

Comparison of the expectations of residents and rescue providers of community emergency medical response after mudslide disasters

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The integration of community resources is critical for emergency response. A thorough understanding of a community's requirements in advance is essential. This study examines communities that suffered mudslide disasters, and discusses expectations of the emergency medical response provided to the community from the perspectives of residents and rescue groups. The questionnaire used in the study was designed to adopt the Likert Scale for quantification purposes. Its content was divided into six categories based on emergency response. Both residents and rescue providers acknowledged that finance and reimbursement were the highest priority. Public information was regarded as the least important by both groups. Significant differences existed between the groups on patient care activities and supportive activities ($P = 0.02$ and 0.03 , respectively), which were more appreciated by residents. We conclude that residents had higher expectations of evacuation, temporary relocation, lodging, food, and sanitary management than the rescue groups.

Keywords: community, disaster, emergency response, mudslide

Introduction

In the past, victims of community disasters were believed to be dependent on external rescue during the initial phase of the disaster and the value of a local response capacity was neglected (Wenger et al., 1985). Decades of experience has improved our understanding of the importance of immediate rescue work performed by the local community. Lichterman describes the community as an essential resource for disaster emergency response. The active involvement of and a high quality training programme for local residents is the cornerstone of establishing a community response system (Lichterman, 2000). Turner et al reported after the San Fernando earthquake that the so-called organisational lag after a disaster could last several days, and that the emergency response must be carried out mainly by local residents and organisations during this period (Turner et al., 1986). This conclusion was also drawn after the Loma Prieta earthquake, the Northridge earthquake and the Taxes flood (Neal, 1992; Kirkwood, 1996). The terrorist attack on the World Trade Center in 2001 and the anthrax attack

of the same year caused many in the United States to reflect on the unpredictability and diversity of disasters as well as the limitations of resources in local responses. It is now strongly believed that gaining a thorough understanding of a community's requirements beforehand as well as integration of community resources are crucial to a successful community emergency response (Barbera and Macintyre, 2002; JCAHO, 2003; Hick et al., 2004).

A mudslide is defined as a movement of a mixture of surface materials down a slope. The mixture is made up of a large amount of water and 50 per cent or more solid materials. The solid materials include soil particles larger than grains of sand and coarse detritus in large quantities. Mudslides are usually caused by earthquakes, volcanic eruptions, melting snow or downpours of rain. Taiwan's mudslide records date back to the Japanese colonial era (1895–1945). The documented history shows that in recent years, whenever there was a typhoon or a downpour of rain, serious disasters subsequently occurred because of failures in the retention of soil or damage to the natural environment caused by the mismanagement and overdevelopment of mountain areas (Taiwan Ministry of the Interior, 2005). The areas in Taiwan that have experienced the major effects of mudslides include Linkou and Taipei (1982), Fongchiu and Nantou (1986) and Tongmeng and Hualian (1990). The mudslide that accompanied the violent typhoon Herb in 1996 caused 41 deaths, in Shenmu Village, Nantou County. Public concern and government attention were stimulated after this tragic event.

The Jiji earthquake in 1999 caused changes to the region's geological structure, including a loosening of the attachment of soil to the earth's surface in mountainous areas. Downpours of rain occurred frequently in the next two years in addition to typhoons Bilis, Prapiroon, Xangsane, Toraji, Nari, and Mindulle. Serious mudslides caused loss of life and financial losses throughout the island each year from 1999. For example, typhoons Nari (2001) and Mindulle (2004), which were categorised as moderate typhoons on the Taiwanese adaptation of the Beaufort scale (force 12–15), claimed 104 and 41 lives, respectively. Mountainous counties in central Taiwan, such as Nantou, Chiayi, Taichung, and Yunling, were the most affected areas. Hualian and Taipei counties, respectively located in the eastern and northern parts of Taiwan, also suffered occasional mudslides.

The Jiji earthquake and typhoons Xangsane and Nari caused catastrophes that proved impossible to handle independently by local emergency medical teams. Instead, in order to respond promptly to the extensive losses and emerging needs for rescue work, resources provided from inside and outside the community had to be integrated. Emergency medical response refers not only to the provision of medical services, but also to all the conditions that could influence the response. Information analysis during disasters, the administrative response, the coordination of different rescue missions in the disaster area, evacuation and care, supplies of manpower and materials, and financial management are all important elements that enable the system to function.

Auf der Heide (1995) describes four phases in community disaster preparedness: planning or mitigation, preparedness, response, and recovery. These four phases cover almost all the possible scenarios that a community will face. An evaluation of the factors

included in these four phases therefore provides a good understanding of how a community's emergency response system is working. The part of the Auf der Heide's evaluation that deals with response contains 900 questions in seven different categories. The seven categories are: a) command and coordination; b) information collection and strategy development; c) public information; d) patient care activities; e) supportive activities; f) volunteer services; and (g) finance and reimbursement. Each category can be subdivided into many different work areas. For example, people in charge of public information have to deal with messages released from emergency response agencies as well as communication with the media. Furthermore, patient care activities include medical services as well as arrangements for the evacuation and temporary relocation of those affected. Supportive activities not only provide food and other material supplies, but also handle the proper disposal of domestic waste and other sanitary issues.

In this study performance in the seven categories described above is reviewed and the results analysed in terms of the expectations, from the perspectives of residents and rescue groups, of community medical emergency response during mudslide disasters. The differences between the two groups are also compared.

Subjects and methods

Communities identified in documentation from the National Fire Agency and the Department of Health as having experienced serious effects from mudslide disasters in 2000–02 were chosen as the study population. Community residents and rescue providers, such as local health administrators, police officers, firefighters and non-governmental rescue organisations, formed the main elements of the study.

A survey questionnaire was constructed. Questions were selected and revised from those parts of the Chinese-language edition of the Community Medical Disaster Planning and Evaluation Guide (Teng, 1996) that are relevant to natural disasters and appropriate to Taiwan's geography, climate and policies. Similar questions were merged into a single comprehensive question. Ten experts who specialise in disaster medicine, epidemiology, public health and community studies were invited to become members of a consulting committee. With the help of the consulting committee and local community officers, 201 questions were chosen from the selected and revised questions. The consulting committee finalised the selection of questions by scoring each. The 60 questions awarded the highest scores were chosen. All the questions were compared with each other, without further division according to their category.

Community leaders and members of the rescue groups were invited to focus group discussions and key information interviews, where the survey questionnaire was completed. The questionnaire was revised after this pre-test. The procedure is shown in Table 1.

Of the total of 98 questions included in the questionnaire, 60 were revised from the Chinese-language edition of the Community Medical Disaster Planning and Evaluation Guide (Teng, 1996) and 38 were original questions. The survey was conducted

Table 1 Mudslide disaster emergency response study questionnaire design

	Number of Questions Revised from 'Community Medical Disaster Planning and Evaluation Guide' (Auf der Heide, 1995; Teng, 1996)	Number of Self-Developed Questions
Questions belonging to the emergency response phase defined in reference book	900 ↓	
Questions selected that are relevant to natural disasters and also appropriate for Taiwan's geography, climate, and policies. Similar questions were merged	500 ↓	
Highest scoring 201 questions selected by experts' evaluation	201 ↓	
Highest-scoring 60 questions selected by experts' second evaluation		
Opinions offered by experts and community leaders		15
Discussions with key information providers and the focus group		23
Total	60	38

by post or through interviews. To reduce the possibility of bias, three versions of the questionnaire were produced—each with the questions placed in a different order.

In line with suggestions in the literature (Auf der Heide, 1995; Teng, 1996), the 98 questions were divided into the seven different categories described above. Each category contained the following number of questions: finance and reimbursement (2 questions), patient care activities (21 questions), supportive activities (21 questions), command and coordination (21 questions), information collection and strategy development (25 questions), public information (8 questions) and volunteer services (0 questions). Because no question about volunteer services was selected, the number given to this category is 0.

Statistical methods

The Likert Scale was used for quantification, by which the five options of ‘very necessary’, ‘necessary’, ‘neutral’, ‘not necessary’, and ‘definitely not necessary’ were given respective scores ranging from 5 to 1.

The analysis was conducted using SPSS 10.0. Three major statistical approaches were applied in the study. First, factor analyses—such as the Kaiser-Meyer-Olkin measure, Bartlett’s test, and principle components analysis—were used to evaluate the compatibility and correlation of the self-developed questions in each category. Then, according

to the mean score in each category, the order of priority of both the residents group and rescue-providers group was established. Finally, a comparison was made between the two groups' expectations of emergency responses. A *P* value less than 0.05 was considered statistically significant.

Results

Seven communities in five counties (Taipei, Miaoli, Nantou, Taichung and Chiayi) agreed to participate in the study, and this comprised the resident group. The local police, firefighters, health administrators and members of non-governmental rescue organisations in these seven communities were used to form the rescue-provider group. The study was conducted in January to December 2003. Of the 350 questionnaires originally distributed, 203 were successfully recovered and 189 qualified to form part of the analysis. One hundred and ten residents and 79 rescue-provider personnel participated. The names of the participating communities and rescue-provider organisations are listed in Table 2.

The differences between the two groups regarding their gender, education, and employment were found to be significant ($p < 0.01$). In the resident group, a little over half (51 per cent) had received no formal education after middle school. Only 12 per cent had a college education. In the rescue-provider group, 54 per cent attended high school and 34 per cent went to college. With regard to employment, the biggest grouping among the residents were farmers (41 per cent), while the majority of people in the rescue-provider group were government employees (48 per cent). Although 43 per cent of the local residents were female, only 11 per cent of the rescue-provider group were female.

Factor analyses found high correlation scores between the 38 original questions and the seven categories, indicating adequate compatibility. No evaluation was performed on the 60 questions revised from the reference book (Auf der Heide, 1995; Teng, 1996).

Table 2 Community and county distribution of resident group and occupational settings of rescue-provider group

Resident group	Number	Rescue-provider group	Number
Zunnan Village, Chiayi county	30	Fire station	15
Benjiu Village, Taipei county	11	Police station	10
Baibufan, Miaoli county	30	Health center	8
Hujhu Village, Nantou county	23	Non-governmental rescue organisation	46
Cinai Village, Nantou county	7		
Nanshih Village, Taichung county	5		
Boai Village, Taichung county	4		
Total	110		79

Table 3 Priority of categories with statistical comparison between the resident group and rescue-provider group

Category	Resident group	Rescue-provider group		
	Order of priority (mean, SD)		95% confidence interval	P-value (2-tailed)
Finance and reimbursement	1 (4.32,0.92)	1 (4.30,0.77)	-0.16–0.19	0.85
Patient care activities	2 (4.31,0.78)	3 (4.25,0.68)	0.01–0.10	0.02
Supportive activities	3 (4.27,0.87)	5 (4.21,0.78)	0.00–0.11	0.03
Command and coordination	3(4.27,0.78)	2 (4.26,0.71)	-0.02–0.06	0.45
Information collection and strategy development	5 (4.26,0.87)	4 (4.23,0.75)	-0.01–0.08	0.17
Public information	6 (4.16,0.91)	6 (4.19,0.69)	-0.10–0.05	0.51

Statistical method: Student *t* test.
SD = standard deviation.

In order to establish the order of priority, the scores of the questions from each category were added and the mean obtained. The higher the mean score, the higher the rank of the corresponding category in the order. It was found that both residents and rescuer-provider groups regarded finance and reimbursement as most important, because questions related to this topic were given the highest scores by members of both groups. The two groups also agreed that public information was the least important category (Table 3).

The expectations of the residents' group and the rescue-provider group of emergency medical response were compared. Significant differences were found in the categories of patient care activities and supportive activities (*P* = 0.02 and 0.03, respectively) (see Table 3).

A stratification method was applied to explore the reasons for these distinctions between the two groups. The 98 questions in the six categories were further divided into 26 subcategories, according to classification systems used in the literature (Auf der Heide, 1995; Teng, 1996). Among the 26 subcategories, there were eight concerning patient care activities and seven that addressed supportive activities. Significant differences were found in the subcategories of evacuation and temporary relocation relating to patient care activities, as well as the subcategories of lodging, food supply, and sanitary management relating to supportive activities (*P* = 0.00 and 0.01, respectively).

Discussion

The selection of the communities in this study was based on information provided by the Council of Agriculture. Their results showed that the communities most likely to be faced with mudslide problems are predominantly located in the rural areas of

the mountainous counties. The propensity for mudslide disasters in these remote communities is caused not only by geographical factors, but also by imbalances in social and economic development. Although the sampling in this study was not random, the demographic structures reflecting resource-deprived status are representative of today's rural areas in mountainous counties, which are composed primarily of farmers and people with lower levels of education.

In a report on the Red River flood (1997), Buckland demonstrates that the more developed a community is, the greater its capacity to cope with emergency situations (Buckland and Rahman, 1999). Additionally, the published reports on the Northridge earthquake (1994) and other disasters state that the marginalisation of a community will not only increase the probability of a disaster occurring, but also cripple its response capacity (Bolin and Stanford, 1998; Oliver-Smith, 1994). Rural mountainous areas with a propensity for mudslides are usually deprived of resources. People living in these areas have a lower socioeconomic status in society. Once disaster occurs, local residents are at greater risk of losing their lives and property. Although local emergency response agencies, such as firefighters and the police, do exist and receive regular training and preparedness guidance, a lack of sufficient resources and back-up still puts them in situations that necessitate further resources in times of disaster (Taipei County Government Police Bureau, 2005). The adverse development of rural mountainous communities compounds the tragedy of loss of life and financial loss, and hampers an adequate and prompt emergency response to such disasters.

In addition to the official emergency response agencies, various non-governmental rescue organisations also participate in disaster relief work. For example, the Chinese Search and Rescue Association (Taiwan) and the Buddhist Tzu Chi Foundation are organisations that are well trained and offer help in many disaster situations. Sometimes, unexpected and self-recruited volunteer groups also appear at disaster scenes. Many studies have been made of the role of this type of volunteer in disaster response (Nehnavajsa, 1989; Berman, 2000). However, no questions about volunteer services were included in the questionnaire for this study. The lack of consideration of this category by our experts, key information providers and focus group during the construction of this questionnaire is in direct contrast to the original content of the Community Medical Disaster Planning and Evaluation Guide (Auf der Heide, 1995), in which volunteer services are comprehensively discussed. This might reflect a lack of recognition of the role of volunteers in society in Taiwan. The public sometimes believes that more people can provide more help. Unfortunately, the unplanned self-recruited volunteers who arrived at the affected areas of Taichung and Nantou during the Jiji earthquake created chaos in terms of housing arrangements and sanitary management, and placed an additional burden on food supplies and transportation (author's personal experience). Moreover, there were conflicts over emergency response resources. The same phenomenon has also been noted in other reports (Auf der Heide, 1995; Pesik and Keim, 2002). Cuny explains how unorganised volunteer activities can result in an inefficient emergency response (Cuny, 1999b). The phenomena of convergent volunteerism and convergence behaviour were discussed after the 2001 terrorist attacks

on the World Trade Center (Cone et al., 2003; Auf der Heide, 2003). In fact, unexpected volunteers can create obstacles for emergency response agencies. For example, personal safety, the legality of medical practice, disturbance of command delegation, and security issues at disaster scenes may all become serious concerns in ongoing rescue efforts. Cone et al. also point out the necessity of training in advance for medical staff who would like to volunteer for disaster relief (Cone et al., 2003).

Our analyses (Table 3) shows that residents and rescue providers agree on most issues in terms of their priority. Since the major air crash near Chiang Kai-shek international airport in 1998, Taiwan has endured numerous air crashes, landscape collapses, earthquakes, floods and mudslides, as well as the recent SARS epidemic. Whether from the news media coverage or tragic personal experience of a disaster, the public has come to recognise the importance of budgets and insurance management to disaster relief. This understanding was well reflected in our survey—finance and reimbursement were chosen as the top priority. In France, Duclos found that community residents were most concerned about financial aid after suffering the effects of flooding (Duclos et al., 1991). A similar conclusion was drawn in a study of the Northridge earthquake in the United States (Bolin and Stanford, 1998). Financial management has been recognised as an important aspect of successful disaster relief (Bollini and Reich, 1994; Green, 2000; Cuny, 1999a). During the SARS epidemic in 2003, the budget for disaster management became a controversial issue throughout the island (China Post, 2004; Taipei Times, 2003).

The categories 'patient care' and 'supportive-care' were higher priorities for residents. Patient care activities include evacuation, transportation, temporary relocation and medical care. Supportive activities include setting up sanitation facilities and the supply of different resources, including housing and food. Since these survey items had a direct influence on residents' welfare, their choices are self-explanatory. Surveys conducted in other countries have reached similar conclusions in terms of residents' priorities (CDC, 2004). For rescue providers, the categories of command and coordination, patient care activities, information collection, and strategy development were a higher priority. Their order of priority, which was consistent with previous studies on similar subjects, could indicate the rationale developed from their regular training and past experience. In fact, command, coordination, analysis of information, evacuation, temporary relocation and medical care are all inter-related and cannot be conducted separately (Altintas and Delooz, 2004; Glick and Birnbaum, 1998). The incorporation of the above factors is key to both successful emergency response and the personal safety of rescue providers.

On the other hand, the residents' group and group of rescue providers both regarded public information as the least important category. This might be linked to an underestimation of the influence of the news media during a disaster and a lack of understanding about how public communication should work during a catastrophe. In fact, accurate information, timely communication and good interactions with the news media are essential to successful emergency response, which usually requires cooperation between different groups. Reports of media stories during a disaster that highlight

stereotypical impressions of disaster-affected areas, such as a complete collapse of social systems and panic-stricken residents who cannot function, are mostly exaggerated. (Simpson, 2000; Glass, 2001) Paradoxically, these exaggerated stereotypes usually facilitate offers of outside help. Furthermore, because of the isolation that results from transportation break-downs and the subsequent communication difficulties, emergency response agencies often overestimate the destruction caused by a disaster. Through the news media, this overestimation often triggers a sudden surge of manpower and donations from the public, wasting resources and masking the real needs behind the media frenzy (Pesik and Keim, 2002; Auf der Heide, 2003; Montagna, 2002). This occurred after the Jiji earthquake in Taiwan. The massive deliveries of food and other materials to the affected areas at the donors' expenses further slowed the already disrupted flow of traffic to the area. In the end, excess donations that were not needed or could not reach their final destination were inevitably discarded. This subsequently caused more problems when it came to the clean-up. If public information had been properly handled, the turmoil caused by the over-response would have been avoided, and public resources could have been saved for more appropriate uses. Accurate public information is thus an indispensable factor in emergency responses.

A comparison was made between the two groups for each category. There was a significant difference in each group's view of patient-care activities and supportive activities ($p = 0.02$ and 0.03 , respectively). These two categories were given higher scores by the resident group, indicating that residents were more concerned about issues relating to personal care and support. These results were consistent with priority ranking of the two groups (Table 3). According to the results of the stratification, the subcategories of evacuation and temporary relocation relating to patient care activities, and the subcategories of lodging, food supply, and sanitation management relating to support activities, were given significantly different rankings by the residents and the rescue providers. This could be explained by the fact that the residents had higher expectations of evacuation, temporary relocation, lodging, food, and sanitation management during a catastrophe.

There have been many reports about needs assessments for residents following natural disasters. These assessments have played an important role in strategy development and the improvement of emergency response. A contemporary study of a major flood in Bangladesh in 1970 found that news of an epidemic of infectious disease reported in the media was untrue. Relief resources were then successfully diverted to work on housing, food supply and sanitation for the local people rather than medicine (Sommer and Mosley, 1972). Similar conclusions have been made from assessments following hurricane disasters in the United States, where victims were in extreme need of security-related support, such as evacuation, temporary relocation, supplies for daily life, and sanitation-related services. (Hlady et al., 1994; CDC, 2002; CDC, 1998). In general, evacuation, temporary relocation, housing arrangements, food, clothing, the necessities of daily life, repairs to homes, restoration of power and water supplies, and domestic waste management are appreciated most by residents. Because the common physical illnesses after hurricanes are skin diseases and minor injuries, there is no

substantial need for major trauma or intensive care. It is ensuring the continuous supply of medicines for people with chronic diseases that is the most needed of all the medical services provided (Pesik and Keim, 2002; Noji, 2000). Although the need for medical service differs depending on the type of disaster, residents who have survived mudslides and residents who have survived hurricanes thought alike—believing evacuation, temporary relocation, and the supply of resources to restore normal life to be the most essential in terms of emergency response.

Study limitations

The questionnaire used in the study had been revised many times before the final survey. Every effort was made to ensure that the contents of the questionnaire were representative of the reality of communities in Taiwan. However, because of the complexity of emergency response, there could still be room for improvement. In addition, given the variations of the geographic features in Taiwan and the relatively small number of communities represented in the study, the applicability of the study's conclusions to other circumstances has still to be verified.

Conclusions

The effects of unexpected, self-recruited volunteers were overlooked during the construction of the questionnaire, indicating that, in Taiwan, the role of volunteers in emergency response is ambiguous and yet to be defined. With regard to residents' and rescue providers expectations of emergency response provided to the community, the priorities of both groups, and the differences between them, appear rational and consistent with reports on similar topics from other countries. However, the importance of public information was underestimated by both groups, indicating that administrators should place more emphasis on this issue in the future.

When disasters strike, adequate preparedness on the basis of a thorough understanding of the needs of the community is the only way to successfully integrate community resources and manage rescue missions. The response capability of a community is built on tight interactions between residents, governmental and non-governmental rescue agencies (Barbera and Macintyre, 2002; JCAHO, 2003; Hick et al., 2004). The unpredictability of disasters, and the numerous circumstances that could therefore be involved, are further complicated by the social and geographic variations between different communities. This means that disaster studies usually focus on reviewing past experience (Guha-Sapir, 1991; Margoluis et al., 1989). This study used an epidemiological approach to carry out an objective evaluation and quantification of the disaster experience. In this way, expectations of emergency response services provided to the community during a mudslide can be understood in detail from the perspectives of both residents and rescue providers. These opinions can be used as the basis for future strategy development in emergency response.

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