Chapter 10
Social Networks and Reduction of Risk in Disasters: An Example of the Wenchuan Earthquake

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Disaster, Risk, and Social Networks

Social Aspects of Disaster and Risk

Disaster is a natural hazard with complex social impacts. When disaster strikes, normal social order is interrupted. This might lead to serious aftermath such as social disorder and social conflicts. Kreps (1984: 312) defined disaster as "events, observable in time and space, in which societies or their larger subunits (e.g. communities, regions) incur physical damages and losses and/or disruption of their routine functioning" and argued that both the cause and consequences of the disaster are related to social structure. Thus, the social science of disasters is of great value for the better understanding of disaster and for devising better management policies.

Sociologists are extremely interested in disasters not only because they hope to answer practical questions like "how to mitigate the social impact of disasters" but also because disasters provide a "natural laboratory" for understanding social structure and social process. In recent years, sociologists have started to focus on the importance of "social networks" and "social capital" in disaster studies.

Social Networks

"Social networks" form the basis for a set of theories and methods to study social structure. The basic idea is to view actors (that could be persons or organizations) as "nodes" and the relationship between actors as "ties." These nodes and ties add

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up to construct a network-like structure. In social network analysis, the structure of the society is exactly this network-like structure (Scott 1991; Wasserman and Faust 1994).

While the methods of network analysis are becoming more advanced and more complex, the theoretical development of social network was not advancing very quickly until the emergence of the concept of "social capital." The concept of social capital has transcended the traditional definition of "visible" capital. It implies that social relationships and interaction among social members and the social norms and structure based on these network relationships are all important types of "capital," which is beneficial both for individuals and for the society. Originating in sociological studies, this concept has rapidly gained popularity in economics, political studies, management, and social science generally in recent years (Portes 1998; Putnam et al. 1993).

Early disaster researchers had already noticed the role of social networks and social capital in disasters. Drabek et al. (1981) argues that social networks and social associations are the basic social units that respond in a disaster. Dynes (2005) holds that disaster destroys all types of capital, including economic, human, and social ones. However, compared to economic and human capital, social capital is the least damaged in disaster. Thus, social capital and social networks may be the most dependable resources in the aftermath of disaster.

Several empirical studies have considered the importance of social networks and social capital in disasters (e.g., Haines et al. 1996; Hurlbert et al. 2000). Nevertheless, few studies have given a comprehensive overview of how social networks reduce risks during and after disasters. Based on the survey data of the Wenchuan earthquake in 2008, this chapter will describe and discuss the role of social networks in reducing risk after disaster.

In May 12, 2008, an earthquake measuring 8.0 on the Richter scale hit Wenchuan County of Sichuan province, China. The seriously damaged area included more than 100,000 km^2 covering four provinces. According to statistics up to September 8, 2008, 69,226 people were confirmed to have been killed in this earthquake, 17,923 were reported missing, and 374,643 were injured. The total direct economic loss amounted to 845.1 billion yuan. As one of the most catastrophic disasters in the history of China, the Wenchuan earthquake has put great economic and social stress on the affected population. During the earthquake, around 6.9 million houses collapsed and 23.4 million houses were damaged. Around 15 million people were displaced. Food, water, shelter, and health care became the urgent needs of the affected population. According to a representative survey in the earthquake-hit area conducted in July 2008,[1] 32 % of the interviewed households had their houses totally destroyed in the earthquake. When asked about their most urgent needs, almost half (49 %) of the affected people declared that "new houses or improved housing" was their most urgent need, around 8 % selected "new jobs," and around 5 % selected "medical care." With the help from the government and society, the

[1]More details of the survey follow in this paper.

people in the disaster area are actively reconstructing their homeland. This disaster also provides researchers with an opportunity to observe how social network reduces risks in disasters.

Data and Measurement of Social Networks

Data

The data came from the Post-Wenchuan Earthquake Rapid Needs Assessment. In July 2008, the Chinese Academy of Science and Technology for Development conducted a rapid needs assessment survey in the Sichuan earthquake area, which was the first large-scale study of post-disaster rapid needs assessment in China.[2] As many as 174 clusters (villages, residential committees, or camps) and 5,000 households in the affected area were randomly sampled, and trained interviewers were sent to conduct face-to-face questionnaire interviews. The questionnaire mainly focused on the living conditions of residents, including their losses in the disaster, housing and infrastructure, education, health, employment, social networks and social participation, attitude, and evaluation. The field work was conducted from July 7 to July 19. Finally, 144 clusters and 4,526 households were interviewed, and 3,652 questionnaires were successfully collected. The response rate was 80.7 %.

Measurement of Social Networks

To measure the social networks of the respondents, we used "spring festival network" indicators. Developed as a revised version of "position generator" in Chinese context by Bian and Li (2000), the spring festival network has proven to be a good indicator for measuring the core social networks in the Chinese society (Bian and Li 2000; Zhao 2002, 2007). We asked the respondents, "In the spring festival of 2008, how many relatives, friends and other acquaintances did you contact?" With this question, we could arrive at two basic indicators of the network. One is the size of the network (total number of contacts). The other is the composition/structure of the network (the proportion of the relatives in the network).

We also measured the change in the network due to the disaster. First, we asked if any of the network members had died in the earthquake. This is considered as the "deterioration of networks." Second, we asked if the respondents had any new network members after the earthquake. This represented the reconstruction of networks.

Table 10.1 showed the basic characteristics of networks in our survey. The mean size of spring festival networks is 17.8 members. Among network members, the

[2]The survey is funded by the Norwegian Ministry of Foreign Affairs and supported by Fafo Institute of Applied International Studies, Norway.

Table 10.1 Statistics of social networks of residents in the earthquake area

	Mean	Std. deviation
Size of networks	17.80	17.68
Composition of networks (proportion of relatives)	0.68	0.41
Death of network members (yes = 1)	0.10	0.30
Have new network members (yes = 1)	0.04	0.20

Table 10.2 Statistics of control variables

	Mean	Std. deviation
Years of education	5.03	3.98
Household income per capital (logged)	4.98	2.08
Self-assessed economic status before the earthquake (1 = lowest , 5 = highest)	2.31	0.85
Loss in the disaster (1 = yes)	0.69	0.46
Live in temporary house (yes = 1)	0.40	0.49
Got governmental economic aid (1 = yes)	0.70	0.46
Self-reported health status in last 2 weeks (1 = very bad , 4 = very good)	2.83	0.82
Party membership (1 = no)	0.87	0.32
Gender (1 = female)	0.23	0.41
Age	59.77	14.19

average proportion of relatives is 68 %. Around 10 % of local residents lost some of their network members in the earthquake. Only 4 % of the people obtained new network members through the earthquake.

Control Variables

To better measure the impact of social networks, some control variables were also included in the analysis. We measured the "years of education" of the respondents as the indicator of their human capital and the "household income per capita" and "self-estimated economic status" as indicators of their economic capital. We also measured the respondents' loss in the earthquake with two variables. One is "the type of house currently living in." Those who were living in temporary housing were considered as more severely affected by the disaster, compared to those who had their own homes. The other variable is "self-estimated loss" in the earthquake. If the respondents reported that their lives became worse after the earthquake, they were considered as have losses in the disaster. We measured whether the respondents "received governmental economic aid" after the earthquake to see the impact of governmental support. To control for the health status before the earthquake, "self-reported health before the earthquake" was measured. Moreover, we also measured some individual characteristic variables, such as sex, age, and hukou registration status.

The statistics of control variables are listed in Table 10.2.

How Social Network Reduces Risks in the Wenchuan Earthquake?

Search and Rescue

During the initial period after a disaster, the normal workings of the social system is temporarily suspended, which leaves an "institutional vacuum" in which informal social institutions like social networks could play a prominent role. One example is search and rescue efforts.

Aguirre et al. (1995) found that search and rescue efforts after disaster are conducted primarily by other victims belonging to the social network of trapped ones. When external rescue personnel do arrive, they also need to locate remaining victims with the help of their neighbors. Based on a study of the 1980 Italy earthquake, Lechat (1989) also reported that 97 % of the injured victims who were successfully evacuated and transported to medical care were rescued by other people who used their bare hands and shovels, not heavy equipment.

The Wenchuan data shows similar patterns. In the survey we found some 130 respondents had been trapped in debris. Among them, around 95 % were rescued by relatives, neighbors, and other members of the public. Only a very small percentage of trapped victims were rescued by external rescue personnel, including PLA (People's Liberation Army) soldiers, professional rescue teams, or volunteers (see Fig. 10.1).

Information

Knowledge and information are of great importance in reducing risks before and after the disaster. A varied literature has shown that one of the main functions of social networks is to facilitate information flow (Granovetter 1973; Lin 1982). Disaster researchers also found that social networks are an important channel for transmitting warning messages before a disaster (Aguirre 1988; Fitzpatrick and Mileti 1994).

Our survey showed that social networks played an indispensable role in facilitating information flows in the disaster affected area. After the earthquake, around 16 % of residents had acquired information about the government's disaster relief efforts through the channel of "relatives, friends, and other social ties." Among all the information channels, social networks were the third most frequently used channel, only less than "television" and "local cadres" (see Fig. 10.2).

Further analysis was conducted to see who were more likely to use social networks as their main information channel. The result of logistic regression shows that those with lower proportion of relatives in their networks were more likely to use the social network to get information. This finding is consistent with that

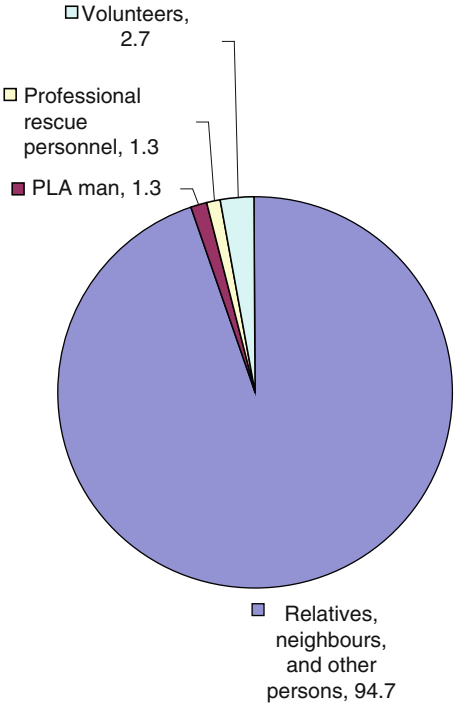

Fig. 10.1 Rescuers in the Wenchuan earthquake

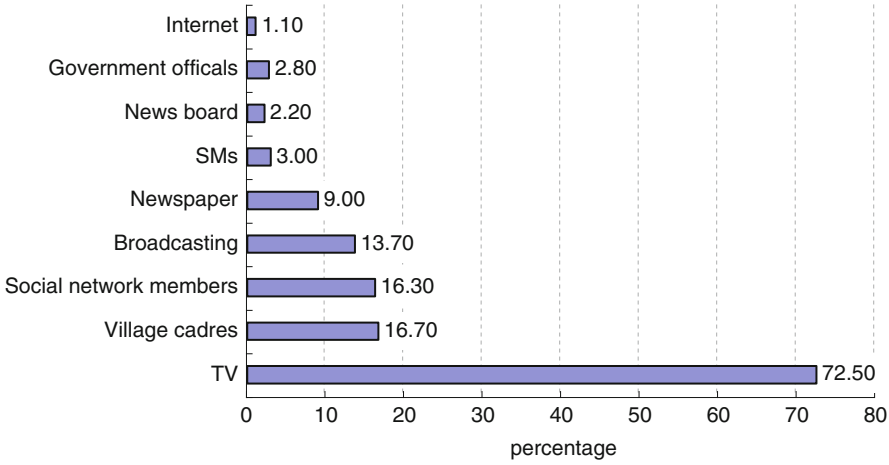

Fig. 10.2 Main channels of policy-related information after the earthquake

of existing literature. Granovetter (1973) argues that weak ties in one's social networks, such as acquaintances, are usually more different or heterogeneous than the strong ties such as relatives and close friends. As a result, weak ties have a higher probability of bringing in new information and knowledge than strong ties.

Table 10.3 Logistic regression of likelihood of using social networks to get information after the earthquake

	B		Std. error
Network size	0.00		0.01
Network composition	−0.32	#	0.20
Death of Network members (1 = yes)	−0.34		0.31
Have new network member (1 = yes)	0.00		0.01
Education years	−0.04	#	0.03
Household income per capital (logged)	0.00		0.04
Self-assessed economic status before the disaster	−0.08		0.10
Loss in the earthquake (1 = yes)	0.20	*	0.20
Living in temporary house (1 = yes)	0.61		
Self-reported health in last 2 weeks	−0.03		0.09
Sex (female = 1)	−0.11		0.20
Age	0.01		0.01
Party membership (yes = 1)	0.72	*	0.34
Hukou (urban = 1)	0.05		0.22
Constant	−4.71		1.02
−2 Log-likelihood	1355.10		
Chi square	36.15	**	
df	14		
N	3, 404		

Note: #, $p < 0.10$; *$p < 0.05$; **$p < 0.01$

Our finding also suggests that after disaster, the more heterogeneous network, i.e., the networks with more non-relatives, is better for getting new information (Table 10.3).

Social Support

After the disaster, the victims are in urgent need of various types of assistance and support. Researchers of the effects of disasters have found that the degree of loss in disaster is strongly related to the support/assistance received (Rossi et al. 1982; Kaniasty and Norris 1995a, b). Among the external support, social support is one of the most important.

Social support is defined as social interactions that provide individuals with actual assistance or embed them into a web of social relationships perceived to be loving, caring, and readily available in times of need (Hobfoll 1988). The source of social support can be divided into formal and informal ones. The formal source of social support may be viewed as coming from the people outside of an individual's social network, while the informal source is within the social network (Vaux 1988).

Our data showed that after the Wenchuan earthquake, the victims obtained various types of support. Though the government was the main support provider,

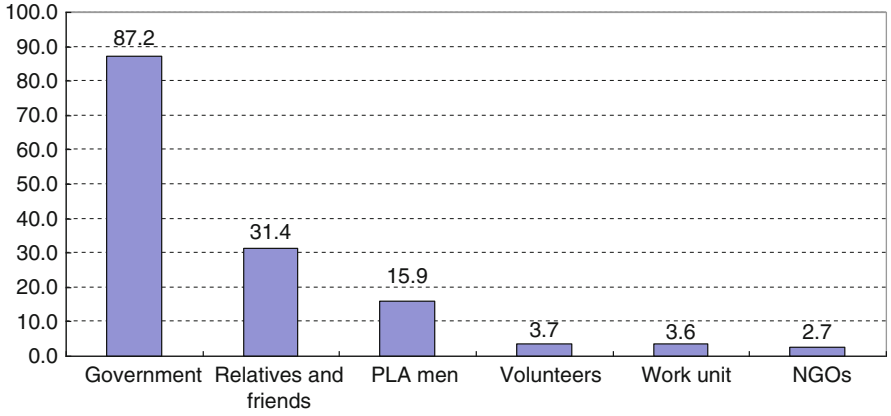

Fig. 10.3 The most important support providers

social networks played an important supplementary role in providing support to the victims. When asked "among those who provide support to you, who is the most important?" the majority of respondents (87.2 %) selected "government," while "relatives and friends" was the second most frequently option selected. More than 30 % of respondents thought social networks were their most important support providers (Fig. 10.3).[3]

An important issue in the wake of a disaster is the distribution of support resources among the victims. Some believe there is a "rule of relative needs," i.e., those in need of more support will be provided with more (Hobfoll and Lerman 1989; Kaniasty and Norris 1995a). Others insist on the "rule of relative advantages," which holds that some social groups are more likely to receive support than others regardless of their needs (Drabek and Key 1984; Kaniasty and Norris 1995a).

To test these two conflicting theories and to see if social networks also played a role in providing support, we further analyzed what kind of households was more likely to get more support than others after the earthquake. We set "the amount of support received" as the dependent variable. In addition to social network variables, we also included control variables such as highest education of household members, household income per capital (loggEd.), self-assessed social status of the household before the earthquake, any loss in the earthquake, type of houses, and the type of residence of the household.

In Table 10.4, the result of an ordinary least squares regression is shown. The network size has a significant influence on the amount of support received, which means that a bigger network will bring more social support. The number of new network members is also a significant variable. If the household has more newly obtained network members, it will receive more support. The results indicate

[3]Please note that since this question is a multi-choice one, the percentage adds up to more than 100.

Table 10.4 Ordinary least squares regression of the factors influencing the amount of support received

	B		Std. error
Network size	0.01	***	0.00
Network composition	0.01		0.06
Death of Network members (1 = yes)	0.24	***	0.08
Have new network member (1 = yes)	0.02	***	0.00
Highest completed education years in household	−0.08	***	0.03
Household income per capital (logged)	0.02	*	0.01
Self-assessed economic status before the disaster	−0.01		0.03
Loss in the earthquake (1 = yes)	0.47	***	0.05
Living in temporary house (1 = yes)	0.88	***	0.05
Residence (1 = urban)	0.05		0.06
(Constant)	0.92	***	0.15
R^2	0.20		
F	80.77	***	
N	3,260		

Note: $*p < 0.05$; $***p < 0.001$

that social network is a very important channel of various types of support after the disaster. Having a bigger social network size, i.e., knowing more people, is apparently one of the "relative advantages" one has in the distribution of support.

Mental Health

The impact of disaster is not only confined to the loss of lives and properties but also affects the mental health of survivors. During the disaster, the victims may experience the loss of relatives, neighbors and friends, the damage to property, and other losses. The great stress brought by these losses may create short-term and long-term psychological distress.

Several studies have found that social networks reduce the negative impact of trauma induced by disasters. After the disaster, social networks can provide the victims with emotional support, help them to release their stress and trauma, and help them to recover from psychological distress (Bolin and Klenow 1983; Kaniasty and Norris 1995a).

The impact of social networks on victims' mental health is quite significant in our survey. The mental health score of the residents in the earthquake area is measured by the CHQ-12 scale. CHQ (Chinese Health Questionnaire) is a revised Chinese version of GHQ (General Health Questionnaire), which aims at measuring the mental health status of the respondents. CHQ was developed in Taiwan and has been tested in several Chinese cities (Yang et al. 2003). We set the mental health score as the dependent variable (the higher the score, the better mental health status) and social network indicators as independent variables in addition to a number of control variables.

Table 10.5 Ordinary least squares regression of the factors influencing mental health status of survivors

	B		Std. error
Network size	0.02	**	0.01
Network composition	0.49		0.26
Death of Network members (1 = yes)	−0.82		0.36
Number of new network member after earthquake	0.03		0.05
Education years	0.10	*	0.03
Household income per capita (logged)	0.15	*	0.05
Self-assessed economic status before the disaster	0.66	**	0.13
Loss in the earthquake (1 = yes)	−1.40	**	0.25
Living in temporary house (1 = yes)	−0.25	**	0.24
Got governmental economic aid (1 = yes)	0.08		9.26
Self-reported health status in last 2 weeks	3.07	**	0.12
Sex (1 = female)	0.05		0.29
Age	−0.02		0.01
Party membership (1 = yes)	−0.21		0.33
Hukou (1 = urban)	0.42		0.28
(Constant)	45.23	**	1.29
R^2	0.23		
F	61.82	***	
N	3,391		

Note: #, $p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

The results of regression are shown in Table 10.5.

From the results we could clearly see that social network is very important in maintaining the mental health of disaster victims. A bigger network will bring better psychological outcomes. Secondly, the higher proportion of relatives in the network, the better mental health status one is in. A high proportion of relatives provides higher density and lower heterogeneity to the network than one with a low proportion of relatives. This result is consistent with existing arguments that a dense and homogenous network is good for providing emotional support (Lin 1982). Finally, death of network members is negatively related with mental health. Apart from the obvious conclusion that people are affected when those they are close to die, the result also supports the argument that the damage to networks will have significant negative impact on individuals' psychological health (Kreps 1984). It is also interesting to note that obtaining governmental aid after the earthquake has no significant impact on respondents' mental health. This finding further implies that after the disaster, informal resources like social networks play a more important role in social lives of survivors than formal/institutional resources.

Other control variables like level of education and economic status have impact on the mental health. Those with relatively high education and better economic status tend to report better mental health. Experiencing loss in earthquake and living in temporary houses lead to decreased mental health. In terms of self-reported health status, the B coefficient shows that when the self-rated health status increases by one level, mental health will also increase by around three points.

Conclusion

The study has shown that social networks play an important role in reducing risks during and after disaster. In the early phase of disaster, most of the search and rescue endeavors come from social network members. In the aftermath of disaster, social networks can facilitate the flow of information, provide various types of support, and help in maintaining the mental health of the victims.

The study also indicates that changes in the social network in disaster is an important topic that needs further study. In the disaster, part of people's social networks will be damaged, and they actively reconstruct their networks after the disaster. These dynamics and their social impact deserve further study.

Some policy implications can also be drawn from the study. Firstly, as mentioned above, the social network members are the most dependable rescuers during the initial phase of the disaster. Therefore, the government should put more emphasis on improving the preparedness of local people in disaster-prone areas, including providing training for basic rescue skills to local dwellers. Secondly, since social networks are indispensable in disaster, it is necessary to take them into consideration when designing disaster management and mitigation policies. For example, after disaster hits, the government should assist the survivors in keeping their social networks intact during rescue and displacement and tap existing social networks in the reconstruction processes. Finally, the government should understand that social networks and social capital require long-term accumulation. Helping people to freely communicate and associate with each other is the best way to help them build up social networks and social capital that build resilience to disaster.

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