

Social networks and reduction of risk in disasters: An example of Wenchuan earthquake

Zhao, Yandong
Institute of Science, Technology and Society,
Chinese Academy of Science and Technology for Development

Disaster, risk and social networks

Social aspects of disaster and risk

Disaster is not only a natural or technical hazard, but also has complex social impacts. When disaster strikes, normal social order is interrupted. This might lead serious results 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 better understanding disaster, and for coming up with 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” is 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 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 and more mature and 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 will bring benefit both for individuals and for the society. Originated in sociological studies, this concept has rapidly gained popularity in economics, political studies, management, and social science generally in recent years (Portes, 1998; Putnam, 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 the disaster is destroying all types of capital, including economic, human and social ones. However, comparing to economic and human capital, social capital is the least damaged in disaster. So the social capital and social networks may be the most dependable resource in the aftermath of disaster.

Several empirical studies have considered the importance of social networks and social capital in disasters (e.g., Haines, 1996; Herlbert 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 Wenchuan earthquake in 2008, this paper will describe and discuss the role of social networks in reducing risk of disaster.

Data and measurement of social networks

Data

The data came from “Post-Wenchuan Earthquake Rapid Needs Assessment”. In July, 2008, Chinese Academy of S&T for Development conducted a rapid needs assessment survey in Sichuan earthquake area, which was the first large scale example of a post-disaster rapid needs assessment in China. As many as 174 clusters (villages, residential committees or camps) and 5000 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, etc. The field work was conducted during 7th to 19th of July. Finally, 144 clusters and 4526 households were actually interviewed, and 3652 questionnaires were successfully collected. The response rate was 80.7%.

Measurement of social networks

When measuring 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 et al. (2000), the spring festival network has been proved to be a good indicators for measuring the core social networks in the Chinese society (Bian et al., 2000; Zhao, 2002, 2007). We asked the respondents “In the spring festival of 2008, how many relatives, friends and other acquaintances had you contacted?” By 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 of the network during the disaster. First, we asked if any of the network members is dead in the earthquake. This is considered as the “deterioration of networks”. Second, we asked if the respondents have any new network members, i.e. the newly recognized social contacts after the earthquake. This represented the reconstruction of networks.

Table 1 showed the basic characteristics of networks in our survey. The mean size of spring festival networks is 17.8 people. Among network members, the average proportion of relatives is 68 percent. Around 10 percent of local residents lost some of their network members in earthquake. Only 4 percent of the people obtained new network members through the earthquake.

Table 1. Statistics of social networks of residents in earthquake area

	Mean	Std. Deviation
Size of networks	17.80	17.68
Composition of networks	0.68	0.41
Deterioration of networks	0.10	0.30
Have new network members	0.04	0.20

How is social network reducing risks in Wenchuan earthquake?

Search and rescue

During the first period after the disaster struck, the normal working of social system is temporarily suspended, which left an “institutional vacuum” in which informal social institutions like social networks can play a prominent role. One of good examples is search and rescue.

Aguirre et al (1995) found that search and rescue efforts after disaster are carried on primarily by other victims, i.e., the social network members of entrapped ones, in the area. When external rescuing personnel do arrive, they also need the knowledge of neighbors to locate remaining victims. Based on a study of 1980 Italian earthquake, LeChat (1989) also reported that 97 percent of the injured victims that were successfully evacuated and transported to medical care were rescued by people around with bare hands and shovels, not heavy equipment.

The Wenchuan data show similar patterns. In the survey we found some 130 respondents had been entrapped in debris. Among them, around 95% percent were rescued by relatives, neighbors and other persons around. Only a very small percentage of entrapped victims were rescued by external rescue personnel, including PLA soldiers, professional rescue teams, or volunteers (see figure 1).

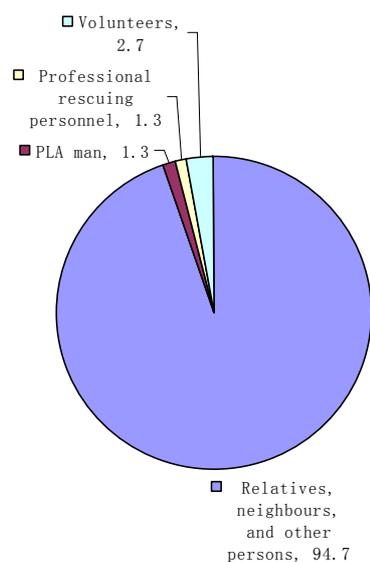


Figure 1. Who rescued the people entrapped in debris?

This result had very strong policy implications. Since the majority of the victims of disaster are rescued by their social network members rather than external rescue personnel, the government should focus on providing basic rescue skills to the residents in disaster prone areas as a key content of disaster preparation.

Information

Knowledge and information are of great importance in reducing risk before and after the disaster. A varied literature have 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 transferring warning message before the disaster (Aguirre, 1988; Fitzpatrick and Mileti, 1994).

Our survey showed that social networks played an indispensable role in facilitating information flows in disaster affected area. After the earthquake, around 16 percent of residents in earthquake area acquired their information about the government’s disaster-relief policies through the channel of “relatives, friends and other social ties”. Among all the information channels, social networks was the third most frequently used channel, only less than “television” and “local cadres” (See figure 2).

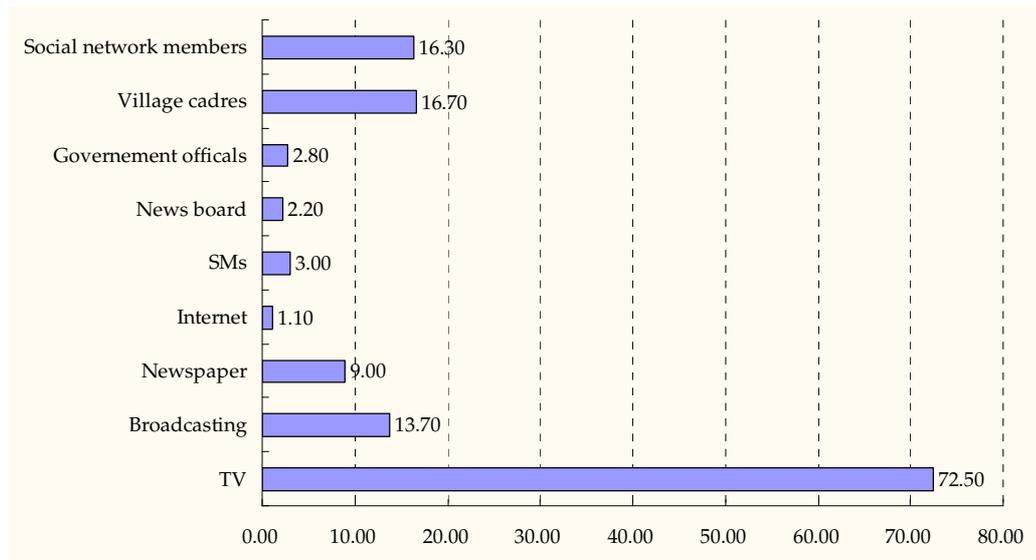


Figure 2. Main channels to get policy-related information after the earthquake

Further analysis was conducted to see who were more likely to use social networks as their main information channel. The result of logistic regression had shown that, those with lower proportion of relatives in their networks were more likely to use the social network to get information. This result is consistent with existing literature. Granovetter (1973) argues that, as weak ties are usually more heterogeneous, they will have higher probability of bring new information and knowledge. Our result also suggested that after disaster, the more heterogeneous network^① is better for getting new information.

Table 2. Logisitic regression of likelihood of using social networks to get information after the earthquake

	B		Standard 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	-0.04 #		0.03
Household income per capital (logged)	0.00		0.04
Sex (male=1)	-0.11		0.20
Age	0.01		0.01
Self-rated health	0.03		0.09
Party membership	0.72 *		0.34
Self-assessed social status	0.08		0.10
Hukou	0.05		0.22
Loss in the earthquake (1=yes)	0.20 *		0.20
Type of house (1=temporary)	0.61		
Constant	-4.71		1.02
-2 Loglikelihood	1355.10		
Chi square	36.15 **		
Df	14		
N	3404		

#: p<0.10; *: p<0.05; **: p<0.01; ***: p<0.001

Social support

After the disaster, the victims may be 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

^① In network studies, 'relatives' and 'friends' are usually considered as 'strong' ties, while 'acquaintances' are considered as weak ties.

et al., 1982; Kaniasty and Norris, 1995a, 1995b). Among the external support, social support is one of the most important.

Social support is defined as those 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 individuals' social network, while the informal source is strongly related to individuals' social networks (Vaux, 1988).

Our data showed that after the Wenchuan earthquake, the victims were getting various types of support. Though the government was the main support provider, social networks played an important supplementing role in providing support to the victims. When being 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 percent of respondents thought social networks were their most important support providers.^①

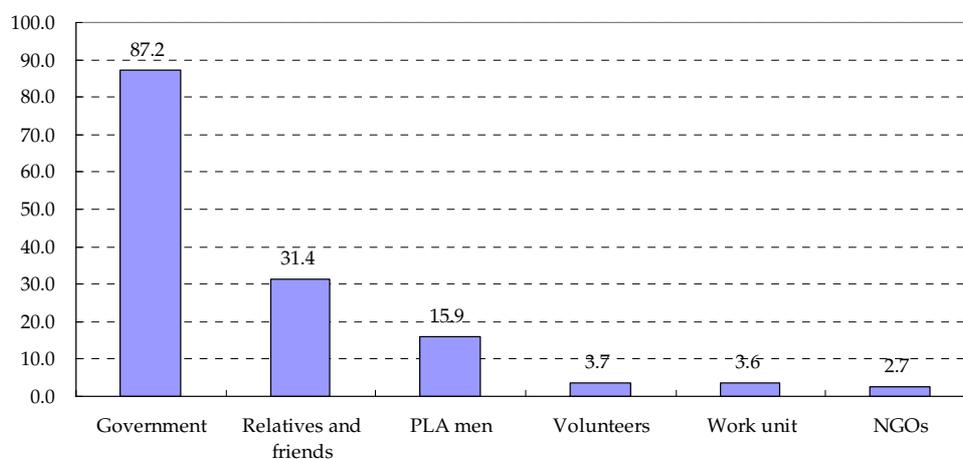


Figure 3. Who are the most important support providers?

An important question in the wake of a disaster is what is determining the distribution of support resources among the victims? Some believe there is a "rule of relative needs", such that 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 hold that some social groups are more likely to receive support than other groups regardless of the needs (Drabek and Key, 1984; Kaniasty

^① Please notice that since this question is a multi-choice one, the percentage adds up more than 100.

and Norris, 1995a).

To test these two conflicting theories, and to see if social networks also played a role in it, we further analyzed who were more likely to get more support after the earthquake. We set “the amount of support received” as the dependent variable. The independent variables includes: “size of the network”, “proportion of relatives in the network (network composition)”, “if any network members died in the earthquake”, “Number of newly recognized network member after the earthquake”. Other control variables includes: highest education of household members, household income per capital (logged), self-assessed social status of the household before the earthquake, if the household had any loss in the earthquake, type of houses, residence of the household, etc.

In table 3, the result of an ordinary least squares regression is showed. The network size has a significant influence on the amount of support received, which means that a bigger network will bring more social support. Number of new network members is also a significant variable. If the household had more newly recognized network members, it will receive more support. The results indicate that social network is a very important channel to provide various types of support after the disaster. The bigger social network size, i.e., the more people one knows, is apparently one of the “relative advantages” one have in the distribution of support.

Table 3. 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 in household	-0.08	***	0.03
Household income per capital (logged)	0.02	*	0.01
Self-assessed social status	0.01		0.03
Loss in the earthquake (1=yes)	0.47	***	0.05
Type of houses (temporary=1)	0.88	***	0.05
Residence (urban=1)	0.05		0.06
(Constant)	0.92	***	0.15
R ²	0.20		
F	80.77	***	
N	3260		

#: p<0.10; *: p<0.05; **: p<0.01; ***: p<0.001

Mental health

The impact of disaster is not only limited in the loss of lives and properties, it also affects people's mental health. During the disaster, the victims may experience the loss of relatives, neighbors and friends, the damage of 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 traumatic impacts of disasters. After the disaster, social networks can provide the victims with emotional support, help them to release the stress and trauma, so that help them to recover from the 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 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 is firstly developed in Taiwan and has been tested in several Chinese cities (Yang, 2003). We set the mental health score as the dependent variable (the higher the score, the better mental health status), and social networks indicators as independent variables in addition to a number of control variables. The results of regression are showed in table 4.

Table 4. Ordinary least squares regression of the factors influencing the mental health status

	B		Std. Error
Network size	0.02	***	0.01
Network composition	0.49	*	0.26
Death of Network members (1=yes)	-0.81	*	0.36
Number of new network member after earthquake	0.01		0.02
Education	0.10	***	0.03
Household income per capita (logged)	0.14	***	0.05
Sex (male=1)	0.18		0.27
Age	-0.02	#	0.01
Self-rated health	-3.07	***	0.12
Party membership	-0.20		0.33
Self-assessed social status	-0.66	***	0.13

Hukou (urban=1)	0.44		0.28
Loss in the earthquake (1=yes)	-1.38	***	0.25
Type of houses (temporary=1)	-0.02	***	0.22
(Constant)	44.66	***	1.19
R ²	0.23		
F	76.13	***	
N	3403		

#: p<0.10; *: p<0.05; **: p<0.01; ***: p<0.001

From the result we could clearly see that, social network is very important in maintaining the mental health of disaster victims. Firstly, the network size has a positive impact. The bigger network will bring better psychological outcomes. Secondly, the network structure also works. The higher proportion of relatives in the network, the better mental health status one is in. High proportion of relatives is usually related to higher density and lower heterogeneity. This result is consistent with existing arguments that 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).

Conclusion

The study has shown that social network is playing an important role in reducing the risk during and after disaster. In the early phase of disaster, most of the searching and rescuing 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 to maintain the mental health of the victims.

The study also indicates that the change of social networks in disaster is an important topic that needs further studies. In the disaster, part of people's social networks will be damaged, while people are also actively reconstructing their networks after the disaster. This dynamics and the social impact of it deserve further study.

Some policy implications can be drawn from the study. Since social networks is so important, it is necessary to take it into consideration when making disaster management and mitigation policies. The government should try to maintain intact of

social networks in disaster prone areas, and try to make good use of existing social network in reconstruction processes.

References

1. Aguirre, E. 1988. "The Lack of Warning before the Saragosa Tornado". *International Journal of Mass Emergencies and Disasters*. 6:65-74
2. Aguirre, E., Wenger, D. , Glass, T., Diaz-Murillo, M. and Vigo, G. 1995. "The Social Organization of Search and Rescue: Evidence from the Guadalajara Gasoline Explosion". *International Journal of Mass Emergencies and Disasters*. 13:93-106
3. Barton, A. 1970. *Communities in Disaster*: Garden City, NY: Anchor, Doubleday
4. Bates, F., Fogelman, C., Parenton, V. and Tracy, G. 1963. *The Social and Psychological Consequences of a Natural Disaster --- A Longitudinal Study of Hurricane Audrey*. National Research Council Disaster Study No. 18. University of Georgia.
5. Beggs, J., Haines, V. and Hurlbert, J.. 1996. "Situational Contingencies Surrounding the Receipt of Informal Support". *Social Forces*. 75(1):201-22
6. Bian, Yanjie and Li, Yu. 2000. "Social network capital of Chinese urban families". *Tsinghua Sociological Review*. 2:1-18.
7. Bolin, R and Klenow, D. 1983. "Response of elderly to disaster: An age-stratified analysis". *International Journal of Aging and Human Development*. 16:283-96.
8. Burton, I., Kates, R. and White, G. 1978. *The Environment as Hazard*. New York: Oxford University Press
9. Coleman, J. 1961. "Community Disorganization". Pp.573-74 in Merton, R. and R. Nisbet (eds), *Contemporary Social Problems: An Introduction to the Sociology of Deviant Behavior and Social Disorganization*. New York: Harcourt, Brace, and World
10. Drabek, T., Taminga, J., Kilijanek, T. and Adams, C.. 1981. *Managing Multiorganizational emergency Responses: Emergent Search and Rescue Networks in Natural Disasters and Remote Area Settings*. Boulder: Institute of Behavior Science, University of Colombia
11. Drabek, T., and Key, W.. 1984. *Conquering Disaster: Family Recovery and Long-Term Consequences*. New York: Irvington
12. Dynes, R. 1974. *Organized Behavior in Disaster*. Columbus: Ohio State University, Disaster Research Center. Serial No.3.
13. ———. 2005. *Community Social Capital as the Primary Basis for Resilience*. University of Delaware, Disaster Research Center. Preliminary paper No. 344.
14. Fitzpatrick, C. and Mileti, D.. 1994. "Public Risk Communication". Pp. 71-84 in Dynes, R. and K. Tierney (eds). *Disasters, Collective Behavior, and Social Organizations*. Newark, DE: University of Delaware Press.
15. Fritz, C. 1961. "Disaster". Pp. 651-94 in Merton, R. and R. Nisbet (eds), *Contemporary Social Problems: An Introduction to the Sociology of Deviant Behavior and Social Disorganization*. New York: Harcourt, Brace, and World
16. Granovetter, M. 1973. "The Strength of Weak Tie." *American Journal of Sociology* 78: 1360-80
17. Haines, V., Hurlbert, J. and Beggs, J.. 1996. "Exploring the Determinants of Support Provision: Provider Characteristics, Personal Networks, Community Contexts, and Support Following Life Events". *Journal of*

18. Hobfoll, S. 1988. *The ecology of stress*. New York: Hemisphere.
19. Hobfoll, S. and Lerman, M.. 1989. "Predicting Receipt of Social Support: A Longitudinal Study of Parents' Recitations to Their Child's Illness". *Health Psychology.* 8:61-77
20. House, J., Umberson, D. and Landis, K.. 1988. "Structures and Processes of Social Support". *Annual Review of Sociology.* 14:293-318
21. Hurlbert, J., Haines, V. and Beggs, J.. 2000. "Core Networks and Tie Activation: What Kinds of Routine Networks Allocate Resources in Nonroutine Situations?" *American Sociological Review.* 65(4):598-618
22. ——. 2001. "Social Networks and Social Capital in Extreme Environments". Pp. 209-32 in N. Lin, K. Cook, and R. Burt (eds). *Social Capital: Theory and Research*. New York: Walter de Gruyter
23. Kaniasty, K. and Norris, F.. 1995a. "In Search of Altruistic Community: Patterns of Social Support Mobilization Following Hurricane Hugo". *American Journal of Community Psychology.* 23:447-77
24. ——. 1995b. "Mobilization and Deterioration of Social Support Following Natural Disasters". *Current Directions in Psychological Science.* 4(3):94-98
25. Kasperson, R., Renn, O., Slovic, P., Brown, H., Emel, J., Goble, R., Kasperson, J. & Ratick, S.. 1988. "The Social Amplification of Risk: A Conceptual Framework". *Risk Analysis.* 8(2): 177-87
26. Kessler, R. and Mcleod, J.. 1985. "Social Support and Mental Health in Community Samples". Pp. 219-40 in Cohen, S. and Syme, S. (eds). *Social Support and Health*. New York: Academic Press
27. Kreps, G. 1984. "Sociological Inquiry and Disaster Research". *Annual Review of Sociology.* 10: 309-330
28. Lechat, M. 1989. *Corporal Damage as Related to Building Structure and Design*. Center for Research on the Epidemiology of Disaster, Catholic Universtiy. Belgium: Lovain.
29. Lin, N. 1982, "Social Resources and Instrumental Action." in Marsden, P. & Lin, N (eds). *Social Structure and Network Analysis*. Beverly Hills, CA: Sage Publications.
30. Mileti, D. 1999. *Disasters by Design: A Reassessment of Natural Hazards in United States*. Washington: Joseph Henry Press.
31. Nakagawa, Y. and Shaw, R. 2004. "Social Capital: A Missing Link to Disaster Recovery". *International Journal of Mass Emergencies and Disasters.* 22(1):5-34.
32. Portes, A. 1998. "Social Capital: Its Origins and Applications in Modern Sociology." *Annual Review of Sociology,* 24: 1-24
33. Putnam, R. *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton: Princeton University Press.
34. Quarantelli, E. and Dynes, R.. 1977. "Response to Social Crisis and Disaster". *Annual Review of Sociology.* 3:23-49
35. Sauri, D., Domingo, V. and Romero, A.. 2003. "Trust and community building in the Doñana (Spain) toxic spill disaster". *Journal of Risk Research.* 6(2):145-62
36. Scott, J. 1991. *Social Network Analysis: A Handbook*. London: Sage Publications Ltd.
37. Stalling, R. 2002. "Weberian Political Sociology and Sociological Disaster Studies". *Sociological Forum.* 17(2):281-305
38. Tierney, K. 1989. "Disasters and Mental Health: A Critical Look at Knowledge and Practice. Pp. 158-77 in Quarantelli, E. and Pelanda, C. (eds), *Proceedings of the Italy-United States Seminar on Disasters*. Newark, DE: Disaster Research Center, University of Delaware
39. Vaux, A. 1988. *Social support: Theory, research, and intervention*. New York: Praeger.
40. Wasserman, S. and Faust, K. 1994. *Social Network Analysis*. Cambridge University Press.
41. Wisner, B. 2003. "Disaster Risk Reduction in Megacities: Making the Most of Human and Social Capital".

- Pp. 181-96 in Kremier, A., Arnold, M. and Carlin, A. (eds), *Building Safer Cities: The Future of Disaster Risk*. Washington D.C.: The World Bank
42. Yang, Tingzhong., Huang, Li. and Wu, Zhengyi. 2003. "The validity of Chinese Health Questionnaire in the mental disorder studies in mainland China". *Chinese Journal of Epidemiology*. 24:769-773.
 43. Zhao, Yandong. 2002. "Social Capital in Re-employment: Its efficacy and limit". *Sociological Research*. No.4
 44. ——. 2007. "Social Capital and Post-disaster Recovery: A Sociological Study on Disaster". *Sociological Research*. No.5