analyses. With the advice sought from Jiaozhou Municipal Commission of Urban-Rural Development, Municipal Water Conservancy Bureau and experts in the industry, the questionnaire was designed and was distributed by trained investigators for the survey among the community residents. The survey content includes: Disaster experience, cognition about and behavioral response to flood early warning in the local, public awareness of and behavioral response to flood risks at different levels of early warnings. The qualitative research was carried out through group discussions, in-depth individual interviews and on-site observation to further learn of local knowledge, attitudes and behaviors towards flood early warnings, as well as their ability to take in the early warning information, their preference to the form in which information was spread, and their suggestions on the launch of IEC activities in the local.

2.3 Data Collation and Analysis
Epi Data3.0 software was used to establish the database, while SPSS11.0 software was employed for the statistical analysis; the main viewpoints in special topic group discussion and in-depth individual interviews were summarized after the records, both textual and audio, were sorted out.

3. Results

3.1 Basic Information of the Respondents
Among the residents investigated in the questionnaire survey, 121 are male, accounting for 46.5 percent of the total, 139 were female, taking up 53.5 percent of the total; 36 are aged 14 to 25, accounting for 13.8 percent, and 184 from 26 to 65 years old, making up 70.8 percent and 40 over 65 years old, accounting for 15.4 percent. The education degree of the respondents is relatively high. 14 residents have received primary school and below education, accounting for 5.4 percent of the total, 152 receiving secondary school (junior high school and senior high school) education, accounting for 28.5 percent, and 94 receiving college education (junior college, college and above), taking up 36.2 percent.

3.2 Awareness and Behavioral Response of the Target Population to Local Flood Early Warnings
During a flood season, 136 of 260 residents (52.3%) showed a high concern about the early warning information, 84 residents (32.3%) expressed concern about the information and only 40 residents (15.4%) showed little or no concern, indicating that most of the residents in Jiaozhou City were concerned about the early warning information. 81.9% of the community residents generally learnt such early warning information as the occurrence time, water level and future precipitation; 18.1% learnt more information, including whether there is a need to organize public rescue, methods of
avoiding disaster locally, and evacuation measures (like evacuation routes, resettlement, etc.). It can be seen that most of early warning information generally recognized by local residents are only about approximate time of rainfall or flood or the amount of precipitation, and they lack adequate measures for response, disaster avoidance and evacuation from a disaster-hit area.

85% of the community residents were promptly informed of early warnings through the television news, 15 percent chose the speakers in a community or a village, while village cadres turned to doorto-door notification, government SMS, or simple alarms (such as, striking gongs, setting off firecracker or fire), indicating that the public often choose the channels of a higher timeliness and authority for early warning information.

Regarding the importance of disaster mitigation measures and the role of early warning, 73 percent of the residents surveyed believed that water conservancy monitoring and forecasting, flood control and water conservancy works, post-disaster government relief were very important or important, 27 percent considered the above mitigation measures were of ordinary importance; 80.8 percent held that early warning was very effective in the protection of life safety, while 73.8 percent regarded that early warning information played an insignificant role in the safety of normal production, life and household properties. To sum up the understanding of the surveyed residents about early warning information, the vast majority did not grasp methods for local disaster avoidance and evacuation measures, who were also lacking in the knowledge about disaster avoidance and self rescue when a flood occurred, for they thought that all they needed to do was to wait for rescue forces’ on-time arrival. However, when the flood disaster strikes, the rescue forces may not be able to arrive in time and find each affected person. Regarding the post-disaster rehabilitation and reconstruction, most held that it was the government’s responsibility and had little to do with them.

3.3 Public Awareness of and Behavioral Response to Flood Risks at Different Early Warning Levels

In order to learn the public awareness of and behavioral response to flood risks at different early warning levels, questions were designed in the paper to investigate the residents on their judgment on the extent to which they are affected faced with several conditions of the flood risks and their countermeasures and disaster control and mitigation behaviors.

| Water situation                                      | Water level going beyond the warning level, but not exceeding the safety level and no serious danger to happen to the dam (42%) | Water level going beyond the warning level, and forecasting to reach or exceed the safety level and serious risk of dam break looming (50%) | Water level exceeding the warning level, serious risk of dam break happening and the water level going beyond the safety level and keeping going up (60%) | Water situation being very serious and the water level close to or over the highest water level in record (82%) |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| A great threat to life safety of families            | 42%                                                                                                                     | 50%                                                                                                                             | 60%                                                                                                                      | 82%                                                                                           |
| A great impact on family property safety            | 58%                                                                                                                     | 65%                                                                                                                             | 72%                                                                                                                      | 91%                                                                                           |
| A great impact on normal work and life              | 66%                                                                                                                     | 70%                                                                                                                             | 74%                                                                                                                      | 96%                                                                                           |
| Strong prevention ability of local environment and facilities | 58%                                                                                                                     | 64%                                                                                                                             | 60%                                                                                                                      | 49%                                                                                           |
| Strong protection ability prepared by families       | 55%                                                                                                                     | 51%                                                                                                                             | 45%                                                                                                                      | 18%                                                                                           |

| Water level going beyond the warning level, but not exceeding the safety level and no serious danger to happen to the dam (16%) | Water level going beyond the warning level, and forecasting to reach or exceed the safety level and serious risk of dam break looming (11%) | Water level exceeding the warning level, serious risk of dam break happening and the water level going beyond the safety level and keeping going up (8%) | Water situation being very serious and the water level close to or over the highest water level in record (2%) |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Not to take any action                                                                                                  | 16%                                                                                                                             | 11%                                                                                                                      | 8%                                                                                           |

| Water level going beyond the warning level, but not exceeding the safety level and no serious danger to happen to the dam | Water level going beyond the warning level, and forecasting to reach or exceed the safety level and serious risk of dam break looming | Water level exceeding the warning level, serious risk of dam break happening and the water level going beyond the safety level and keeping going up | Water situation being very serious and the water level close to or over the highest water level in record |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 16%                                                                                                         | 11%                                                                                             | 8%                                                                                                           | 2%                                                                                                                                   |
It was designed to learn the public awareness of and behavioral response to flood risks at different early warning levels in Jiaozhou City. After receiving the flood early warning, the vast majority of residents would take some actions for disaster control, and keep an eye on the future water situation. As the level of early warning increased, the residents surveyed felt that the flood had an increasing impact on their normal living, production, life and property safety, and that the prevention ability of the local environment and facilities against such water situation were generally higher than the family’s ability to get prepared for a flood. The above survey shows, to a certain extent, that the public lacked disaster avoidance and self-rescue knowledge when flood happened. Most felt that when flood disaster came, rescue and post-disaster rehabilitation and reconstruction were the government’s responsibility and had little to do with them, or that they had a poor ability to avoid disasters.

The education degree of the respondents is relatively high. 14 residents have received primary school and below education, accounting for 5.4 percent of the total, 152 receiving secondary school (junior and senior high school) education, accounting for 28.5 percent, and 94 receiving college education (junior college, college and above), taking up 36.2 percent. It can be seen from the questionnaire that the public awareness of flood control and education level are positively correlated to a certain extent, that is, the higher the level of education, the stronger their awareness of flood control and the richer their knowledge about different levels of flood early warnings.

The respondents are from different communities. According to their distance from the waters, they were divided into three groups, i.e., within 1km, 1 to 3km and above 3km; and according to their terrain of living and production, they were divided into three groups, i.e., those living in the plain area, in the hilly area and in the mountainous area. Based on the analysis of the questionnaire, the risk awareness of the residents has a significant correlation with the geographical characteristics of their residence. Residents living closer to the source of floods have a higher awareness of a flood risk. Besides, those closer to the flood risk source are more likely to act in response to a flood, such as the purchase of sandbags and other self-protection measures.

4. Analysis
It can be observed from the survey results that the target population is relatively highly educated, and has the awareness and ability to take the initiative to learn knowledge about early flood warning and emergency response measures. It was further learnt in the field interviews and post-training feedback that the local residents hope for access to more learning and training on flood control and mitigation. In their words, “more training on knowledge about flood control and mitigation may help prevent the disaster in a more scientific and effective way in flood season”, and “the flood management training is very helpful and timely, we hope that there will be more such trainings in the future”. Local residents hold an open and welcoming attitude towards the training and education. At the end of the training, the trained residents remarked that “the training has greatly enhanced their knowledge of flood control”, and “we expect the enhancement of awareness level of flood and waterlogging control”. Therefore, the training for residents has also produced a significant effect.

The community cadres are playing and will play an important role in the dissemination of knowledge and behavior promotion regarding flood control and mitigation. The residents in the communities surveyed mainly learn the information about flood control and mitigation from the community cadres’ publicity and education. Though both publicity and education work have room for further enhancement, it has been learnt from the opinions and suggestions collected that the local residents have the eagerness to learn about flood control and mitigation and a complete trust in the publicity provided by community cadres. Thus, interpersonal communication is the most basic, most important and most effective means of publicity and education.
At the same time, with the widespread use of mobile phones and other communication tools, Publicity Month and Publicity Week activities can be carried out in the forms of public service advertising, video broadcast, special reports, photo exhibition and various other forms on television, radio, newspapers, microblog and WeChat, so that the citizens may develop a correct understanding of urban flood control, become fully aware of the public benefits from flood control work and thus, able to become attentive and supportive to the cause of flood control, both inwardly and in action. Telephone, WeChat and QQ and other media can be brought into full use for timely spread and communication about flood and disaster situations as well as for the scheduling in flood protection.

Through the above means, the residents are able to receive the latest early warning information anytime and anywhere and learn the relevant knowledge of disaster control and mitigation as required, thus greatly speeding up information dissemination and penetration rate of flood control and mitigation.

5. Conclusion

Through the analysis on the factors influencing flood risk awareness, social factors and geographical environment factors, such as education level, distance from a production and living area to waters, produce a significant effect on the cognition about flood risks. IEC strategy, taking the target population as the focus and the dissemination of flood control knowledge as a socially marketing activity, develops appropriate contents, materials and forms for dissemination, through the analysis on the behavior of the target population, the availability of various communication channels, the design of dissemination contents and forms, time and spatial arrangement for dissemination, the integration of dissemination information and channels and other market researches, and ensures the effective implementation of IEC strategy via the timely feedback from the target population on the dissemination effect. Interpersonal communication is also one of the most basic, most important and effective ways to obtain knowledge of flood control. Therefore, it is appropriate to organize the publicity based on interpersonal communication and supplemented by a variety of mass media.

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