

**MAPPING NETWORKS OF ORGANIZED VOLUNTEERS  
FOR NATURAL HAZARD PREPAREDNESS**

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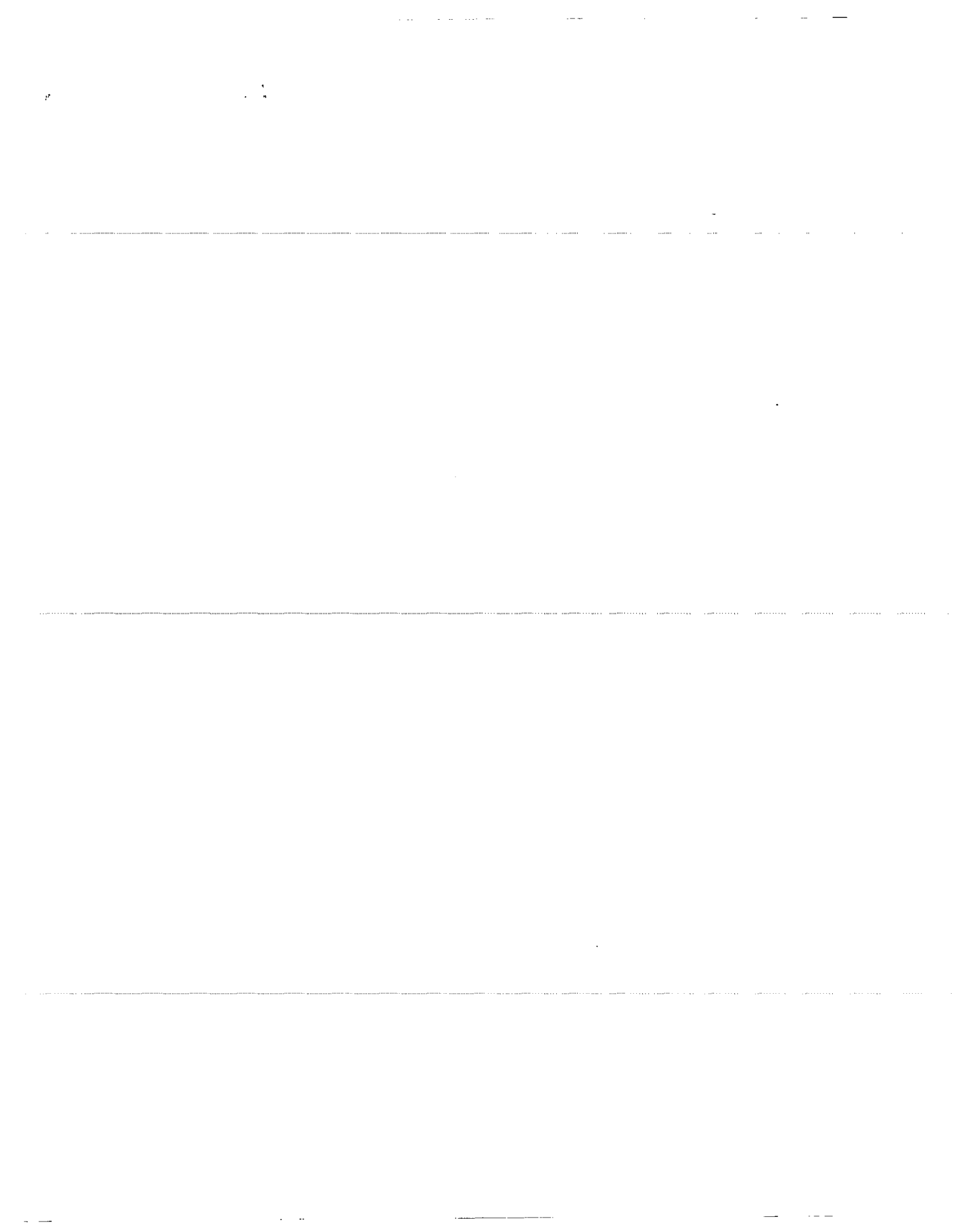
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<b>16. Abstract (Limit: 300 words)</b> Two networks of disaster preparedness organizations are described: 80 social service organizations and 37 communication organizations. Objectives were: (1) to synthesize knowledge on organized volunteers, (2) to integrate knowledge on interorganizational networks, (3) to describe existing networks, and (4) to assess different study methods. The research focused on the possibility of a major earthquake, and on preparedness for the first 24 to 48 hours. Correlation, regression, graphic illustration, blockmodel, and cluster analyses were used to meet objectives. Three kinds of conclusions are presented: theory development, research recommendations, and practice guidelines.				<b>12. Type of Report &amp; Period Covered</b>
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State Chapter of the American Red Cross; Robert Stiffler, Director of Emergency Operations at the St. Louis Bi-State Chapter of the American Red Cross; and Jim White, Director in the Office of Civil Preparedness for St. Louis County. The advise of these experts sharpened the precision and relevance of the instrument.

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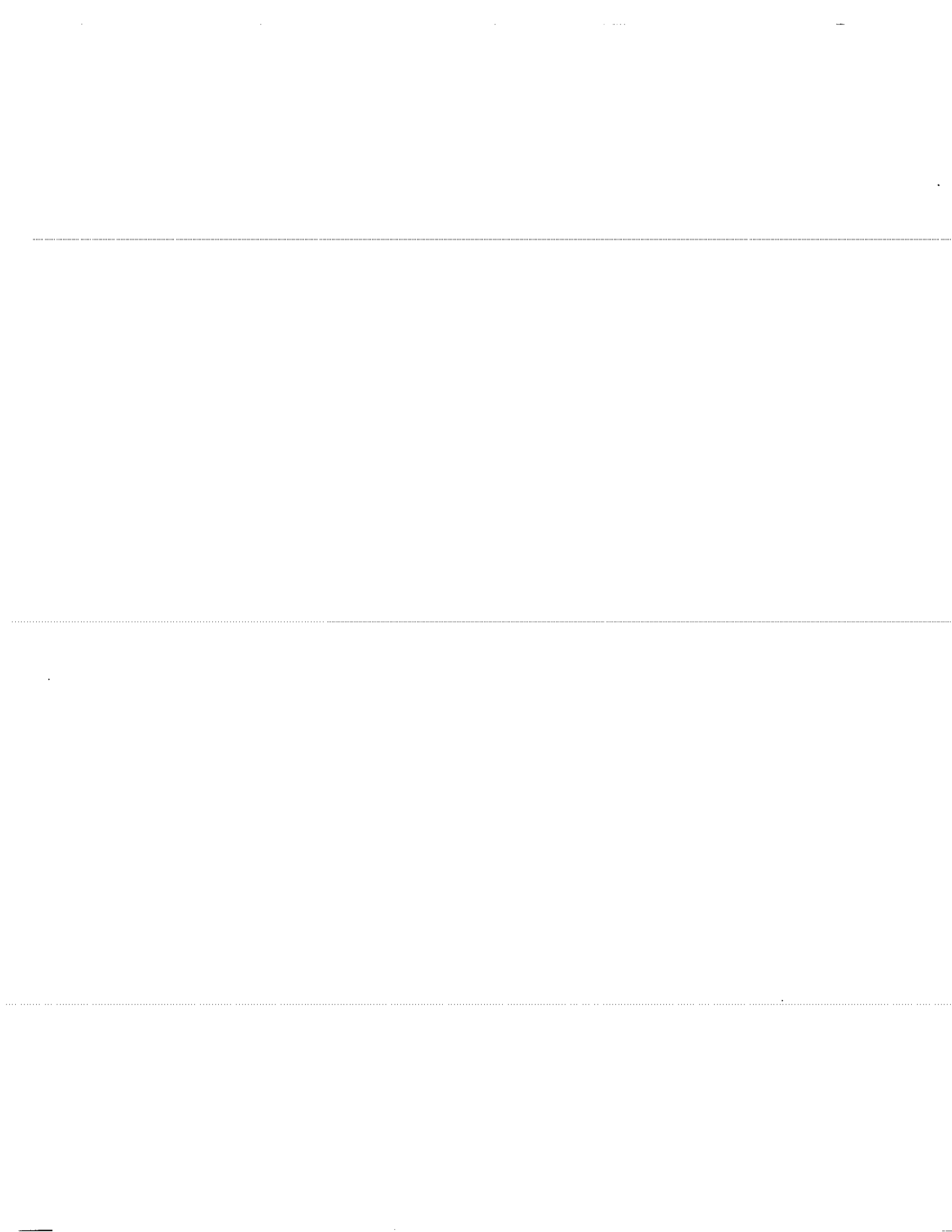
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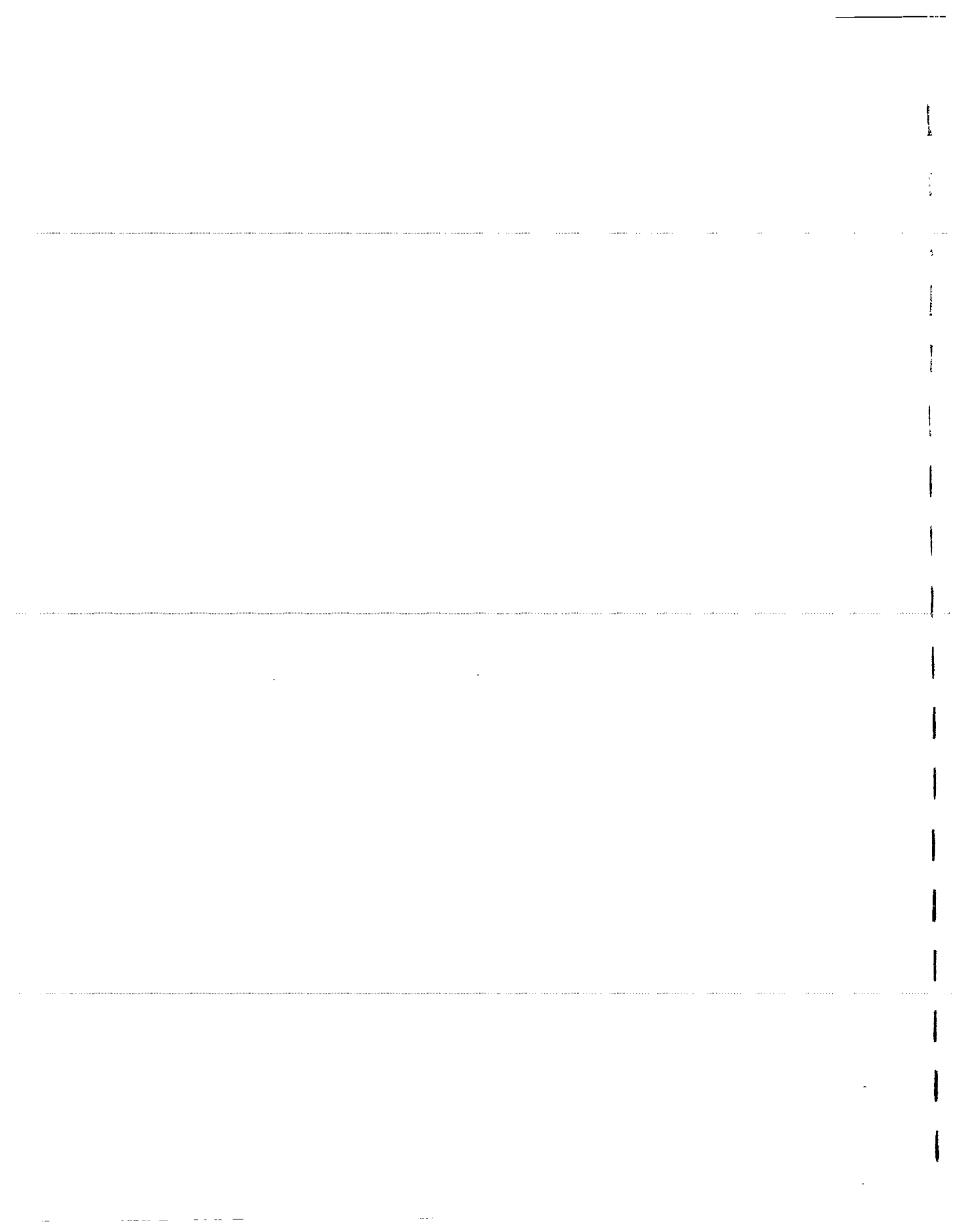
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## Executive Summary

### **NETWORKS OF ORGANIZED VOLUNTEERS FOR NATURAL HAZARDS PREPAREDNESS**

This report describes organized volunteer networks for natural hazards preparedness in the St. Louis metropolitan area. Two functional networks were examined: the social services network and the communications network. Objectives of the study were: (1) to synthesize knowledge on organized volunteers, (2) to integrate knowledge on interorganizational networks and show the relevance of this knowledge to preparedness for natural disasters, (3) to describe existing social service and communication networks in St. Louis, (4) to assess advantages and disadvantages of different network analytical approaches in study of natural hazards, and (5) to interpret and transfer research findings to emergency managers.

The study focused on the possibility of a region-wide disaster, specifically a major earthquake, and on preparedness for the first 24 to 48 hours. This immediate response period was selected because it is a critical period for saving lives and, during this time, any urban area would have to rely extensively on its own resources, especially volunteers. The St. Louis metropolitan region is an important geographical area to study because of active seismic activity in the central United States but low preparedness for earthquakes. The midwest will eventually suffer a significant, and possibly catastrophic, earthquake, which could occur at virtually any time.

Organized volunteers were studied because they play a critical role in disaster preparedness and response. Interorganizational networks were examined because multiorganizational preparedness patterns are believed to determine effectiveness of the overall response, and this is a rapidly developing area of research. Two complete organizational networks are described: emergency services and communications.

The network of emergency social services consisted of 80 organizations. Fifty-three (66%) were located in the county; 24 (30%) were in the city; and three (4%) were outside of the metropolitan area. Twenty-three were identified as social service organizations, eleven as disaster offices, nine as disaster offices within police departments, nine as religious organizations, eight as police departments, eight as fire departments, five as senior citizen organizations, four as youth groups, and three as neighborhood organizations.

The communications network consisted of 34 organizations, six (18%) of which were located outside of the metropolitan area. Five were identified as military organizations, four as disaster offices, four as social service organizations, three as police departments, three as transportation organizations, three as utilities, two as amateur radio groups, two as citizen band radio groups, two as fire departments, two as medical organizations, and one each as telecommunications, commercial radio, newspaper, and television organizations.

Data were gathered from the organizational populations in both social services and communications with a survey questionnaire. For communication organizations, a supplemental telephone interview was conducted. Information on organizational characteristics and interorganizational relations was elicited under day-to-day (normal) conditions and, with the aid of a disaster scenario, under assumed disaster conditions.

Organizational variables included the type of organization; size of staff, both paid and volunteer; stability of staff, both paid and volunteer; formalization; methods of showing appreciation to volunteers; funding base; auspice; geographical service range; and several aspects of preparedness, including disaster experience, estimated disaster response capacity, planning, and training. For the social services network, interorganizational variables included the number of linkages among organizations; types of services exchanged among organizations; formalization of agreements among organizations; and frequency of contact among organizations. For the communications network, methods of communication was used instead of types of services exchanged among organizations.

An important feature of the study was the use of four interorganizational dimensions for each network. Another important feature was the use of intensity scales for the interorganizational variables. A third important feature is that these variables were used to describe the networks on an organization-specific basis, pair-by-pair throughout the entire networks. Together, these highly detailed features of

the study, combined with almost total organizational populations, yielded an interorganizational data set which has potential well beyond the original scope of the project.

Six types of analysis were undertaken. These were (1) description of organizational and network characteristics during both day-to-day and disaster conditions; (2) an assessment of relationships between organizational attributes and dimensions of the interorganizational network; (3) geographical depictions of interorganizational networks; (4) more abstract graphic presentations of network relations using organizational types; (5) blockmodeling; and (6) cluster analysis. For the communications network, in part because it was comprised of a smaller population of organizations, only the first two types of analyses were employed.

Looking first to the social services network, results were as follows: Pre and post-disaster measures of the four interorganizational variables were much the same. Considering correlations of the eight interorganizational variables (four pre-disaster and four post-disaster) with 15 descriptor (organizational level) variables, 53 (44%) of 120 correlations were statistically significant at  $p = .05$  or less. The correlations in the post-disaster condition tended to be stronger. Among three general categories of descriptor variables, both operations and capacity variables were more likely to correlate with interorganizational variables than were organizational size variables.

In further regression analysis, eight of the fifteen descriptors surfaced as key variables associated with dimensions of the network. These variables were: expression of appreciation to volunteers, preparedness, number of pre-disaster volunteers, organizational type, pre-disaster organizational size, service range, member stability, and capacity to respond to different kinds of disaster. Each of the eight network dimensions correlated with a different subset of these descriptors. Three of the four pre-disaster network dimensions were associated significantly with only a single descriptor. This pattern was reversed in the post-disaster condition, with three of the four dimensions each being associated with two or three variables. Overall, the picture presented by these analyses was one of striking network complexity. It is apparent that different interorganizational dimensions yield different networks.

A unifying theme underlying complexity of the network was reflected in clear distinctions between emergency management organizations and social service organizations on all of the network dimensions and many of the descriptor variables. These distinctions indicated that emergency management

organizations were more central to the network, while social service organizations were more peripheral but also essential to disaster response. The overall network pattern suggests an interesting dynamic of two different but complementary processes for involvement in the network: emergence and pre-planned linkages. Emergency management organizations were more extensively represented in the pre-planned network, while social service organizations were situated to play a more emergent role. This bifurcated network structure is illustrated through graphic depictions of interorganizational relations, and corroborated with both blockmodel and cluster analyses.

The statistical pattern for the communications network was, in some respects, similar to the pattern for the social services network. Interorganizational measures were much the same in both pre and post-disaster conditions. Looking at associations of the eight interorganizational variables with 15 descriptor variables, 32 (27%) of the 120 intercorrelations were significant at  $p = .10$  or less (the higher significance level was used for the communications network because of the smaller number of organizations in the population). As with the social services network, post-disaster correlations were somewhat larger. Among the three categories of descriptor variables, organizational operations had the most significant relationships, followed by size variables, and then by capacity variables.

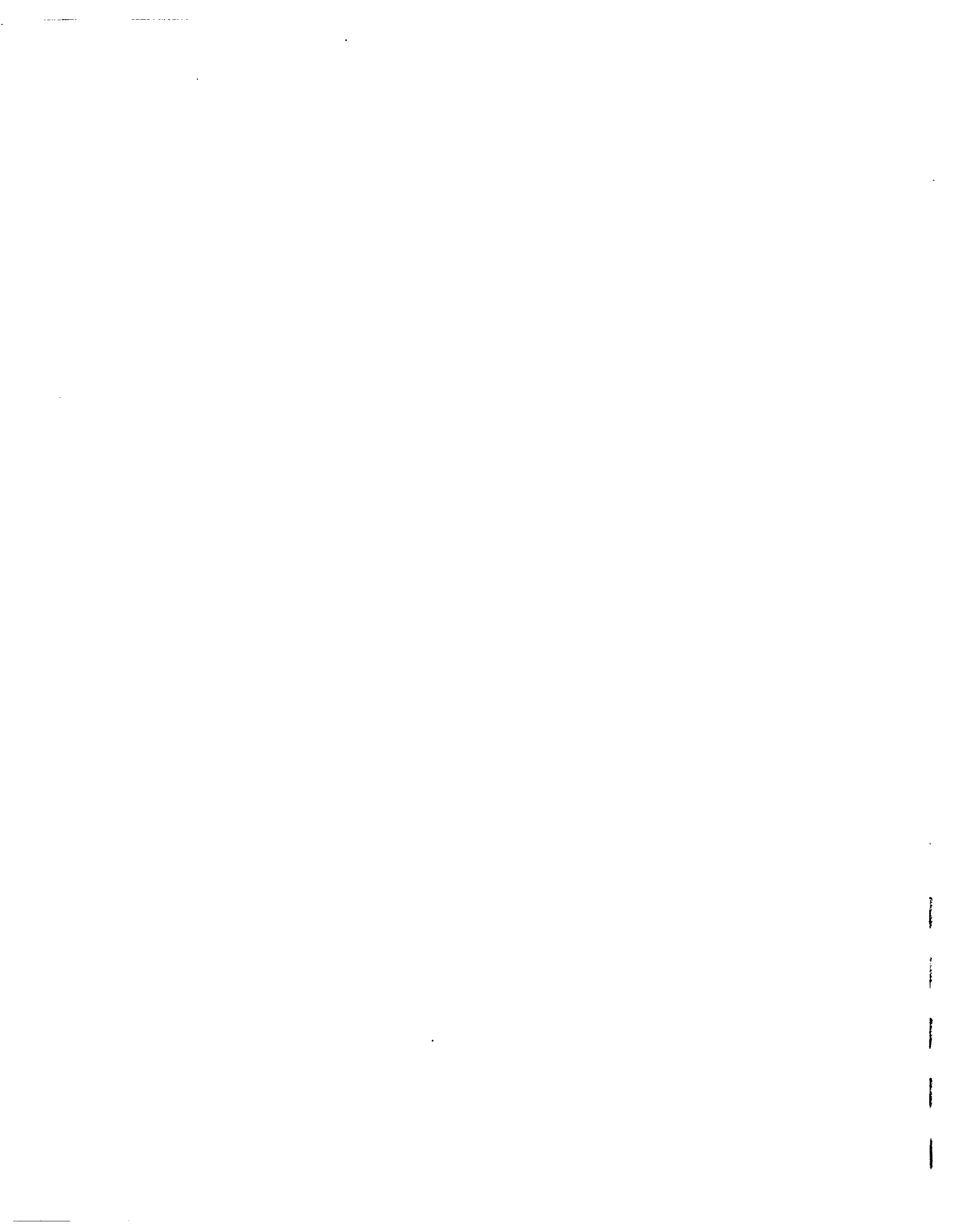
Looking at semi-partial correlation through regression analysis, seven descriptor variables were significantly associated with at least one of the eight interorganizational variables. There were a total of ten significant relationships, five pre-disaster and five post-disaster. For example, number of methods of volunteer recruitment was strongly and negatively associated with both pre and post-disaster number of methods of communication. Again, each of the significant relationships was very interesting in itself, but the pattern presented was complex. Multiple interorganizational dimensions yielded complex network relations.

Conclusions have been grouped into three areas: theory development, research recommendations, and practice guidelines. Turning first to theoretical contributions, there are indications of useful theoretical development in the following directions: (1) conceptualization of different networks for the various preparedness functions, (2) interrelation of multiple network dimensions for more accurate and interactive network conceptualizations, (3) a shifting from organization-specific to general organizational types for analyses of larger networks, (4) a merging of the ideas of

planning and emergence into a concept called "planned emergence," and (5) conceptualization of optimal levels of network development.

Recommendations for future research include: (1) More research should be done to corroborate and refine the concept of "Integrated Emergency Management System" (IEMS). (2) More studies of organization-specific networks should be done using ordinal and interval level measures of interorganizational relations. (3) Studies of preparedness networks should use disaster scenarios to provide a uniform basis for examining perceived response patterns. (4) More time than is usually allocated in survey research should be allowed to collect data on network populations. (5) Longitudinal studies of networks are needed to capture dynamic qualities and assess the effects of changes in key roles or organizations.

The most important practice guidelines are : (1) The critical role of volunteers should be more clearly recognized and more sophisticated systems for identifying, recruiting, training, motivating, using, and rewarding volunteers should be developed. (2) Emergency social services planning should make a greater effort to identify resources, contact peripheral or potential service providers, and facilitate their entry into the preparedness network. (3) Because the spirit, if not the letter, of the IEMS concept is well-established, it should be used as a basis to launch increased development of a full area-wide disaster preparedness network. (4) Emergency managers in the St. Louis area should review and consider flexible response systems which take into account the jurisdictional blindness and uncertainty of disaster situations. Such a system should be adopted and its use should be regularized through application to many different situations, large and small. (5) Continuation of multi-state planning in the central United States is desirable. Missouri's SEMA should enhance efforts in joint city-county planning in the St. Louis metropolitan area. St. Louis County should make a greater effort to communicate constructively with emergency managers in the municipalities. The Red Cross and other leading service providers should clarify with local units of government their role and anticipated procedures in a disaster situation.





## CHAPTER 1

### INTRODUCTION

This report presents the results from a study of preparedness for a major earthquake and other potential disasters in the St. Louis metropolitan area. The purpose of the research is to describe preparedness networks of organized volunteers for emergency social services and emergency communications.

In a brief comment entitled "A Strategic Research Nexus," Drabek (1983) notes that hazard studies are "located at the intersection of numerous critical avenues" in social science research. Features of this strategic location include immediate applicability of research findings, broad research scope at relatively low cost, and great potential for theoretical enrichment.

For these strategic research potentials to be realized, certain developmental goals must be recognized and nurtured. According to Drabek, these goals are: (1) increased interaction between researchers and practitioners; (2) improved theoretical integrations; (3) refined data gathering and analysis techniques; and (4) development of comparative data sets across cultures and across hazards. In the research project reported here, we have attempted, where possible, to follow these suggestions.

## Objectives of the Study

The research was designed to meet five objectives:

1. To synthesize knowledge on the use of organized volunteers in natural disasters, and to show ways to improve community preparedness;
2. To integrate knowledge on interorganizational networks, and describe the relevance of such networks to preparedness for natural disasters;
3. To describe interorganizational networks of organized volunteers and their preparedness to provide emergency social services and emergency communications in the event of a major disaster;
4. To assess advantages and disadvantages of different analytical approaches, indicating applications in the natural hazards field; and,
5. To interpret and transfer research findings to emergency managers through development of practice guidelines.

Originally, the study had an additional objective: To compare interorganizational network characteristics across two different types of hazards, tornadoes and earthquakes. As the research progressed, however, it was discovered that the concept of Integrated Emergency Management Systems (IEMS) was more widespread than we anticipated. In other words, preparedness networks for different types of hazards in St. Louis were comprised substantially of the same organizations with the same resources. Thus, this original research objective was omitted because it would not have yielded fruitful comparisons.

The apparent acceptance of IEMS is, in itself, a noteworthy research finding. To date, nearly all information about natural disasters has been organized by type of disaster or type of impact (Carr, 1932; Barton, 1962). Typically, resources that are recognized as available in a given community reflect prior disaster experience (Fritz, 1961; Parr, 1969; Mileti et al., 1975; Drabek, 1985). Prior disaster experience has tended to be related to particular types of natural hazards. Some areas have experienced more earthquakes, others more hurricanes, and so forth. Although certain resources are more or less disaster specific -- boats for floods, geiger counters for nuclear waste spills -- most resources are useful in many types of disasters.

The resources for social services and communications generally fall into this multiple-use category. Emergency officials and volunteers in St. Louis clearly recognize these multiple applications. As one disaster official succinctly stated, "a disaster is a disaster," meaning that the same personnel and material resources can be applied in a variety of disaster situations.

### Significance of the Study

The study is significant for at least four reasons:

1. Information on preparedness and the use of organized volunteers spotlights a critical resource in local community response to disasters;
2. Information on interorganizational networks integrates this area of social science theory with hazards research and helps build a foundation for subsequent theoretical efforts;
3. The use of different network-analytic techniques leads to greater understanding of appropriate data analysis procedures for organizational networks in the natural hazards field; and,
4. The emphasis on accurate descriptions of preparedness networks provides information of immediate use to community leaders and emergency managers.

### Organized Volunteers

The term "organized volunteers" refers to the patterned activity that can be brought into play following a disaster. Organized volunteers may be viewed as contingency organizations. The increased complexity of the hazards environment as well as financial cutbacks and limited resources accentuate the need for community-wide interorganizational coordination and contingency planning (Gillespie and Perry, 1983). Moreover, for earthquake preparedness, community-based volunteers are critical because outside assistance may not be able to reach the disaster area for an extended period of time (M & H Engineering and Memphis State University, 1974).

When disaster strikes, immediate response to human needs is provided by volunteers from The American Red Cross, The Salvation Army, church groups, civic clubs, and other organizations. These organized volunteers are especially

critical because they are on-the-scene, and they can assemble various kinds of disaster workers. In many instances, local organized volunteers can provide emergency social services more effectively than any other group, and organized volunteers also play critical roles in certain aspects of emergency communications.

Research on volunteers has emphasized the mass convergence response during the post-impact period and problems associated with integrating formal organizational activity and the informal mass assault (Barton, 1969; Gillespie and Perry, 1976). Dynes (1970a: 179) has noted that many organizations confront a surplus of volunteers who, while highly motivated to help, cannot be easily integrated into the organizational task structure. Similarly, Demerath and Wallace (1957) indicate that organizations can be hampered by excessive assistance. Studies by Clifford (1956), Form and Nostow (1958), Warheit (1968), and Brouillette (1971) demonstrate that organizations with disaster responsibilities are successful depending on how well they fit themselves into the informal rescue pattern that emerges spontaneously following the disaster impact.

Gillespie and Perry (1976:309) note that volunteer groups have too often been viewed as "part of the problem" instead of being recognized as a resource through which established organizations can increase their effectiveness. While the capacity of existing organizations to adapt to sudden change is always limited (Mileti and Gillespie, 1976), there is great potential for institutionalized volunteer response to disasters (Sherraden and Eberly, 1982). One international example of highly trained and organized volunteers who mobilize quickly and effectively in emergency situations is the Technical Aid Service in West Germany, a decentralized organization of 50,000 young adults which provides assistance in major disasters or public emergencies (Landrum, 1982). An historical example in the United States is the extensive emergency and disaster work of the Civilian Conservation Corps (Sherraden, 1985). In both of these examples, organizational design has facilitated rapid mobilization of trained volunteers for temporary response to emergency situations.

Local control and flexibility appear to be keys to the success of such highly organized volunteer response. In the United States, The American Red Cross has done an excellent job in developing plans for volunteer response (Bunker, 1957), but there has been little basic knowledge about coordinating relationships, especially across organizations. Researchers observing the response to the Coalinga, California earthquake in 1984 noted that the Red Cross was the only organization to be effectively mobilized for the first day and a half. In

general, there is a need for more research to increase understanding of the roles played by organized volunteers in community preparedness and response to disasters.

### Interorganizational Networks

Coordination among organized volunteers is essential for disaster response to be effective. In the overall response, it is the combined effort of an interorganizational network which determines success. For example, Perry (1982:14) notes that "problems of resource shortages can be attenuated by having groups of localities band together either in county or regional structures to engage in emergency management." This idea is consistent with a focus on interorganizational networks. An accurate description of the community preparedness network is a necessary prerequisite to developing theories of volunteer mobilization, organizational integration, and other aspects of emergency management.

The coordination of different organizations is one of the most important concerns in contemporary organizational theory (Gillespie and Mileti, 1979b). Emphasis on team building (Galbraith, 1973) and other forms of lateral relations, such as matrix organization (Davis and Lawrence, 1977), may be seen as a search for effective strategies of organizational design to meet the contingencies of rapidly shifting, turbulent environments. Task forces, special projects, and numerous interorganizational joint programs are being experimented with in contemporary organizations, even among long-standing and traditionally legitimated organizations such as universities and hospitals. These contingency theories are relevant to strategies of effective mobilization in response to disasters.

The network of relationships among organized volunteers in disaster response cuts across many types of organizations. The complexity of such networks makes it scientifically prudent to concentrate on activities associated with a limited number of functions. It would be expected that interorganizational networks are more developed in some areas than in others (Mulford, 1984). To date, however, little is known about the structure and process of interorganizational preparedness in any community.

### Preparedness for Immediate Response

Little research has been conducted on emergency preparedness during periods of normal equilibrium. Most studies have concentrated on short-term actions reported during post-impact disaster periods (Mileti et al., 1975).

Research by Drabek et al. (1981) has documented the importance of emergent multiorganizational networks in search and rescue efforts. According to Drabek et al. (1981; 1982), pre-event linkage patterns appear to be important factors in understanding post-disaster response.

Post-impact response effectiveness rests on an understanding of who has responsibility for what and how this responsibility complements or fits into the overall effort. In communities where particular functions have been assigned to specific organizations as a result of planning, there is less post-impact confusion (Raker and Friedsam, 1960). Preparedness can "normalize" the impact in ways that help emergency response organizations operate effectively (M & H Engineering and Memphis State University, 1974). Preparedness entails general operating plans that indicate mobilization of resources within the context of local communities (Gillespie and Miletic, 1980).

This study concentrated primarily on pre-disaster preparedness for the immediate -- first 24 to 48 hours -- response period. The study did not address longer-term response or the recovery phase. Because the pre-disaster preparedness network is believed to influence disaster response, the study assessed the network prior to disaster and also, using a disaster scenario, assessed the perceived network during the immediate response period.

Methodologically, use of the scenario avoided the cumbersome problem of waiting for a disaster to strike before undertaking research on the response. Although use of the scenario had drawbacks, the major advantage of this method was that it sharpened the focus on aspects of readiness to act.

The major reasons for concentrating on the immediate response period were: (1) this period is critical in easing human suffering and saving human life; (2) this period is critical in establishing an effective foundation for the longer-term response; and (3) with a major regional disaster, the St. Louis metropolitan area would be forced to rely almost entirely on local resources for the first 24 to 48 hours. If bridges were down and highways were blocked, outside assistance would not reach the area for at least a day and probably two days. Therefore, local preparedness for the immediate response is crucial.

## Emergency Social Services and Communications

The study was limited to disaster preparedness for two critical functions: emergency social services, and emergency communications. Other emergency functions, such as food and shelter, search and rescue, medical care, damage control (containing fires, preventing looting), or emergency infrastructure repair (fixing water and gas lines, establishing temporary roads) were assessed together in an overall summative measure of capacity to deliver services. Social services and communications were selected because less is known about these functions, and organized volunteers are known to play important roles in both social services and communications.

Emergency social services are provided primarily by organized volunteers. These services include a number of short-term functions such as re-uniting families, stabilizing post-impact emotional reactions, providing supervision and care of children, providing assistance to special populations such as the elderly and disabled, offering support services within emergency medical settings, and providing information or referrals to professional, governmental, and other services for those in need.

Effective emergency communication is a prerequisite to other aspects of an effective emergency response. As one official noted, "Without a communications system in place, you cannot command and control. Without communications, you have nothing." Another official said, "The two big problems in a disaster are who the hell's in charge and communications. If you could solve these two things, you'd have it." Despite its obvious importance, knowledge about emergency communications is limited. Responsibilities for disaster communications are fragmented and dispersed across a variety of local, state, and federal agencies. There are many organizations of different types, sizes, and political mandates, each accountable to different groups with different interests. It is not surprising, therefore, that during periods of disaster response, problems with communications among agencies and across lines of authority have been reported (Killian, 1954; Bates et al., 1963; Drabek et al., 1982).

Certain aspects of emergency communications rely extensively on organized volunteers. For example, the work of Drabek et al. (1981) reveals the importance of organized volunteer emergency communications groups with CB and ham capability. In the event of a major regional disaster in the St. Louis metropolitan area, organized volunteers in communications would play a vital role in the emergency response.

Geographic, Demographic, Social, and Political Features in St. Louis Relevant to Disaster Preparedness

The City of St. Louis forms a rough half circle against the western bank of the Mississippi River in the State of Missouri. Several surrounding counties in Missouri and across the river in Illinois combine with St. Louis City to make up the metropolitan area. Figure 1.1 (pp. 9) illustrates the St. Louis metropolitan area.

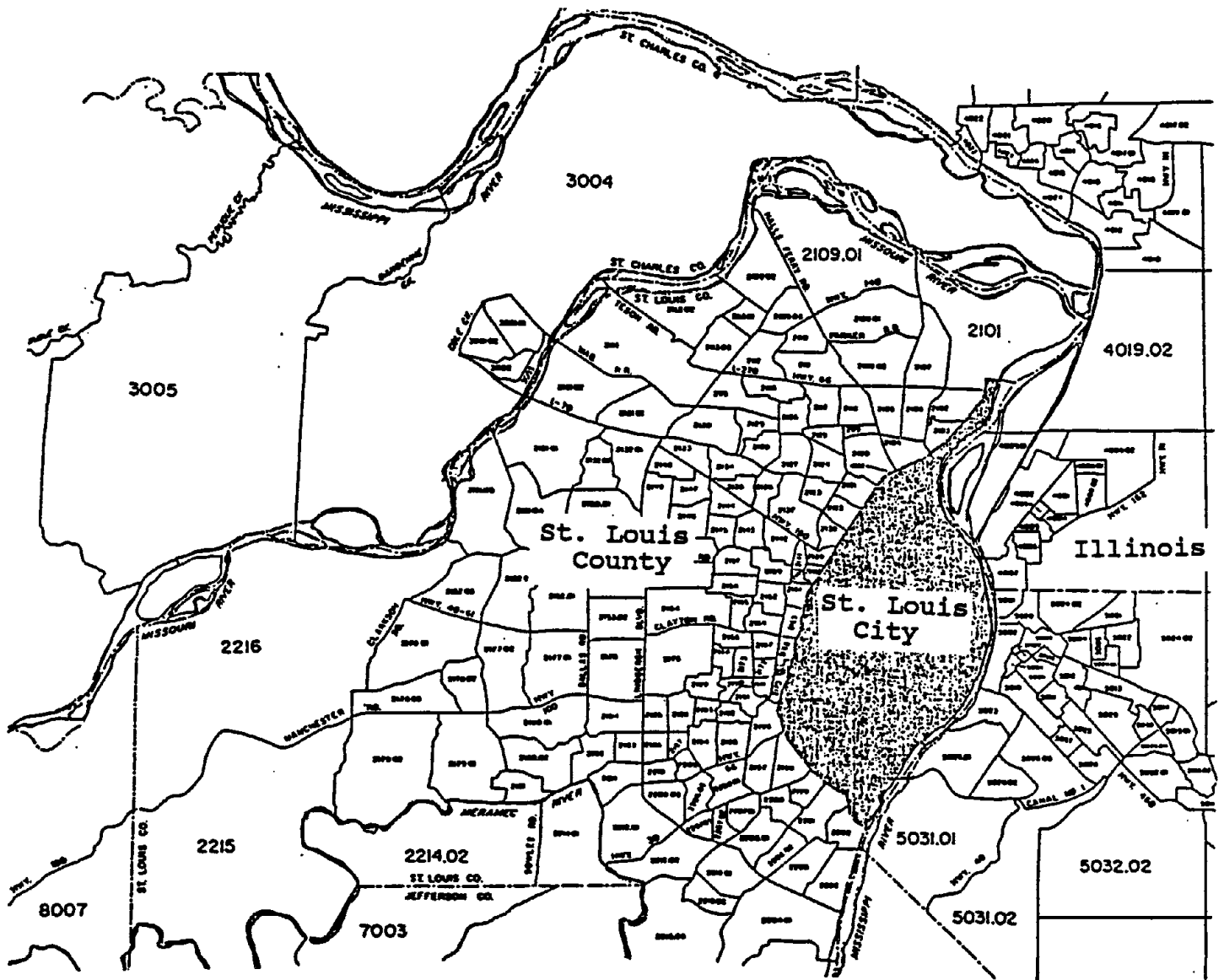
The City of St. Louis has a population in excess of 400,000 and the metropolitan area (including both Missouri and Illinois) has a population of approximately 2,250,000. The City has been losing population while the county has been gaining, but overall, the metropolitan area has remained fairly stable. There are increasing numbers of non-English speakers -- Indochinese, Africans, Russians, Hispanics -- but census figures are not yet available to document their number. The problem of dealing with non-English speaking people is almost completely unaddressed in the disaster preparedness network in St. Louis.

The area is racially segregated. The northern part of St. Louis City is predominantly black and the southern part is predominantly white. In the event of a region-wide disaster, blacks probably would suffer disproportionately greater damage because they live, on the average, in more poorly constructed or maintained dwellings, carry less insurance protection, have less access to medical care, and know less about the sources of disaster assistance that are available (Dynes, 1970a; Torry, 1979; Miletic and Nigg, 1984).

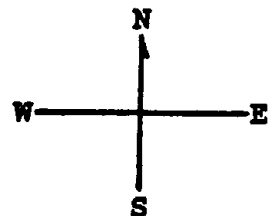
Politically, several key jurisdictional issues affect disaster response. Perhaps most striking, the Mississippi River, which forms the boundary between Missouri and Illinois, is like a wall between two separate disaster response systems. The two states cooperate very little. Only The American Red Cross and a few smaller voluntary agencies have a policy of "crossing the river." For this reason, it was decided to study only the Missouri side of the metropolitan area. Studying both sides would have yielded two separate preparedness networks.



Figure 1.1 Map of Census Tracts for St. Louis SMSA.



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Even on the Missouri side, there is a significant barrier to cooperation between St. Louis City and St. Louis County. The City is not part of St. Louis County or any other county, but rather is a totally separate political jurisdiction. At best, the City and County have an ambivalent relationship and this ambivalence has a long history. Despite efforts to integrate resources for disaster response, City-County cooperation remains elusive. It has been more than a decade since County personnel and resources went into the City to assist with a disaster.

As an example of City-County political separateness, the City is currently installing a new disaster communications system, an 800 megahertz trunk system with 20 channels. The system will require new equipment for all users, and it will not be compatible with existing equipment in the County or equipment of most voluntary, commercial, or other organizations. Nonetheless, the City has undertaken this initiative in the absence of cooperative planning with the County. The City will maintain the old communication system so that it might be used for region-wide communication, and most communication organizations say that the new system will not affect their disaster communication functions. However, how well the old system will be maintained remains to be seen -- most resources will probably go into the new system. This is not to say that the City is wrong to plan for new and more effective disaster communications technology. But greater cooperation in planning would be desirable. In the politics of the St. Louis metropolitan area, cooperative planning is not always the first priority.

Within St. Louis County, there is still another major political issue. Many of the 90 municipalities which make up St. Louis County are in conflict with the County's Office of Civil Preparedness. These municipalities place a high value on local control and they do not want to relinquish responsibility for their municipalities to the County. During the period of the study, this became a prominent political issue.

The County initiated a ballot initiative to gain greater authority in "taking charge" of disaster situations wherever they might occur within the County's boundaries. Municipalities, acting through an amalgamated group -- The Emergency Preparedness Council of St. Louis County -- objected. The Council objected both to the intent of the resolution and to its introduction without prior consultation between the municipalities and the County office. The objection raised by the Council prompted the County to withdraw the proposed amendment. However, as one member of the Council put it, "The cat's asleep for now, but it's only a matter of

time before it wakes up again and jumps out of the bag." Although active participation is limited to perhaps two dozen municipalities, the Council provides an important basis for cooperation, mutual support, and disaster preparedness.

### Disaster History, Current Susceptibility, and Public Awareness in St. Louis

The St Louis area regularly experiences flooding because of its location near several major rivers: the Mississippi, the Missouri, the Meramec. Also, St. Louis is located in an area of high tornado occurrence. In general, both floods and tornadoes are a "part of life" in St. Louis. More recently, attention has been focused on the possibility of a major earthquake in Southeastern Missouri which could have a devastating impact on the St. Louis metropolitan area. For this reason the project focused considerable attention on earthquake planning and preparedness.

Most of what is known about earthquake preparedness comes from research and experience in California (White and Haas, 1975; Mann and Wyner, 1978; Turner, Nigg et al., 1979; Mileti et al., 1981; Olson and Nilson, 1982). Although California is an important location for studying earthquake preparedness and seismic safety, there are significant differences between California and the midwest region of the United States (Nuttli, 1982).

California's uneven terrain as well as its location between the Pacific Ocean and the Sierra Mountain Range serve to dampen shock waves from earthquakes. Hays's (1981) comparisons of isoseismal contours of the 1811-1812 New Madrid earthquakes, the 1886 Charleston earthquake, the 1906 San Francisco earthquake, and the 1971 San Fernando earthquake demonstrate that the effects of an earthquake are much greater and extend over a larger area in the New Madrid region, which cuts across seven midwestern states. Thiel and Morelli (1981) estimate that a New Madrid earthquake today similar in magnitude to those of 1811-1812 would result in immediate property damage of \$12 to 14 billion (1980 dollars).

This potential for catastrophic destruction has brought about increased interest in developing a sound knowledge base in the midwest to deal with the threat of earthquakes. This interest has been heightened with Nuttli's (1980) estimates of a 25 percent probability of an 8.5 surface-wave (Richter) magnitude earthquake for the time period 1811 to 2000, and a 63 percent probability of an earthquake with a 6.5 or greater surface-wave magnitude for the same time period. Nuttli (personal communication) estimates that if an earthquake were

to occur today it would register a surface-wave magnitude of 7.6. The more time that elapses without an earthquake, the greater the expected magnitude of the earthquake when it occurs. St. Louis is located near the New Madrid Fault region and is therefore likely to experience a major earthquake at virtually any time (Nuttli, 1981 and 1982).

St. Louis lies approximately 160 miles north of the New Madrid Fault, which in 1811 and 1812 produced a series of earthquakes which were among the largest ever recorded in the continental United States. The first shock hit the area on December 16, 1811 with a magnitude estimated to be 7.2. Two additional major shocks occurred on January 12 and February 7, 1812. The magnitude of these two shocks have been estimated at 7.1 and 7.4 respectively (Nuttli, 1973).

On October 31, 1895 the New Madrid Fault produced another major earthquake. The magnitude of this earthquake has been estimated at 6.2 on the Richter scale (Nuttli, 1974). At the time there were no high rise buildings in St. Louis and most residential construction was wood frame. Consequently, damage was limited.

These earthquakes occurred a long time ago and many residents of St. Louis are not aware of the potential for another major earthquake in this area. Recent publicity has focused attention on the 1811-1812 earthquake but public awareness of the 1895 quake is almost non-existent. If such an earthquake were to occur today, the entire St. Louis area would be severely affected.

Despite the probability of a major earthquake, the general population in St. Louis is not well aware of the danger. A very large percentage of residential dwellings are today made of brick and mortar, which is more susceptible to damage in an earthquake; many of the buildings in St. Louis City are 50 or more years old; and many home owners are without earthquake insurance. Building codes for commercial real estate do not incorporate the concept of earthquake resistance, and therefore many commercial buildings would be badly damaged in a major earthquake.

While the potential for damage is much higher in the midwest than the west (Nuttli and Herrman, 1981), levels of community preparedness are much lower. Key government officials in the State of Missouri have begun to recognize the importance of seismic safety, but a great deal of preparedness planning and activity remains to be undertaken (Liu et al., 1981; Drabek, et al., 1982).

### Summary

This research report describes networks of organized volunteers prepared to deliver emergency social services and emergency communications. Such research is worthwhile for several reasons. First, it adds information about a critical resource in community disaster response. Second, the study of networks brings an important area of research to the disaster field. Third, future research can be strengthened as a result of the study's assessment of different methodologies. Finally, accurate descriptions of the network will help improve preparedness. The study makes theoretical, methodological, and practical contributions.

Organized volunteers such as the Red Cross, Salvation Army, civic groups, and many others are like contingency organizations. Coordination among such organizations is critical to an effective disaster response. The number and variety of volunteer organizations creates complex networks. Evidence indicates that patterns of interaction during pre-disaster periods influence post-disaster response, and also that organized volunteers are especially critical in the earliest stages of response. Thus, the research used a disaster scenario to focus on pre-disaster preparedness for immediate response.

The study is limited to the Missouri side of the St. Louis metropolitan area. The potential for earthquakes exist in the midwest as well as along the west coast, yet most of what is known about earthquake preparedness is based on work in California. There are lower levels of awareness and preparedness for earthquakes in the midwest, but the likelihood of damage is greater. St. Louis is close enough to earthquake fault zones to experience serious damage when an earthquake occurs. The metropolitan area has a population of two and one-quarter million people. Many of the buildings are old and built out of masonry, and few people carry earthquake insurance. There are political divisions between Illinois and Missouri, St. Louis City and St. Louis County, and between St. Louis County and many of the municipalities within it. There is a need for greater cooperative efforts to coordinate an area-wide network of preparedness for disaster.

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## CHAPTER 2

### ORGANIZED VOLUNTEERS IN DISASTERS

Participation of organized volunteers is crucial in disaster response, particularly in the initial hours and days after the disaster impact (Mileti and Nigg, 1984). The first priority of communities in the immediate aftermath of a disaster is to provide for survival needs of the victims, including search and rescue, medical care, shelter, food, and clothing (Dynes, 1970a:87). Often, particularly in smaller communities, it is volunteer fire departments which initiate this activity. The American Red Cross and certain emergency management organizations arrive soon after a disaster strikes to conduct damage assessment, establish shelters, and provide emergency medical care. Church groups, The Salvation Army, and other volunteer organizations then converge to provide relief services such as emotional support, emergency welfare services, and assistance in locating missing persons (Ross, 1970:407).

Volunteer organizations offer communication support and help coordinate the activities of other organizations. In the case of disasters with wide impact, the necessity for additional communication and coordination is vital, because more organizations become involved in the mass action to minimize loss and suffering (Dynes, 1970a:54). For example, the Red Cross enlists the help of ham radio operators to aid in communication, and together they provide information to the public concerning the whereabouts and condition of friends and relatives. Ham operators help the Red Cross coordinate field units as well, particularly when phone lines are inoperative (Stallings, 1971:11). Coordination among other organizations

is achieved partly through disaster committees within the Red Cross. These committees represent many community organizations (Dynes, 1970a:37).

Volunteer organizations in disaster response provide psychological support and financial aid. Counseling and spiritual support, as well as emotional reassurance are offered. Many organizations help with financial assistance, including the Red Cross, the Salvation Army, neighborhood associations, unions, church organizations, civil-rights groups, public counseling services, and other volunteer associations (Torry, 1979: 529). The work of these organizations must be coordinated to achieve effective disaster response.

An understanding of volunteer organizations in disasters requires recognition of their special characteristics. First, in volunteer organizations, the majority of participants are not reimbursed by a paycheck. Second, organizational goals are not related to the business of making a living (as in trade unions or cooperatives). Third, membership is voluntary in the sense that it is neither mandatory nor acquired through birth (Sills, 1968; King, 1984; McCurley, 1985).

This chapter (a) presents two of the major functions of volunteer organizations in disaster, (b) surveys the special characteristics of these organizations to consider their affect on disaster response, and then (c) suggests approaches from the collective behavior and social movement literatures which can contribute to understanding volunteer organizations in disasters.

### Functions of Volunteer Organizations

Survival functions. After a disaster strikes, the highest priority is care for victims. Care for victims includes first aid and transporting the injured to hospitals or places they can receive medical attention. This occurs at the same time as rescue activities, extricating trapped individuals or evacuating individuals from dangerous areas. Once immediate survival needs are met, longer-term basic needs -- food, shelter, clothing -- become important.

Volunteer organizations are prominent in meeting survival needs. The American Red Cross helps to mobilize medical personnel and supplies such as blood and plasma. The Red Cross and Salvation Army are major providers of food and shelter. Schools, auditoriums, churches, and other public



buildings are made available for shelter. Many other local volunteer organizations offer clothing and various supplies to disaster victims (Dynes, 1970a).

Coordination and communication. Communication and coordination functions establish a basis for other activities. During disasters these functions promote community connectedness which facilitates opportunities to help victims. Connectedness, in turn, promotes communication and dissemination of knowledge about damage and suffering, both to volunteer organizations and to individual volunteers. Based in knowledge about which parts of the population have been most hard-hit, volunteer organizations can better mobilize to help those in need (Dynes, 1970a).

Most volunteer organizations have relationships with other organizations, some of which are central in the coordination of disaster response. The need for interorganizational coordination increases as the number of volunteer organizations in disaster proliferates (Stoddard, 1969). For many volunteer agencies, coordination and links with other organizations are absolute necessities in obtaining money, volunteers, and other types of aid (Ross, 1970). While interorganizational coordination is essential for volunteer organizations, their distinctive qualities present special problems for coordination.

### Distinctive Qualities of Volunteer Organizations

The responses of organizations in disaster varies with the type of organization (Drabek, 1970:332). Volunteer organizations are often less distinct in their structure than government or business organizations, which are more likely to approach the ideal of a Weberian bureaucracy. For example, authority relations between Red Cross staff and non-paid workers are vague (Adams, 1970), and Salvation Army personnel sometimes circumvent rules and directives to meet any "genuine need" of disaster victims (Ross, 1970). This is an important difference because much of the sociological theory used to study organizations assumes that the unit of analysis is like a bureaucracy.

Different types. Dynes (1970a) discusses four types of organizations in disaster response. Organizations which maintain their structure and regular tasks in a disaster are referred to as "established." Those which have new tasks are "extending," while those with a new structure and additional personnel are called "expanding." Finally, "emergent" organizations are those which take on both a new structure and

non-regular tasks (Dynes, 1970a), because no organization existed before the disaster. A more detailed discussion of these organization types is presented in Chapter 3.

Volunteer organizations are often expanding organizations in disasters. These organizations have a small, central, permanent core of workers during non-emergency periods. During expansion, the structure and function changes (Dynes, 1970a). After the disaster, the organization reverts back to its pre-disaster structure. This lack of permanence further distinguishes volunteer organizations from established organizations in disaster. Neither expanding organizations nor emergent groups are adequately understood using formal organizational theory (Quarantelli and Dynes, 1977).

Established organizations have difficulty in relating to expanding organizations and emergent groups, and they are often unwilling to recognize the legitimacy of these organizations in any particular disaster (Dynes, 1970a). Conflict sometimes occurs between different organizations over issues of legitimation and access to the news media (Ross, 1970). As an illustration, two organizations may compete for news coverage that highlights the relief efforts of volunteers. Bitterness may develop between leaders of the organizations if they feel the story of their organization has been inadequately reported.

In expanded organizations, pre-disaster channels of communication are often inadequate to carry the large number of messages. Thus, it is helpful to plan for alternate and additional lines of communication during the initial period of a disaster response. Groups which specialize in communication, such as ham radio clubs, must be called in to help (Stallings, 1971). The lack of both legitimation and adequate communication hampers interorganizational relations and coordination in volunteer organizations. These interorganizational problems occur to a greater extent in rapidly expanding organizations, which are likely to be volunteer.

Structural differences. Many volunteer organizations or associations which are active in disaster settings are small. Smallness is associated with a loose division of labor, less formal communication patterns, highly flexible systems, and so on. Again, volunteer organizations do not always fit substantively or methodologically with assumptions in sociological theories of complex or formal organization (Quarantelli and Dynes, 1977:31).

While it is the case that some volunteer organizations (e.g., Red Cross) are closer to the bureaucratic model than others (e.g., ham radio clubs), most of these organizations differ in the distinctness of their structure. Volunteer organizations, especially those which are expanding, tend to have vague functions during disasters. They frequently go beyond their assigned emergency tasks, and several volunteer organizations may attempt to perform the same tasks. For example, two organizations may distribute food to the same victims at the same site (Dynes, 1970a:144).

Volunteer organizations have vague boundaries; core workers may not know what peripheral volunteer workers are doing at any given time, and coordination of work activities may be ambiguous. These coordination difficulties are made more difficult by lack of previous coordination practice (Adams, 1970), and by uneven leadership hierarchies. Leadership is often left up to local chapter leaders, or the hierarchy is unclear (Adams, 1970; Ross, 1970; Stoddard, 1969).

The structure of volunteer organizations can affect interorganizational networks. Many of the volunteer organizations active in disasters are likely to be characterized by a federated, rather than a corporate, structure. Federated structures involve loose collections of semi-autonomous local units, while corporate structures are centralized. Large organizations such as The American Red Cross and The Salvation Army are federated. In general, federated organizations are more likely to be involved in joint organizational involvement, and thus these organizations tend to be more involved in interorganizational networks (Levine and White, 1961).

Personnel issues. Volunteer organizations frequently have both administrative and line workers who lack formal training. Leaders in volunteer organizations are recruited not strictly on the basis of competence, but on the basis of social status, wealth, or personal relationships to political leaders. These practices make ineffective leadership more likely (Barton, 1969:156). This problem is not easily resolved, for volunteer organizations cannot always reward leaders with money or high political status in the community. The problem of ineffective leadership is resolvable only if the organization is made highly attractive to people, and if some rational set of tests is used to determine skill and ability (Barton, 1969:158).

It is also difficult for volunteer organizations to obtain skilled line workers. Many volunteers in emergencies are walk-on, rather than trained, volunteers (Adams,

1970:344). Thus, many disaster volunteers lack the training and skills to perform specialized relief tasks (Dynes, 1970a:143-4). This problem is compounded by the fact that it may not be possible to screen volunteers, so that an organization may be inundated by the wrong type of volunteers. Middle-class individuals may turn up as volunteers, for example, when lower-income volunteers are needed to act as effective outreach workers for lower-income victims (Stoddard, 1969:185). More than other organizations, volunteer agencies lack adequate numbers of trained, skilled, and otherwise appropriate workers.

### Complementary Approaches

Collective behavior. Some volunteer organizations depend on outside individuals for personnel. These organizations must effectively exploit the mass informal assault in order to achieve effectiveness in disaster (Axelrod, 1956; Gillespie and Perry, 1976). Organizations linked into a centrally coordinated system can direct workers to where they are most needed, and avoid overcrowding in some places. They can provide equipment and leaders to complement large numbers of untrained workers. A well-coordinated linkage of established organizations, expanding and emergent organizations, and the mass assault in disasters can increase effectiveness of community response. In addition, role conflict between family and organizational roles can be minimized by providing more structured roles for volunteer workers (Barton, 1969).

Generalizations from collective behavior studies in disaster offer useful models of preparedness for volunteer organizations. Volunteer organizations attempt to distribute workers optimally in the system of disaster relief (Merton, 1969). Prior training ensures that volunteer workers have the necessary skills in disaster response, but these workers must be adequately placed organizationally, and they must perform designated tasks rather than other roles.

Barton (1969) has enumerated several generalizations which serve as a model for coordination during disasters. He notes that direct contact with victims facilitates awareness of deprived individuals, sympathetic identification with them, and thus an altruistic orientation toward them. Mass media coverage, discussion, and contact with victims also increases sympathetic identification with victims. Thus, if organizations are connected in a network and circulate volunteers that have been exposed to different groups of victims, it is likely that more individuals will volunteer on a sustained basis to help the victims.

While many individuals volunteer to help initially in the aftermath of a disaster, these individuals typically lose interest in the long process of recovery. Thus Barton's propositions may be helpful in motivating community members to volunteer over the longer periods of time in the days and weeks after a disaster. Another important use of Barton's propositions is in helping minorities and other segments of the population. Volunteer organizations, through interorganizational networks, can inform the general community about issues which render these groups vulnerable to disaster.

Social movements. The study of social movements and social movement organizations is an important area within the general field of collective behavior. Recently, there has been a shift in emphasis in the field of collective behavior from emergent, elementary forms of collective behavior to more conventional forms such as social movement organizations (Marx and Wood, 1975). With this shift in emphasis, there is an accompanying recognition that emergent and conventional behaviors share many similarities, perhaps representing ends of a continuum.

The emphasis on social movement organizations and the relationship between emergent and conventional forms of behavior allow for better understanding of the collective forms which emerge in disaster response. Where aspects of formal organizational theory do not apply to volunteer organizations (Quarantelli and Dynes, 1977), approaches from the social movement literature can help fill the gap.

Social movement organizations are different from formal bureaucracies in that they have either emergent norms or emergent relationships, or both (Weller and Quarantelli, 1973). Still, collective behavior and social movements may be defined from a perspective that also applies to formal organizations. This provides a way of defining collective behavior in relation to organizational characteristics, rather than by their complete absence.

Social movement organizations emerge when there is consensus concerning a crisis. The consensus is reflected in an overall agreement about goals and about what needs to be done. This situation prevails in most communities after a disaster (Quarantelli, 1970). Social movement organizations which are likely to be most active in a consensus crisis are what Quarantelli terms "accommodation" organizations. According to Quarantelli, "These groups are characterized by the fact that their internal activities are highly cooperative in nature and their external behavior aims at or results in action of an integrative sort" (1970:113).

Accommodative organizations, like most social movement organizations, are likely to cooperate with other social movement organizations at the community and regional level to procure information and material resources (Neal, 1983). These groups may be ephemeral and disappear after their goals are met. However, they may take on a bureaucratic structure and become a permanent part of the social system (Gillespie et al., 1976), particularly if they are legitimated by other organizations (Quarantelli, 1970).

Many volunteer organizations which are active in disaster response appear to be accommodative organizations. Volunteer associations attempt to integrate diverse roles in the social system and to accommodate otherwise conflicting roles (Little, 1965). New roles and relationships are created and linked into the existing social structure (Banton, 1968). These processes of integration and accommodation may be important intervening variables between the new needs for disaster relief, and the actual changes and adaptations which are institutionalized at the social structural level (Keesing, 1975).

The literature on social movement organizations and their growth, maintenance, and decline point to a number of qualities of volunteer organizations active in disaster response. They are likely to differ from formal bureaucracies in their goals to restructure society or individuals in some way. Additionally, they place more emphasis on value fulfillment and social solidarity to motivate participants, rather than material rewards or coercion. This reliance on purposive incentives means that these organizations often have the problem of maintaining membership commitment and participation in the face of competing employment and family demands.

Social movement organizations which have become institutionalized gain some formal power. These more formal social movements are likely to become conservative, bureaucratic, and oligarchic. For all of these organizations, if the chance of reaching goals is somewhat distant, it is likely that organizations or clusters of organizations will separate into homogeneous subgroups on the basis of ethnicity, class, and generational (age) differences (Zald and Ash, 1966). Overall, volunteer organizations in disaster can be expected to share many of the same characteristics and processes of social movement organizations which are accommodative in nature.

### Summary

Organized volunteers are critical in disaster response, especially during the first 24 to 48 hours. The two major functions of volunteer organizations in disaster are meeting the immediate survival needs of victims, and providing communication and coordination. Some of the attributes of these organizations create difficulties in fulfilling their functions. Volunteer organizations tend to have vague structures which confuse communications and complicate authority relations. They are less permanent and often not recognized as legitimate organizations. Leaders are frequently recruited on the basis of social status, wealth, or political contacts, rather than competence.

Ideas from the collective behavior and social movement literatures suggest direction in overcoming some of the difficulties with volunteer organizations. The points made include prior training to ensure adequate levels of skill, assignment of workers according to areas of greatest need, direct exposure of workers to victims and rotation among different victims to increase altruistic involvement, and capitalizing on the cooperative and integrative orientation of organizations that results from consensus regarding the disaster.

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## CHAPTER 3

### INTERORGANIZATIONAL NETWORKS IN NATURAL HAZARD PREPAREDNESS

Most communities have a wide range of organizations which interact on a regular basis to achieve goals and meet ongoing needs of the community. Under normal conditions, these organizations establish routine patterns of interaction through which they negotiate and maintain organizational domains, carry out established tasks, allocate resources, and make decisions concerning future goals and activities (Gillespie and Mileti, 1979a).

When disaster strikes, routine patterns of interaction are disrupted or altered in important ways. Some organizations abandon their normal activities, others redirect their activities toward new or special goals, and still others alter their activities to pursue extensions of their regular goals. Disasters tend to strengthen community identification and create a consensus that places high priority on activities which benefit the entire community and low priority on individual, self-interests (Dynes, 1970a).

Organizations shift from goal-directed behavior toward survival behavior during conditions of turbulence and uncertainty (Emery and Trist, 1965; Hall, 1972; Gillespie et al., 1976). During disaster response, normal organizational goals are replaced by concern for the survival needs of the community and its members. The crisis promotes a convergence of objectives among the various organizations in the community and encourages them to enter into exchange relationships that would generally not be considered under normal conditions. Thus, the community provides the context within which interorganizational response to a disaster must be examined.

It is the disruption and novel working relations which facilitate emergence of new patterns of interorganizational relationships. These new relationships allow the community to respond to the crisis confronting it.

### Community As a System of Systems

Warren (1963) describes a community as a system of systems. All communities, especially those in an urban context, are comprised of a variety of institutions, organizations, and informal sub-groups. These organizations and sub-groups are themselves social systems which, through their interaction, make up the larger social system of the community. They provide the mechanisms by which the day-to-day needs of the community members are met and act as the problem-solving arm of the system (Dynes, 1970b).

Communities are normally organized around five major locality-relevant functions (Warren, 1963:9-11). These functions are:

1. Production-distribution-consumption: the production, distribution and consumption of goods and services which are part of the daily life considered desirable in the community.
2. Socialization: the transmission of knowledge, social values, and behavior patterns to individual members of the community.
3. Social control: the maintenance of conformity with established community norms.
4. Social participation: the provision of opportunities for social interaction on a local basis.
5. Mutual support: meeting the needs that arise from individual and family crises.

Under normal conditions these functions tend to be performed concurrently with little recognition of overall community priorities. They emerge as organizations in the community pursue their normal activities through established patterns of social interaction. When a major disaster strikes, however, normal patterns of interaction are disrupted and normal functions of the community are drastically altered (Dynes, 1970a; Yutzy, 1970). Activities related to production-distribution-consumption and socialization are either suspended or reduced to a minimum. The social control

function is expanded. Violations of certain community norms are overlooked while others are carefully monitored and controlled. For example, traffic violations and domestic disputes are virtually ignored while looting and other violations of private property are dealt with severely. The functions of social participation and mutual support assume much greater prominence.

As normal community functions are altered, so are the usual patterns of interaction between organizations in the community. New demands, new goals, and new priorities are reflected in new patterns of interorganizational relations. Old relationships are altered and new relationships are established as the emergency response system evolves. These new patterns of interorganizational relationships allow the community to mount an organized response to the crisis.

### Disasters and Organized Response

The term disaster refers to many natural and human-caused phenomena which disrupt normal patterns of social interaction in a community. Labels that describe disaster events, such as earthquake, flood, tornado, fire, airplane crash, and toxic material accidents are useful in distinguishing between the major types of disasters. They are of limited use, however, in understanding the range of impact that a disaster may have on the community. It is more useful to consider the dimensions of variation in disaster events (Barton, 1969; Dynes, 1970a; Berren et al., 1980). Some of those dimensions include: speed of onset, predictability, controllability, duration, scope of impact, and destructive potential.

Disasters can also be characterized by the degree of community consensus they generate. Natural disasters tend to generate a high degree of community consensus because the crisis is seen as a "act of god," and, therefore, beyond human control. On the other hand, some human-caused disasters can generate dissensus, especially in cases where the disaster could have been prevented or blame can be placed on a particular individual or group. Such disasters can have a polarizing effect on the community and, as a result, make a well organized response more difficult (Bucher, 1957; Drabek and Quarantelli, 1967).

Wenger (1978) notes that no disaster event has meaning outside of a social context. While earthquakes occur on the ocean floor and tornadoes rip across open plains, they have no meaning outside of a social context. The importance of dimensions such as speed of onset, predictability, community consensus, and so forth is their ability to delineate the

social impact as well as the physical impact of the disaster event. It is the social consequences and not the physical which give a disaster event meaning.

Organized behavior in disasters. Different organizations experience disaster events in different ways. Organizations performing high priority tasks automatically become involved in disaster-related activities. Organizations such as the police and fire departments perform tasks which are essentially the same ones they perform on a regular basis. Other organizations take on new or extraordinary tasks which are related specifically to the disaster.

Four types of organizations can be identified in the aftermath of a disaster. Quarantelli (1966) and Dynes (1970a) offer a two dimensional typology of organized behavior based on the nature of the disaster related tasks performed by the organization and the post-impact structure of the organizations. The types of organized behavior that appear in the immediate post-impact period are depicted in Figure 3.1.

Figure 3.1 Types of Organized Behavior in Disasters.

		TASKS	
		Regular	Nonregular
STRUCTURE	Old	Type I (Established)	Type III (Extending)
	New	Type II (Expanding)	Type IV (Emergent)

Source: (Dynes, 1970a)

Type I, established organizations, carry out their normal or regular tasks within the framework of their old structure. These organizations have immediate relevance to the disaster response, and they have greatly increased demands placed upon them early in the disaster situation. Examples of established organizations include police and fire departments, utility companies, and hospitals and medical clinics.

Type II, expanding organizations, have a small central core of personnel during normal periods but maintain a cadre of volunteers who can be mobilized rather quickly when the need arises. When a disaster occurs, this type of organization provides a core of permanent workers and a name for the new structure that develops. Such organizations are generally the result of pre-disaster planning. Examples of expanding organizations include local Red Cross chapters, Salvation Army units, and local Emergency Management offices.

Type III, extending organizations, take on new tasks during a disaster but they maintain the integrity of their old structure. Two sub-types of extending organizations can be delineated: (1) emergency-relevant organizations and (2) community-relevant organizations. Emergency-relevant organizations are those that might be able to continue their normal activities but because they control special resources or personnel needed for the disaster response their efforts are diverted to disaster related activities. For example, building contractors may divert their personnel and equipment from normal construction sites to assist in search and rescue operations or debris removal. Community-relevant organizations are community service organizations which become involved in the disaster response as a group. Emphasis in such groups is on group membership and group participation. Examples of this type of organization include Boy Scout and Girl Scout troops, service clubs, fraternal associations, and church groups.

Type IV, emergent groups, have no pre-disaster existence and tend to dissolve once the disaster is over. They emerge in response to specific needs which are not being met by any of the other three types. Three kinds of emergent groups are identified, each centering around a specific function: (1) damage assessment, (2) operations groups, and (3) coordinating groups.

The more severe the disaster, the greater the range of organizations that are likely to be involved in the response effort. However, not all organizations become involved at the same time. There appears to be a sequential pattern to the activation or involvement of the four types of organizations (Quarantelli, 1966; Dynes, 1970a).

Type I organizations tend to be the community's first line of defense in its disaster response. Since these organizations work within their pre-existing structure, they can mobilize quickly and efficiently. Type II organizations become involved next and tend to be activated in the event of any disaster. Their mobilization is generally slower and more difficult because of the need to develop a new structure.

Type III organizations become involved next. Their involvement is based primarily on a strong community orientation, a desire to help, or because they have specific resources or skills relevant to the disaster. As a result their participation is delayed until assessments can be made and relevant tasks identified. Type IV organizations are the last to become involved because their emergence depends on the involvement of the other types of organizations. Emergent groups tend to form when a specific need is identified that is not being met through the other types of organizations. However, if the disaster is intense enough so that it is readily apparent that the capacity of the other organizations is not sufficient to address all the needs, emergent groups can appear rather quickly.

Disorganization and reintegration. Dynes (1970b) notes that an interesting paradox emerges as a community experiences a disaster. The effects of most disasters are both disorganizing and integrating. The apparent contradictory nature of these effects are the result of the community going through a process of adaptation to the disaster conditions. Since communities are organized to meet day-to-day needs, they do not have the structural mechanisms in place to cope with the new demands created by the disaster. As a result, the community becomes disorganized as it struggles to develop a new structure to address the new and often overwhelming demands made upon it. As this process unfolds and the community develops the capacity to cope with the disaster, a new form of integration emerges.

Part of the disorganizing effect is due to the fact that many organizations in the community may have sharply diminished capacity to perform their normal tasks as a result of the disaster. Some organizations which could perform essential tasks may be unable to play a role in the response. Parr (1970) found that a sudden and sharp increase in demand created by a disaster is frequently accompanied by a high degree of organizational impairment. This organizational impairment may involve an absence or loss of personnel, especially key personnel; an absence, loss or breakdown of equipment, materials, or buildings; and an absence or loss of information or records.

As the degree of organizational impairment is assessed and the capacity of the community to respond becomes apparent, changes in the relationships between community organizations are necessary. New organizational domains are negotiated, new tasks are identified and undertaken, resources are reallocated, and the new community structure is reintegrated into a coordinated response effort.

## The Interorganizational Response

Normative structure. A disaster event tends to facilitate changes in the normative structure of the community. Since new demands are being placed on the community, a new normative structure emerges which allows the community to better organize its response activities. Barton (1969) had suggested that this shift in normative structure results in the formation of an altruistic community which places high priority on humanitarian concerns, mutual support, cooperative and helping relationships.

This new normative structure can be seen in the modifications of property norms described by Quarantelli and Dynes (1970). Under normal conditions there is high normative consensus concerning the ownership and control of private property. It is generally accepted that individuals and organizations can use their private property as they wish and undertake measures to protect it from outsiders. During a disaster, however, the confiscation and use of private property for communal activities is readily accepted. On the other hand, the taking of private property belonging to someone else and using it for personal non-disaster related activities is condemned and is often severely punished.

The altruistic community provides the normative backdrop for the interorganizational response to disaster. In the initial response period, relationships between organizations often involve informal exchanges based on the revised normative structure rather than exchange agreements carefully negotiated between the organizations. Thus the interorganizational response is facilitated by the new normative system which emerges during a disaster.

Organizational domains and task specification. When a community is hit by a disaster, numerous organizations immediately begin to respond to the crisis. Many of these organizations have no prior experience working together. This means that procedures have not been established to govern their interaction and responsibilities have not been negotiated ahead of time. An organized response necessitates the establishment of organizational domains of action and the specification and integration of tasks into task subsystems (Dynes, 1970b).

Disasters generate a number of specific demands on the community system. Domains represent the translation of the disaster-generated demands into spheres of social action (Krep, 1978). Stallings (1978) defines domain as a collective claim upon a portion of the organizational environment. As

such, an organization's domain can be seen as its claim to certain aspects of the disaster response. In some cases domain is clearly defined before the disaster occurs. In others, domain becomes recognized and clearly defined only as the response effort unfolds.

Tasks represent social definitions of how the demands of the domain are organized and implemented. Every domain is made up of many tasks which must be integrated into an efficient and effective response effort. Not only are there many tasks in each domain but many organizations will be involved in accomplishing them (Form and Nosow, 1958). Krep (1978) points out that, like domain, tasks may be pre-established or socially constructed as the crisis develops and, even where pre-planning is extensive, it is difficult to anticipate all the tasks that will need to be completed to meet disaster generated demands.

Organizational legitimation<sup>1</sup>. As domains are established and tasks are specified, integration and coordination of these activities become crucial to the community's overall response effort. It was noted above that communities rarely maintain the ongoing structures needed to present a coordinated front in the face of the new demands. Typically there is some degree of ambiguity over which organizations and individuals have legitimate authority to make key decisions concerning task priorities and resource allocations. Barton (1969) suggests that, when a disaster strikes, ambiguity over authority is most prevalent in areas characterized by a "crazy-quilt of jurisdictions."

For coordination of disaster response activities to occur, a new decision-making structure must emerge. That is, one that represents the overall interests of the community. However, Dynes (1970b) points out that the question of who represents the community is not an easy question to answer. Is it the political structure and the elected officials? Or is it those persons and organizations who have the most knowledge, are most involved, or have the greatest resources? Are there traditions from past experience which provide guidelines? Are there legal definitions which support or contradict these traditional guidelines? These questions are generally resolved on the basis of an organization's legitimation.

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<sup>1</sup> This discussion of organizational legitimation in a disaster context follows a more detailed discussion offered by Dynes (1970a:196-202).



Organizations which become involved in a coordinated response effort bring with them varying degrees of legitimacy. Some organizations are explicitly legitimated by the community because of legally mandated responsibility to perform certain disaster-related activities. Legitimation implies community recognition as the appropriate organization for performing a set of tasks within a particular domain of activity (Gillespie and Mileti, 1976). Legitimate organizations and patterns of interaction between them are those which the community approved, while illegitimate ones violate the prevailing values in the community (Blau, 1964). Three functions are important in determining organizational legitimacy in times of disaster: organizational goals, means, and leadership (Dynes, 1970a).

When agreement exists between an organization's goals and the emergency consensus which develops in the wake of a disaster, the organization has greater legitimacy. Organizations with normal activities that are closely identified with specific disaster-related tasks automatically have recognized legitimacy. This is true for police and fire departments, emergency management offices, hospitals, and emergency social service organizations. Organizations with objectives not consistent with the emerging community consensus often suspend operations for the duration of the disaster response. This frees their resources and personnel for legitimate response activities. Organizations that might be questioned often try to establish cooperative relationships with legitimate organizations as a means of countering their critics and legitimating their involvement. Such organizations strengthen their legitimacy through interaction with other organizations.

Under normal conditions, organizational legitimacy is based largely on the use of legally accepted means of achieving organizational goals. However, the emerging normative structure in a disaster situation may allow an organization to use means considered illegal under normal conditions without losing its legitimacy. This is the case when private property is requisitioned for use in disaster-related activities (Quarantelli and Dynes, 1970). Such acts would be considered stealing under normal conditions, and severely sanctioned by the community.

Organizations can also gain legitimation by the character of leadership. An organization's legitimacy can be strengthened if its leaders assume positions of power and influence in other parts of the community structure. Organizations which maintain stable interorganizational relationships through their leaders prior to the disaster are

often endowed with greater legitimacy in the disaster context. Because the leaders of such organizations are familiar with the goals, objectives, and resources of other organizations in the community they serve as a link between the various organizations and assume a greater role in developing an overall coordinated response to the disaster.

The process of coordination. As the emergency response develops, consensus begins to emerge as to which organizations have legitimacy for carrying out the various task subsystems. Coordination of these activities requires exchange of information and resources among the various organizations involved in the disaster response. Dynes (1970b) suggests that coordination develops over time as a by-product of the search for information. Organizations need information in order to perform their tasks. However, under normal conditions, no single organization in the community has responsibility for collecting and disseminating information. As organizations seek the information they need in exchange for the information they have, a coordinating group begins to emerge. This emergent group usually consists of leaders from legitimate organizations, individuals with links to many organizations in the community, and individuals with special technical competence relevant to the coordinating activities.

Effective exchange of information makes the coordinated exchange of resources possible. An organized response to disaster-related demands requires a wide range of human and material resources. Normally resources are dispersed throughout the community. An effective disaster response is hampered when resources are lacking, when resources are inadequate, or when it is impossible to mobilize resources because of inappropriate flows of information. As a result, the role of the coordinating group becomes crucial to the appropriate exchange of resources in the disaster response.

During the period immediately following the impact of the disaster, interorganizational exchanges among organizations in the community increase. Normal patterns of interaction with organizations external to the community are drastically altered. Stronger links between organizations within the community emerge as a result of norms favoring altruistic behavior, the perceived urgency of activities to protect lives and property, and the isolating effects of breakdowns in communication links to the outside world (Wenger, 1978). As a result, the community focuses inward on its own needs and its capacity to mobilize resources to meet those needs.

As the disaster response unfolds, however, links to external organizations again become important. As the scope of the disaster becomes apparent, state, regional, and

national offices of local organizations begin to channel resources into the community. Mass convergence behavior can create special coordination problems for the community (Fritz and Mathewson, 1957; Gillespie and Perry, 1976). Domain overlaps, authority conflicts, and value and normative dissensus are likely to arise as the coordinating group attempts to integrate resources into the community response effort.

The pre-disaster community structure is characterized by diversity of goals and pursuit of private interests. The onset of crisis brings about a shift toward common goals and community interests. Disaster response reshapes the social structure of the community. A new, normative structure and the emergent community consensus facilitate the coordination of interorganizational exchange in a way impossible to achieve under normal conditions.

#### Cooperation and Conflict in Interorganizational Relations

Interorganizational relationships can assume a variety of forms as organizations interact with one another in pursuit of their goals and objectives. Gillespie and Mileti (1979b:27) have conceptualized relationships between organizations along two basic dimensions: goal relations and activity relations. Figure 3.2 illustrates a range of relationships based on goal orientation and activity relations.

Drabek et al. (1981) have noted that disasters impose demands on organizations which exceed their capacity to respond. As a result, interdependence among organizations in the community is heightened. Increased interdependence, coupled with shared or common goal relations emerging out of the emergency consensus, suggest that interorganizational relations in a disaster context are likely to be dominated by cooperative interaction (see Figure 3.2). Indeed several authors have noted a high degree of cooperation as the community strives to respond to the crisis (Fritz, 1961; Turner, 1967; Barton, 1969; Dynes, 1970a; Wenger, 1978).

While cooperative patterns of interaction tend to dominate during times of disaster, some conditions created by a disaster may lead to conflict among organizations involved in the disaster response. One source of conflict emerges as the result of the diminished capacity of the community to respond to the disaster. Under normal conditions, each organization in the community has some degree of legitimate claim to community resources needed to achieve its goals. A disaster, however, often creates a condition where demand for resources is dramatically increased at the same time that

availability of resources is drastically reduced (Parr, 1970). Under such conditions, conflict can arise as organizations attempt to gain control of resources needed to accomplish the tasks associated with their domain of activity.

Figure 3.2 Goal and Activity Relations.<sup>2</sup>

		Activity Relations		
		High Inter-dependence	Medium Inter-dependence	Low Inter-dependence
R e s o u r c e s	Common/ positive	Cooperation	Bargaining	Accommodation
	Separate/ neutral	Coalition	Compromise	Awareness
	Opposed/ negative	Conflict	Competition	Monopoly

Source: (Gillespie and Mileti, 1979b:27)

At the other extreme, the problem of excess resources can also create interorganizational conflict during the disaster response. While excess resources are rarely a problem in the immediate post-impact period, a spontaneous outpouring of unsolicited relief items from a variety of sources often occurs as news of the disaster spreads. Fritz and Mathewson (1957) have found that such generous responses often add to the problems facing disaster response organizations. They note that in most cases the items arrive in volumes far in excess of the actual need, are largely comprised of unneeded and unusable items, require large numbers of personnel and facilities which are needed for more essential tasks, and add to the problem of congestion in and near the disaster site. Conflicts can emerge among organizations as they try to cope with this deluge of supplies without further disrupting their normal disaster-related activities.

<sup>2</sup> This figure is a slightly modified version of the figure presented in Gillespie and Mileti, 1979b.

Conflict can emerge among public-supported disaster-response organizations as they compete for "social credit" which they hope to cash-in for future support (Thompson and Hawkes, 1962). Such organizations maintain an implied social contract that in exchange for tax support and private contributions they will respond when a disaster occurs. These organizations are keenly aware that if they are to obtain support for their activities in the future, they must make it clear to the community that they performed their disaster-related activities in an effective and efficient manner. Competition for social credit can result in conflicts over legitimation and authority, and increasingly to disputes over access to publicity through the mass media.

Conflict and competition rarely occur openly in such a way as to disrupt the disaster response. In describing a dispute between the Red Cross and Civil Defense over authority to direct disaster response activities during the Worcester tornado, Rosow (1955) pointed out that the relief to those in need continued almost unaffected by the arguments between the "front offices" of the organizations. Cooperation among organizations still has a high priority in disaster situations. In fact, organizations are often evaluated not only on how well they perform their disaster-related tasks, but also on how well they allow others to perform theirs (Form and Nosow, 1957).

#### Summary

A disaster disrupts normal patterns of social interaction in a community. This disruptive effect not only impacts on every individual in the community but also on the structural organization of the community itself. Normal patterns of interaction among organizations are altered as the community mobilizes its resources to cope with the crisis. New patterns of interaction emerge, new individuals assume positions of prominence in the community, new decision-making mechanisms are put into place, and new community priority systems are established. Thus, the study of interorganizational relations in a disaster context offers a unique opportunity to study the dynamic processes involved in the formulation of relationships among organizations.



## CHAPTER 4

### METHODOLOGY

Research methodologies were selected and created to meet the goals of the study. The goals were descriptive and comparative. Descriptive studies measure characteristics of some phenomena and develop associative statements. Comparative studies examine the same phenomenon at different points in time, or different phenomena at the same time but under a common condition. This study examined interorganizational network characteristics under (a) normal day-to-day circumstances, and (b) a disaster response condition using an earthquake scenario. Different procedures for analyzing networks -- correlation analyses, graphic displays, blockmodeling, and cluster analyses -- were employed to assess advantages and disadvantages in describing the network.

#### Field Work

While the primary focus was on quantitative description of disaster preparedness networks, the project also developed a useful set of qualitative data to complement the quantitative results. Although it was not our original intent, it soon became apparent that "immersion" in the field was necessary in order to (1) understand the overall context of disaster preparedness in the St. Louis area, (2) establish relationships of acceptance and trust with key individuals and organizations, (3) inform successful questionnaire development, and (4) collect important information that could not be captured through the use of structured questionnaires.

The research team conducted person-to-person interviews with key individuals, made hundreds of phone calls, and attended numerous meetings, conferences, training exercises,

and disaster simulations. As members of the project team became better known, they were asked to attend conferences and meetings. Throughout this process, field notes were kept as a useful addition to the quantitative findings.

Keeping field notes seemed especially important since it appeared that the emergency preparedness networks and key actors were changing rather quickly. These changes may have been due to the earthquake preparedness efforts of FEMA, as well as increased media attention to the prospects of a major earthquake affecting the St. Louis area. Media attention was particularly intense following the earthquakes in Mexico on September 19 and 20, 1985. Project members were interviewed by newspaper and television reporters; considerable interest was expressed in parallels between Mexico City and St. Louis. There was a clear impression that the preparedness networks were undergoing change. A purely quantitative and cross-sectional network analysis would have been more difficult to interpret and understand.

Qualitative data also suggested the important role of key individuals in the preparedness networks. Even though the project focus was on organizations as units of analysis, field experiences suggested that certain individuals make a considerable difference in preparedness networks. For example, one committed individual assumed the volunteer position of emergency preparedness director in a local municipality about the time our project started. After one year, the community had over 70 trained volunteers organized into a preparedness network. This group of organized volunteers now conducts an elaborate community-wide training exercise every spring and a smaller simulation in the fall. The individual who spear-headed this group of organized volunteers subsequently assumed the presiding leadership role in the Emergency Preparedness Council of St. Louis County, an organization of municipal emergency preparedness directors.

Becoming acquainted with the political, social, and economic contexts of the preparedness community provided a much better idea of how to ask questions which fit the population in question. This effort resulted in more precisely formulated quantitative instruments, and more informed interpretation of findings. Field observation is now believed to be critical to network analyses.

### Construction of Instruments

Two procedural changes from the original proposal were made in constructing data collection instruments. First, the



proposal called for two waves of instruments to be designed, one for telephone interviews, and a second more detailed instrument for face-to-face interviews. From May through August of 1984, telephone contact was made with over 800 social service agencies and emergency management directors. A short form was designed to identify organizations involved in the disaster preparedness network (Appendix A, p. ???). This procedure was used to identify the potential population of organizations to be included in the study.

Because of the size and dynamic nature of the networks, it would have been excessively time consuming and potentially wasteful to conduct face-to-face interviews with a representative of each organization. In addition, the evolving nature of the networks raised questions about the use of published directories to identify members of the emergency preparedness network. This, in turn, led us to design a questionnaire that would pick-up organizations not listed in published directories, and also give us an accuracy check on organizations presumed to be participants in the network. A mail questionnaire was developed to handle the data collection in a more efficient manner.

Since network level research examines patterns of interaction among members of a network as a unit, it was critical to get as close as possible to full participation of all members in the network. Anything less than full participation would have been a problem because patterns of interaction in a network are interdependent, thus missing cases alter the total composition of the results. Therefore, several follow-up letters, phone calls, and in some cases face-to-face interviews were used to achieve as close to a 100 percent response rate as possible.

The second procedural change involved separating data collection between the social service network and the communication network. On becoming acquainted with the preparedness network in St. Louis, it was apparent that social services and communications entailed two distinct networks. There were, of course, organizations with linkages in both networks, but these frequently had separate divisions or personnel to handle the different functions. More importantly, the differences between the two networks suggested dissimilar conceptual frameworks. The social service and communication networks are both systems, but communications corresponds to a single system of roles structured according to technology, while social services involves a set of systems -- organizations -- within a geographical boundary.

Concern for field relevance, validity, and brevity led to a much more lengthy process of questionnaire construction than had been anticipated. Decisions about what information to collect came from reviews of the literature, as well as from telephone interviews, face-to-face interviews, and informal observations during meetings with emergency preparedness groups. Numerous drafts of the questionnaires were produced through a series of meetings between Fall 1984 and Spring 1985. At these meetings, issues regarding item meaning, the relative importance of different variables, appropriate response categories, format, and function within our conceptual frameworks were debated and resolved. Pretests with students and representatives of the two networks were conducted.

The focus on disaster preparedness networks attached special significance to the measurement of preparedness and interorganizational relations. Emergency managers in the network commented that preparedness is "a state of readiness" to mobilize in response to a disaster. It is akin to the concept of effectiveness and, like effectiveness, it makes sense only in relation to a clearly defined goal or referent. This suggested the need for a disaster scenario so that the informants from each organization would have a common referent to use as a baseline in reporting about their organization's operations and relationships with other organizations.

In developing the scenario, the "worst-case" scenario methodology was rejected in favor of a region-wide, moderate disaster scenario -- an earthquake. The scenario appears at the beginning of Section III of the questionnaire (Appendix B, p. 175). The decision to use a region-wide, moderate disaster scenario was based on the belief that most organized volunteer groups would report a complete lack of preparedness if presented with a catastrophic disaster, thus restricting variance in our measures. In addition, it was assumed that a wide-scope, moderate disaster would maximize the need for interorganizational coordination across social, political, and economic boundaries of the metropolitan area. The earthquake scenario was written to be consistent with the empirical damage assessment literature as well as the opinions of local emergency management officials.

The questionnaires were designed with four sections: (1) information about each organization under day-to-day (non-disaster) conditions, (2) relations between each organization and others under day-to-day conditions, (3) anticipated characteristics of each organization during disaster operations, and (4) anticipated relations between each

organization and others during disaster (Appendix B, p. 170-179). All questions elicited information about organizations or their relationships with other organizations.

### Measurement

Key variables in the study were grouped into three clusters: (1) organizational descriptors, (2) preparedness and preparedness-related measures, and (3) interorganizational variables. This grouping provides an organizing device for variables that may affect patterns of interaction in the networks. All variables, except for the interorganizational variables, were included as conditional variables to assess possible influences on network configurations and interorganizational networks. Within each of the clusters, the variables are defined, their purpose beyond the overall rationale is stated, and features (number of items, wording, response format, etcetera) are described.

#### Organizational Descriptors

Data were collected on a variety of organization descriptors: organization type, number of paid members (pre and post-disaster), number of volunteers (pre and post-disaster), amount of turnover in paid staff and volunteers (pre-disaster only), formalization, the ways organizations show appreciation to their volunteers, funding base, legal authority, and service range.

Organization type. The type of organization was defined by the principal orientation of output goals. It was included as a useful descriptor of the organizational environment involved in disaster preparedness. That is, the number and variety of organizational types reflects the range of services delivered in the preparedness network.

For social services, two major categories -- social services, and emergency management -- were elicited by asking organizational representatives to check at least one of eighteen different types of organizations listed, or to write-in a type if their organization could not be adequately described by the types listed. The types included: (a) social service agency, (b) mental health agency, (c) neighborhood organization, (d) religious organization, (e) fire department, (f) police department, (g) city or county disaster office, (h) hobby club or recreational club, (i) service club or organization, (j) military unit, (k) youth group or youth organization, (l) senior citizen organization, (m) school or

university, (n) commercial enterprise, (o) transportation service, (p) fraternal organization, (q) health clinic, and (r) hospital.

For communications, two major categories were elicited based on prominence in disaster communications. These two types were labeled simply primary and secondary. The types included: (a) amateur radio organizations, (b) citizen band radio clubs, (c) police departments, (d) fire departments, (e) city or county disaster offices, (f) commercial radio stations, (g) weather bureaus, (h) newspapers, (i) military, (j) television station, (k) social service agencies, (l) hospitals, (m) communication monitoring units, (n) telecommunications, (o) utilities, (p) transportation, and (q) other. Another question asks whether communications, in general, are the primary purpose or whether communications are important but not the primary purpose. This is a two-level nominal measure, scored zero or one; the informant for an organization checks one or the other category.

Organizational type was included to achieve as much precision as possible in describing the kinds of organizations involved in disaster preparedness. The listings of different kinds of organizations were believed to be comprehensive. It was known that too few organizations were involved in disaster preparedness to justify a classification of so many types. But it was thought that the distribution of types and mixed types would be useful in more accurately describing the organizational composition of the metropolitan area.

In addition, for social service, it was desired to validate the crude classification of social services versus emergency management by assessing the pattern of mixed responses and empirically collapsing the categories. Impressions gathered from field work suggested distinct output orientations between emergency management organizations and those providing social services. These impressions would be supported if the pattern of mixed responses did not cross over between emergency management and social services, and if there were a high correlation between "type of organization" (classified in a dichotomy -- social service versus emergency management -- by the research team at the time of data collection on the basis of official charter or name) and "type of organization" (classified in the same dichotomy by collapsing the empirically designated categories).

Size of paid staff. The size of paid staff was defined slightly different for the social service and communication networks. For social services, it was the number of

organizational members paid a salary for their work. For communications, it was the number of communications staff paid a salary for their work.

The number of paid staff is one measure of organizational size. Organizational size is a useful attribute to describe the range of organizations in the study. Size of paid staff can also be used as a ratio with size of volunteer staff to get a measure of "voluntariness" of the organization. Size measures may be used as well to standardize or adjust the scores on other variables, such as capacity scores.

This variable was measured as an open-ended interval measure eliciting the number of members in the organization paid a salary for their work. The information for this variable was requested at two points in the questionnaire, once before the disaster scenario to assess size during day-to-day operations, and once after the scenario to note any changes during disaster operations.

Size of volunteer staff. The size of volunteer staff, like the paid staff measure, was defined with two variations. For social services, it was the number of regularly active volunteer members. For communications, it was the number of regularly active communications staff.

The number of volunteers in relation to the number of paid staff permits an assessment of whether the organization is a voluntary organization or another type. The number of volunteers or the ratio of volunteers to paid staff are useful attributes to describe the environment of organizations involved in disaster preparedness and response.

This variable was operationalized as an open-ended interval measure eliciting the number of volunteers in the organization. In addition, for communications, a ten-point interval scale was provided, along which the organizational informant could circle the extent to which the organization relies on volunteers for communications. Thus, for communications, two different questions on size of volunteer staff provide a validity check. Also for communications, a question was asked to identify overlap or possible double-counting of volunteers in disasters.

Stability of paid staff. For social services, stability of paid staff was defined as the relative proportion of paid organizational members working for the organization less than one year; that is, the ratio of paid staff working less than one year to the number of paid members. For communications, it was defined as the relative proportion of paid communications staff working for the organization for less than one year.

Stability of paid staff was assessed with an open-ended interval measure eliciting the number of members in the organization who were paid a salary for their work, and who have been with the organization for less than one year.

The number of new paid staff is one measure of organizational stability. Stability is a useful attribute to use in describing aspects of preparedness. The number of new members may be combined with size to produce an estimate of the turnover ratio. This is calculated by subtracting from one the number of paid staff minus the number who have been with the organization for less than one year and dividing by the number of paid staff. This assumes relative stability of the organization within the year, and that workers who have been with the organization for less than one year are replacements.

Stability of volunteers. For social services, stability of volunteers was defined as the relative proportion of volunteers working for the organization less than one year; that is, the ratio of volunteers working less than one year to the total number of volunteers. For communications, it was the relative proportion of communications volunteers working for the organization less than one year. The operationalization and rationale for assessing stability of volunteers is the same as for stability of paid members.

Formalization. Formalization was defined as the degree to which job descriptions of the organization are specific. Formalization can also be used separately or with other variables to describe the character of the organizations making up the preparedness environment.

Formalization was operationalized as an interval variable measured through six items on a four-point scale ranging from true (score = 1) to false (score = 4). The items were originally adopted from Hage and Aiken (1969) as recommended in Price (1972), then adapted to fit the population of emergency social service organizations. Hage and Aiken's "definitely true" and "definitely false" were adjusted to read simply "true" and "false." The middle values of "more true than false" and "more false than true" were adjusted to read "partly true" and "partly false." In addition, the response category of "not sure" was provided in case it turned out that the job specificity dimension of formalization was not appropriate for certain voluntary organizations. Since the items were written as positive statements of formalization -- for example, "everyone has a specific job to do" -- and scale values were low for affirmation, it was necessary to transpose item scores before computing the average value of the six items to achieve the formalization score for each organization.

Organizational appreciation of volunteer service. This variable was defined as the things done for or given to volunteers in recognition for service provided. Organizational appreciation represents a potentially useful administrative tool. If organizations with high levels of appreciation are found to have higher levels of preparedness, then this is a basis for improving the overall level of community preparedness.

Appreciation was operationalized as an ordinal variable with four fixed-choice categories: (a) provide formal training and certification, (b) give awards, citations or individual letters of recognition, (c) provide badges, insignia or identifying apparel, (d) give parties, picnics or banquets for recognition of service. The organizational informant was asked to check each category that applied as far as how their organization expressed its appreciation to the volunteers. A score of one-point was assigned for each category, and the number of categories checked were compiled for each organization. Scores of 0, 1, 2, 3, or 4 were possible. The operationalization assumes that categories are of equal weight and interchangeable. This assumption can be tested since coding preserved the nominal identity of each category.

Funding base. The funding base was defined as the source of money used to maintain organizational operations. The exchange of money invariably entails constraints. The kinds of constraints differ depending upon the source of money. For social services, funding base was operationalized as a three-category nominal measure, indicating (a) government sources of funding, (b) non-government sources of funding, or (c) both government and non-government sources of funding. For communications, a fourth category was added: (d) self-support.

Auspice. The source of legality in implementing organizational actions. Legal authority entails constraints. The kinds of constraints differ depending upon the source of legality. Auspice was operationalized as a four-category nominal measure, indicating (a) public (government) source of authority, (b) private not-for-profit, (c) private for-profit, and (d) both public and private.

Geographical service range. Geographical service range was defined as the nominal size of the geographical area where services are delivered. Service range can be used to weight each organization as a unit in overall preparedness across the metropolitan area. For example, capacity measures for each organization can be adjusted or weighted to take into account the service range. Service range was operationalized as a five-category cumulative scale, beginning with services

offered only in the immediate locality surrounding an organization, extending out to other localities, and on to services offered anywhere in the metropolitan area.

### Preparedness and Preparedness Related Measures

Preparedness. Prepared was defined as the degree of readiness to deliver services in response to a disaster. The networks that exist do so to facilitate or promote disaster preparedness. Preparedness is conceptually similar to effectiveness. It can not be directly assessed until response to a disaster occurs, and then it can be assessed only if pre-disaster measures of tasks to be performed have been taken. It can be indirectly assessed through disaster relevant training sessions and exercises. The more an organization is participating in training sessions and exercises, the more likely they are to know their role, and how to carry it out.

A composite index was computed for each organization to indicate its level of preparedness. For social services, preparedness was operationalized as an average of seven items believed to be indicators of preparedness. Four of the items relate to specialized training in the network, two relate to planning, and one asks whether respondents know about the Integrated Emergency Management System (IEMS).

The four specialized training items were (1) past participation in training sessions related to disaster preparedness, (2) past participation in simulated disaster exercises, (3) future participation in disaster response training sessions, and (4) future participation in field disaster exercises. For the two past participation items, the informant was asked to write down the number of different times during the past three years that a representative of their organization had participated in a training session, and also in simulated disaster exercises.

Some collapsing was necessary to make the variables useful in the composite measure. The raw data for number of training sessions and number of simulations in past three years were positively skewed with a few organizations listing 10 or more in each case. The variable asking about expected training during the upcoming year ranged from 0 to 7. These variables were all collapsed into 4 point scales ranging 0 to 3 to help deal with skewness in the original distributions.

The IEMS item was in reference to an emergency management approach which emphasizes similarities in response across different types of disasters and, accordingly, fosters planning for disasters as a whole rather than for individual



types of disasters. IEMS is promoted by the Federal Emergency Management Agency (FEMA). In addition to reflecting preparedness, this variable was included to assess the extent to which FEMA has been successful in promoting IEMS, including (a) whether people are familiar with the concept and (b) how well it is understood.

For both social services and communications, a two-level nominal question asks if the organizational informant is familiar with the term "Integrated Emergency Management System." In addition, for communications, the informant, if she or he has answered yes to the familiarity question, is asked how the IEMS concept applies to their work. The latter question is open-ended.

Whether they had an emergency plan and knowledge about IEMS are both dichotomous variables and were coded 0=no and 1=yes. Organizational informants were also asked to list the number of years and months since their plan had been updated. Again, the distribution was skewed with a few of those saying they had a plan indicating that they had not updated their plan for three or more years. One organization indicated that it had not updated its plan for eighteen years. To use this variable, the years were converted to months. The responses were then collapsed into a four-point scale with 0=no plan, 1=1-8 months since update, 2=12-14 months since update, and 3=24 or more months since update.

In order to have higher values on the preparedness measure indicate greater preparedness, the coding was reversed so that a longer time since the plan was updated was represented by a smaller value, and a more recent update was indicated by a larger value. These seven items were then averaged to obtain an overall preparedness measure for each organization in the network.

For communications, the measure of preparedness was a composite of five variables. These were (1) the existence of a disaster plan, (2) number of months since the plan was updated, (3) number of training sessions during the past year, (4) number of disaster simulations during the past year, and (5) number of training sessions expected during the coming year. As with the preparedness measure in social services, numerical values of composite variables were reversed where necessary and collapsed into only a few ordinal categories to eliminate skewness in the distribution.

Experience in disasters. Experience in disasters was defined as the number of times an organization has participated in disaster response efforts for particular types of disaster. Experience in disasters may be used as a partial

validity check for the capacity measures. That is, there should be consistent responses between the indicated level of capacity to respond to particular types of disasters and the amount of experience in responding to the same type of disaster.

For social services, experience was operationalized as an eight-item interval measure, indicating the number of times during the past three years that the organization responded to eight specific types of disaster, plus three blank items which offered the opportunity to add types of disasters not included in the list of eight. The eight items are: (a) earthquake, (b) flood, (c) tornado, (d) plane crash, (e) severe heat or cold, (f) blizzard/ice storm, (g) fire/explosion, and (h) hazardous materials accident. For communications, another item was added: (i) civil disturbance.

Extreme scores in a few of the responses required that several adjustments were necessary to achieve a useful distribution for the measure. Since most of the scores were concentrated at the lower end of the distribution (2 or fewer), we collapsed the few extreme cases into the third category, producing a four-point range from 0 to 3. While this solution ignores some large actual differences, it does maintain the relative rank position of the organizations. With such a few number of extreme cases in each instance, the distributions are still slightly skewed to the lower end.

Seven of the original eight items were used to compute a measure of overall experience for each organization. Earthquakes were dropped from the original list of disaster because every case listed 0 responses in the past three years. The overall measure was computed by taking an average of the number of responses listed on the remaining seven items (eight in the case of the communication network). The overall experience measure gives us an indication of the organization's past experience in responding to a wide range of disasters in the St. Louis area.

Disaster capacity. Not all disasters require the same level of response. In addition, some organizations in the preparedness network will be able to cope with certain disasters better than others. For example, a major earthquake would require more from an organization than severe heat or cold. In addition, organizational goals may influence an organization's capacity to respond. An organization may be involved in flood relief but have not capacity to respond to a hazardous materials accident. Therefore, it was determined whether organizations were better prepared to respond to some types of disasters than others.

To assess disaster capacity, each respondent was asked to rate their organization's capacity to respond to eight different types of disasters, with reference to the goals of their organization. Ratings were based on a ten-point scale with 0 representing no capacity and 9 indicating full capacity to respond to each of the specific types of disasters. The types of disasters were the same as those used in assessing past experience.

Service capacity. Organizational goals determine the types and levels of disaster services that organizations provide. Different organizations in the preparedness network provide different types of services. The strength and structure of disaster response is determined by service capacity.

For social service organizations, service capacity was assessed with a ten-point scale with 0 representing no capacity and 9 indicating full capacity to provide specific types of emergency services. Twelve types of services were listed: food, clothing, shelter, emergency counseling, information and referral, medical services, transportation, search and rescue, security and protection of property, debris removal, managing overall disaster response, and warning and evacuation. Respondents were asked to rate the capacity of their organization to provide each of the services listed. The question was asked with reference to the disaster scenario provided at the beginning of section III in the questionnaire (Appendix B, p. 175).

### Interorganizational Measures

The patterns of interorganizational relations were central to the goals of the project. More work went into these items than any of the others. The interorganizational instrumentation is straightforward and relatively easy to complete, yet it potentially provides a more precise and refined basis for network analyses than has been available.

Each organization was asked to list, in order of importance to them, at least two and no more than ten of the most important organizations they worked with, first on a day-to-day basis (section II of the questionnaire, Appendix B, p. 173), and then during a disaster, with reference to the disaster scenario presented in section IV of the questionnaire (Appendix B, p. 177). Three questions follow these lists, one directly below each list and two directly across from the lists on the right-hand page of the questionnaire pamphlet.

All three of the questions are positioned so that the list of organizations remains in view of the informant, thus providing easy reference back and forth in answering the questions.

This format was designed to achieve precise interorganizational linkage descriptions. Response categories for the three questions referred, each in turn, to the specific organizations listed by the informants. For example, one question elicited information on the frequency of contacts, so the frequency of contacts for the first organization listed would be checked, then for the second organization, and so on until the frequency of contacts had been checked for all organizations listed. In this way, the information collected about interorganizational relations in the network is organization-specific. It also allows the informants to empirically define the network, rather than have the research team categorically define the network. Moreover, each of the interorganizational variables were designed with four to six scales points or response categories. These measures, therefore, allow collection of data highly relevant to both network process and structure, rather than just network structure.

Three interorganizational variables were used for both day-to-day conditions and the disaster condition. These three variables were designed to provide organization-specific information about (1) services delivered and received, (2) formalization of organizational agreements, and (3) the frequency of contact between organizations in the disaster preparedness network.

Resource exchange. For social services, resource exchange was defined as the number of different resources exchanged between the members of the network. It was included to assess the range of different types of resources exchanged between the organizations in the disaster preparedness network. Resources are defined in terms of services either delivered to or received from other organizations in the network.

Exchange was operationalized as a six-point scale indicating the types of services delivered to and received from other organizations in the network. For each of the organizations listed, the informant was asked to indicate whether their organization delivered or received six types of services from the organizations they had listed. These included: personnel, equipment and supplies, building or land, financial, information and referral, and training. When the informant answered yes to a service the response was coded 1, when answered no, they were coded 0. By summing the responses and dividing by six, we have a proportional indicator of

intensity of the relationship between each pair of organizations. Comparisons can be made between pre and post disaster conditions and among subnetworks of the larger network.

A summative measure of resources exchanged was computed to show the overall number of different types of service and resources exchanged between the members of the network. First, an average was computed of the number of resources exchanged between the respondent organization and each organization it had listed. Then, an average was computed across all organizations listed, which produced a measure of the average number of resources exchanged between an organization and all others it had listed. The same procedure was followed for both day-to-day and disaster conditions, thus making comparisons possible between pre and post-disaster conditions, and among subnetwork of the larger network.

Methods of communication. For communication organizations, the resource exchange variable was not used because it was not as relevant for these organizations. Instead, method of communication, a communication technology variable was used. Seven basic communication forms were identified: (1) face-to-face, (2) written, (3) teletype/computer, (4) telephone, (5) two-way radio, (6) public radio, and (7) television. Each organization was asked to check which of the communication methods were used in relation to each of the organizations listed in its network. By summing all the communication methods checked across all organizations and dividing by the number of organizations, it was possible to construct a measure of the average number of communication methods used by each organization.

Linkage formalization. Linkage formalization was defined as the extent to which interactions between organizations are officially recognized and supported by clearly prescribed agreements. A distinction is made between linkage formalization (agreements between different organizations) and structural formalization (formalization of tasks and roles within a given single organization). Interorganizational linkage formalization assesses the degree to which interactions among organizations in the network are formalized or ad hoc.

Informants were asked to indicate, on a five-point scale, the nature of agreements between their organization and each of the particular organizations they had listed: 1=awareness but no agreement, 2=casual verbal agreement, 3=explicit verbal

agreement, 4=written formal agreement, and 5=legally mandated authority. The larger the value of the response, the more formalized the nature of agreement between two organizations.

An overall measure of nature of agreement was computed for each organization by taking an average of their responses to this question for all the organizations they listed. Mean scores indicated the degree of formalization of agreements between the organizations in the network. The question was asked for both the day-to-day and the post-disaster conditions. Comparisons of the degree of formalization in the network can be made between pre-post conditions and among various subnetwork which emerge during analysis. For communication, an additional open-ended question on mutual aid agreements provides more data for interorganizational linkage formalization.

The interorganizational formalization measure provide an indicator of the extent to which rules, policies and procedures have been established to govern the flow of resources and information under disaster conditions. The more linkage formalization that exists within the disaster response network, the more likely that channels for information and resource exchange have been established. As an indicator of disaster planning and preparedness, a higher degree of formalization would indicate that some preplanning had occurred among the agencies represented. Interestingly, it was noted by an official of one of the social service organizations that agencies are very reluctant to sign formal agreements. They may have elaborate verbal agreements but written agreements are "like pulling teeth." It should also be noted that formal agreements might in some way obstruct or limit effective disaster response.

Frequency of contact. Frequency of contact was defined as the number of times organizations interact with one another. It was measured on a four-point scale for both day-to-day and disaster conditions. However, for social services, the scale metric was differentially adjusted to the two conditions. In the day-to-day condition, the scale was 1=fewer than once per month, 2=monthly, 3=weekly, 4=daily. In the disaster condition, the scale was 1=fewer than once per day, 2=daily, 3=hourly, 4=continual contact. An overall frequency of contact score was computed for each organization to indicate the average level of contact between the organization and all other organizations it listed.

Adjusting the scale metric made comparisons across the day-to-day and disaster condition more difficult to interpret, but it was necessary to make this adjustment in order for the scale to apply adequately under the two conditions. Dynes

(1970a) has shown that the frequency of contact among organizations increases under disaster conditions. Discussions with emergency managers who pre-tested the instrument confirmed that the day-to-day scale would make little sense under disaster conditions, and at the same time, the scale adjusted for disaster would have little meaning to many organizations during day to day operations.

### Data Collection and Coding

Social service network. Data collection began in April 1985 and continued through the summer months. Questionnaires were mailed to 139 organizations on April 10, 1986. These organizations had been identified as potential participants in the network through telephone contacts during the preceding several months. Questionnaires were mailed to all 139 organizations even though we suspected that some of these organizations were not part of the disaster network. It was our intention to check out every possible member of the disaster preparedness network. If responses on the questionnaire made it clear that some organizations did not belong in the study, they could be dropped from analysis at a later date.

Initial returns were encouraging. The first completed questionnaires arrived one week after mailing the questionnaire; eight were returned on April 17. By April 24, two weeks after the initial mailing, 31 (22%) of the questionnaires had been returned. To increase the number of responses, follow-up letters were mailed on April 26, May 10, and May 23. By May 10 we had received a total of 61 responses (44%) and by May 23, 78 questionnaires had been returned (56%). At this point, it was decided that follow-up letters would not improve the response rate, so the 61 organizations which had not responded were divided among the research team and telephone contacts were made with each organization. This resulted in 25 additional questionnaires being returned throughout the summer months.

The follow-up telephone calls found 29 organizations which had received questionnaires but which were not part of the disaster network. These organizations were removed from the population list, thus reducing the list from 139 to 110 potential network participants. Careful inspection of responses on all returned questionnaires and follow-up telephone calls by the research team found an additional 26 that were defunct or clearly not part of the disaster network

in St. Louis. Eliminating these from the population list left a total population of 84. Of these organizations, we received 80 (95%) completed questionnaires.

As questionnaires were returned, they were inspected for missing data or unclear responses. When such cases were found, a member of the research team would call the informant to obtain clarification. This extra persistence was important to ensure high-quality data. It was also possible because of the relatively small size of the network.

By the end of August, all questionnaires had been received and cleaned-up. Four organizations did not return the questionnaire, despite numerous telephone calls and face-to-face contacts. Coding began in early September with responses being transferred from the questionnaires to code sheets and then to the computer.

Communication network. Data collection for the communications network involved both a mailed questionnaire and a follow-up telephone interview. Originally thirty-seven organizations were identified as members of the communication network. These informants were divided among the members of the research team, and each member telephoned the contact person sometime during the week of June 17-21.

The purpose of this contact was to inform the person that the questionnaire would be mailed within the next few days and to schedule a time to do the follow-up interview. Scheduling the interview before mailing the questionnaires was believed to increase the likelihood of prompt response to the questionnaire. An attempt was made to schedule interviews for the weeks of July 1 to July 12. However, because of vacations and other events during the week of July 4, it was not possible to schedule all interviews during this time.

Questionnaires were mailed on June 21, 1986. In most cases, the questionnaires were returned by the date of the interview. In those cases where the questionnaire had not been received, the organization was again called on the telephone to encourage sending the questionnaire as soon as possible and to reschedule the interview. It was important to have the questionnaire in hand before the interview, so that any ambiguous or missing responses on the questionnaire could be clarified during the interview.

Interviews ranged from 30 minutes to over an hour. There was an interview schedule to follow, but most questions were open-ended. This allowed the informants to answer questions in as much detail as they wanted, and to bring up related



topics that we had not asked about. In many cases the respondents talked in very technical terms about their communication technology, and a request for clarification was made to explain what was meant in lay terms.

All questionnaires and interviews were completed and cleaned by September. Coding was done during October and November of 1985.

### Analysis

The study employed six types of analysis for social services: (1) a description of the organizational and network characteristics, during both day-to-day operations and in response to the disaster scenario; (2) an assessment of relationships between organizational attributes and dimensions of the interorganizational network; (3) graphic depictions of the organization-specific interorganizational network; (4) analytical graphic presentations of network relations among organizational types; (5) blockmodeling of network characteristics; and (6) cluster analysis. For communications, only the first two types of analysis were employed.

Techniques used in the analyses included: (a) descriptive statistics, (b) graphic mapping, (c) tabulation of the data into graphic displays of linkages between organizational types, and (d) inspection of both the quantitative and qualitative data for regularities and patterning of the responses. The following discussions, each focused on one of the six types of analysis, include clarification of the purpose and place of each of these techniques in arriving at conclusions.

#### Descriptors of Organizational and Network Characteristics

The first section of analysis was concerned with describing the preparedness network and the organizations involved. Frequency and percentage distributions, mean scores and standard deviations, and correlations were calculated for measurements on each of the organizational and interorganizational variables. These data provided a basis for overall summary statements regarding the organizations studied and their relations in the preparedness network.

## Network Correlates

The second section of the analysis turned to an assessment of network correlates. Here the concern was to identify key organizational characteristics associated with variables describing network relations. The identification of such characteristics would indicate variables potentially useful in trying to strengthen the preparedness network. A series of semi-partial correlation analyses with t-tests of significance were conducted to identify the organizational variables most strongly associated with the network dimensions.

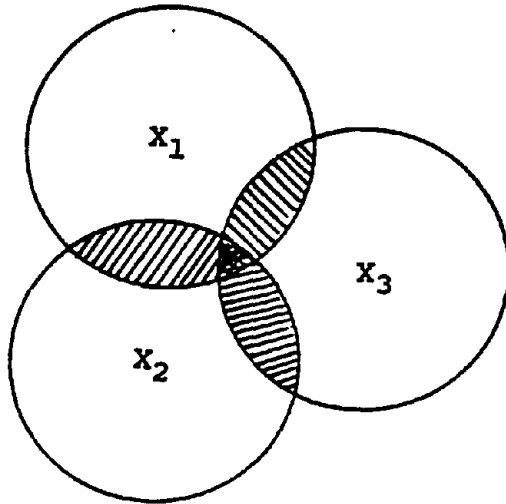
Semi-partial correlations, in contrast to partial correlations and multiple correlations, partial out only the independent variables from the variables being correlated (Pedhazur, 1982:115-125). This allows an assessment of the associations between a set of variables with a particular variable such that each variable in the set is unaffected by the others in its relation to the variable of interest, and the amount of variance in the variable of interest is the same for all variables. Partial correlations and multiple correlations partial all variables in the set, which changes the amount of variance in the variable of interest for each of the variables. This complicates comparing the individual importance of the different variables. Figure 4.1 (p. 56) shows graphically the distinction between semi-partial correlations and partial correlations.

## Graphic Depictions of Interorganizational Networks

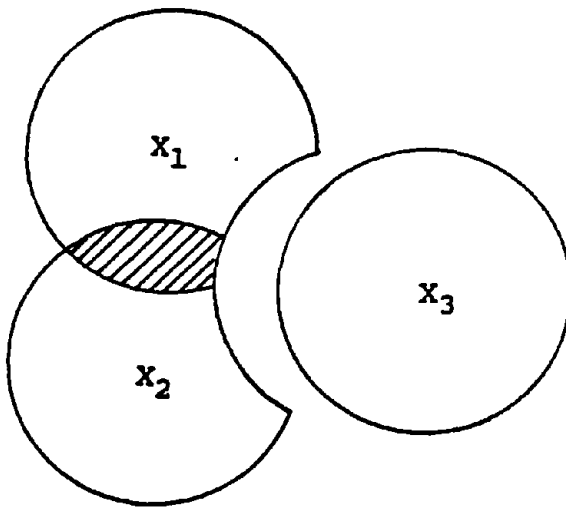
The third part of the analysis mapped the linkages between specific organizations involved in the preparedness network. Graphic representations provided powerful descriptions. But there was a limit to the amount of information that could be accurately conveyed in two-dimensional space. The best use of graphs in describing networks was made by introducing simplifying assumptions to highlight important linkage patterns. In this study, simplifying assumptions involved (a) deleting organizations extraneous to the network, (b) considering one interorganizational dimension at a time, (c) depicting different levels of network relations separately, and (d) focusing on patterns of variation which surfaced as potentially important in the correlational analyses.

The open-ended strategy employed to identify all organizations participating in the network resulted in a list of 283 specific organizations and 40 general types. Some

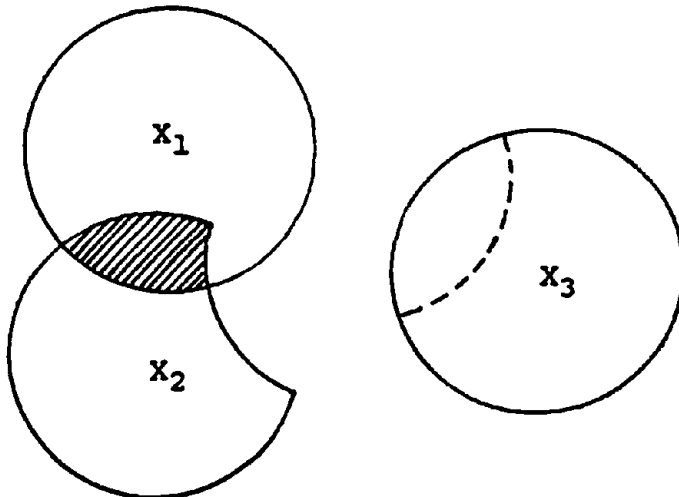
Figure 4.1. Illustration of Squared Zero-Order, Partial and Semi-Partial Correlations



Squared zero-order correlations among three variables. Single cross-hatched areas show correlations between  $X_1$ ,  $X_2$  and  $X_3$  respectively. Double cross-hatched area shows intercorrelation of  $X_1$ ,  $X_2$  and  $X_3$ .



Squared partial correlations of  $X_1$  and  $X_2$ . Partial correlations are correlations between two variables after the effects of one or a set of variables have been removed from both. In this case the cross-hatched area represents the correlation of  $X_1$  and  $X_2$  with the effects of  $X_3$  removed from both  $X_1$  and  $X_2$ .



Squared semi-partial correlation of  $X_1$  and  $X_2$ . Semi-partial correlations are correlations between two variables after the effects of one or a set of variables have been removed only from the independent variable. In this case, the cross-hatched area shows the correlation between  $X_1$  and  $X_2$  after the effects of  $X_3$  have been removed only from  $X_2$ .

respondents listed a combination of specific organizations and general types such as police departments, fire departments, and so forth. Most (n=203) of the specific organizations, however, were listed only once. The role of such organizations in the network would be necessarily peripheral, and any attempt to graph a network where 80% of the links were between two unique organizations would obscure the important network patterns. Therefore, organizations with only a single link in the entire network were deleted from network analyses.

Twenty of the eighty organizations participating in the study revealed only a single link. Deleting these organizations left a population of 60 organizations having established linkages with two or more other organizations in the network. Interestingly, twenty additional organizations were listed by two or more of the 60 organizations in the population. These twenty organizations were thus included in the population under the assumption that two or more linkages represented adequate network participation. The population used for graphic presentation, therefore, is comprised of 80 organizations; 60 identified in the original telephone survey and 20 revealed through the survey instrument. It is important to remember that this interorganizational network of 80 organizations differs by twenty organizations from the original population of 80 organizations.

A map produced by the U.S. Postal Service was used because of its size and representation of zip-code areas. A corresponding map -- Wunnenberg's St. Louis City and County Street Guide (St. Louis Area Maps, Inc., 1986) -- with labeled coordinates was used to pin-point the location of each organization in the network. The coordinates for each organization were then transcribed to a computer file containing the data on interorganizational relations for each of the organizations. Using an Atlas computer mapping program, lines were then drawn between each of the organizations that had relations.

Atlas is a software package which allows the user to design and draw a variety of geographic map displays. Its primary strength is its ability to draw census, zip-code, and political boundary maps. It then fills these boundaries with hatch and color patterns according to selected variables, such as population density. Data files can be created for use with boundary files.

Files can also be created which draw lines, points, polygons, and circles. Atlas is useful for creating patterns of line linkages, however, it misdraws a small percentage of lines and points from boundary files that are created by the user. Often, lines are arbitrarily placed in the empty

sectors of graphs drawn by the program. Thus, while Atlas is excellent for displaying network patterns, it is not completely accurate in displaying the exact position of lines and points on the geographic maps. In this study, every line was double-checked with the data and errors were hand corrected.

Atlas was used to draw 16 maps, one for each post-disaster level of the organization-specific network dimensions. One map was drawn for the number of linkages established. Six maps showed each of the six levels of exchange for disaster operations. Five maps depicted the five levels of interorganizational formalization for disaster operations. Four maps indicated the four levels of contact during disaster operations. Of the total 16 maps, four are included in the report: number of linkages established with other organizations during disaster, level-four frequency of contact (continual contact), level-five exchange (5 or 6 exchange relations), and level-4 interorganizational formalization (written formal agreements).

The graphic analyses were geared to the relations during disaster primarily because these most clearly accentuated preparedness. The disaster preparedness network was most vividly shown in the post-disaster condition because it exemplified the purpose of the network, and illustrated a snapshot picture of the network in action. The question was not how prepared do you think your organization is to respond to disaster, but, rather, given the earthquake described, what would your organization do? Which organizations would it contact? How frequently would you organization be in contact with each organization listed? And so on. Also the tedious process of transcribing the coordinates of each organization and programming the computer for use of the Atlas program made it prudent to be selective in describing aspects of the network believed to be most useful and valid. Both the limited amount of time to conduct analyses and the applied emphasis of the project led us to present key features of the data in as simple, straightforward, and useful ways as possible. Subsequent work with these data will tackle some of the thorny theoretical issues alluded to throughout the report.

#### Graphic Descriptions of Networks Using Organizational Types

The fourth area of analysis involved the production of analytic graphs to show network patterns among types of organizations. It was necessary to collapse the specific organizations into types because of the large number of organizations that had been listed by those surveyed: 282

individual organizations and 40 general types. Collapsing the specific organizations into types was accomplished through a two-step process.

The first step was to collapse the 282 individual organizations and 40 general types listed by the respondents into useful categories. Because of the high degree of similarity between the 40 types listed by the informants and the types contained in the first question of the questionnaire, each of the 40 types was fit into one of the 18 categories. All organizations listed by the informants, but not part of the original population, were then classified into one of the 18 categories. Except for seven specific organizations -- St. Louis City Police, County Police, City Fire Department, City Government, County Government, SEMA, and FEMA -- all the others listed by the informants were successfully identified as one of the 18 general types on the questionnaire.

The seven specific organizations were retained as "special types." That is, although each is a specific organization in this study, every metropolitan area has comparable organizations which are likely to be key actors in disaster preparedness networks. Thus, they are special types in the sense that there is only one of each kind per metropolitan area but many like-kinds if other metropolitan areas are considered. One of the 18 general types -- military unit -- came up empty, so the first step produced 17 general types.

The second step involved the 80 organizations surveyed. Each organization surveyed was recoded according to the general type checked in response to the first question on the questionnaire. Five specific organizations were not included in the general categories: American Red Cross, Salvation Army, United Way, St. Louis County Office of Civil Preparedness, and St. Louis City Disaster Operations Office. Again, the specific designation of these organizations was retained as special types. Empirical support for this special status was reflected in the fact that each of these five organizations had been listed by at least five or more of the other organizations. The second step, then, produced 17 general types and 12 (7 + 5) specific organizations. This was the set used to conduct the network analyses of organizational types.

After reclassifying the organizations as general types, there was some duplication of linkages between types. For example, one organization classified as a social service organization had listed relations with three other social service organizations. This created a duplication of linkages between social services and social services. The duplications

were eliminated by taking the first social service organization listed as the most important and deleting the second and third responses. The elimination of duplications was, of course, done for each of the interorganizational dimensions: nature of agreement, frequency of contact, and resource exchanges.

There was experimentation with many different arrangements to display the linkage patterns among organizational types. Two formats stood out as being most in highlighting key patterns of interaction. The first depicted an arc of the 29 types arrayed across the top of a page, and a corresponding arc of the types across the bottom. Those across the top represented the types surveyed, while the bottom arc indicated the types listed as having interorganizational linkages. Lines drawn between the top and bottom arcs showed the linkage patterns of interaction between organizational types in the network. This format revealed certain overall concentrations in the linkage patterns, but the large number of linkages rendered it difficult to read and interpret. For this reason, these graphs are not included in this report.

The second format is less complex, and more highly structured to highlight aspects of the linkage patterns. First, the organizations surveyed were classified as high or low on the five organizational variables found to be associated with network dimensions: (a) kinds of appreciation expressed to volunteers, (b) preparedness, (c) number of pre-disaster volunteers, (d) organizational type, and (e) pre-disaster organizational size. Except for organizational type which already existed as a dichotomy (social service/emergency management), each of the other key variables were divided at a reasonable point of central tendency to produce two categories of organizations.

Second, these two categories are displayed as large nodes in the center of a page. There is a separate page for each of the five key variables. Third, the linkages between each of the two categories with the 29 possible types are drawn such that the types linked to both high and low categories appear across the bottom of the page; those linked to only the high category appear on the right side of the page; those linked to only the low category appear on the left side of the page; and those which are not linked to either category appear across the top of the page.

The problem with this format is that the configuration of diagrams changes with every alteration of the network. That is, the magnitude for each interorganizational relation must be graphed separately. Even though the patterns from graph to

graph may resemble each other, the nodes are often different. Thus, in examining the graphs of organizational types attention must be given not only to the patterns of linkages, but also the the configuration of the nodes. The graph depicting the pattern of network interaction for organizations high and low on preparedness is shown in the report. A discussion of the empirical findings for each of the other key configurations is presented without the graphs. This was done because the imagery of the graphic model is essentially the same for all of the presentation.

### Blockmodels of Networks

The fifth section of analysis was blockmodeling. Blockmodeling is a hierarchical clustering technique to discover blocks and patterns of high and low density values for a variable or set of variables that describe a system of networks (Lorr, 1983:95) It offers a number of alternatives (White et al., 1976; Knoke and Rogers, 1979; Drabek et al., 1981; Lorr, 1983). Blocks can be created on the basis of one type of tie or linkage dimension, or several dimensions can be combined. Also, this kind of analysis allows assessment of directionality. For example, in a network of exchange, patterns of elements received can be compared to patterns of elements given. However, in the present study, data on interorganizational linkages was collected in a way that precluded assessments of directionality. The complexity of the instrument designed to elicit organization-specific linkage patterns made it exceedingly difficult to also elicit information on directionality without compromising validity. The decision in this study, as discussed in the beginning of this chapter, was to achieve a more refined description of the network by developing ordinal and interval level measures of organization-specific linkage patterns in the network. In keeping with the applied emphasis of the project, blockmodel analyses were conducted on each linkage dimension separately.

Blockmodeling entails the iteration of correlation matrices until all cells are represented by a -1.0 or +1.0 coefficient. In this study, the original matrices were set up with the coordinates indicating organizations and the cells containing linkage data. Two sets of data and coordinates were prepared, one for organization-specific linkages and one for linkages between types.

For the organization specific linkages, the same population of organizations used in the mapping analyses was employed. This population included all organizations which had been mentioned at least twice by the organizations surveyed. As discussed above, this criterion produced a



network population of 80 organizations, 60 from our original population and 20 from the organizations listed by the organizational informants. As in the mapping analyses, the post-disaster condition was used because it is assumed to present the most valid depiction of the preparedness network.

An 80 by 80 matrix was then constructed for each of the network dimensions to reflect the possible links between these organizations. A set of coordinates was prepared showing row and column position of each cell. Four data matrices were constructed, one for each of the interorganizational measures. For the linkage dimension, nominal data was entered into the cell to reflect the linkage: 1 if there was a link, and 0 if no link existed. For the exchange, formalization of agreement, and frequency of contacts dimensions, the reported values for each variable were entered into cells. In the few cases where two organizations indicated links with each other, the average of the two values was placed in the cells.

Since the data collected did not allow two-way links between organizations, each data point had to be entered into the matrix twice. For example, if organization 1 said it was linked to organization 50, it was assumed that organization 50 was also linked to organization 1. Thus, the data point was entered in two cells, one at column 1/row 50 and the other at column 50/row 1. This produced a non-transposed or reciprocal matrix; the two halves of the matrix are mirror images of each other.

Extensive analyses are possible in the search for various combinations of clusters reflecting forms of structural equivalence in the network. The initial blocks derived from data matrices may be subdivided, by repeating the analysis, to examine the component structure of each block. Then, sub-blocks can be further subdivided to analyze their structures. This process can continue indefinitely. Although methodological "stopping rules" have been developed (Mojena, 1977; Milligan, 1980), the theoretical or applied usefulness of the rules remains unknown because so little work has been done with the technique. Lorr (1983:101) recommends that "because of the state of the art, the researcher using clusters should apply at least two methods to confirm that the underlying cluster structure is being recovered."

Following Lorr's advise, blockmodeling was used to examine the relative concentrations of emergency management and social service organizations in the initial blocks constructed for each of the interorganizational dimensions of the networks. This decision was made after the correlation analyses indicated a bifurcated network structure between these two major types of organizations. Results of these

analyses should suggest directions for future development along these lines. For the purpose of the present project, every attempt was made to present findings in as simple and accurate manner as possible, so as to provide a solid basis for subsequent work, and also to provide a basis for useful practice guidelines.

Construction of the matrices for the general types of organizations was somewhat more complicated. Since the specific organizations had been collapsed into 17 general types and 12 specific organizations, there now was a 29 by 29 matrix. The process of collapsing organization-specific data required that several organization-specific linkages be combined to show linkages between general types of organizations. As a result, each cell value in the matrix could actually represent several specific linkages. It was, therefore, necessary to use a summary value for the linkage which would accurately reflect the several linkages represented by the cell value. To deal with this problem, mean scores were used as the summary value; all means were smaller than their standard deviations.

From this point on, construction of the data matrices followed the same procedures used in constructing the organizations-specific matrices. Three matrices were constructed, one for each of three interorganizational variables: resource exchange, nature of agreement, and frequency of contact. No matrix was constructed to reflect linkages only, because the process of collapsing to general types would have given considerably more weight to some types than others.

The network patterns derived from blockmodels of organizational types were studied differently than those derived from the organization-specific matrices. Since the types represented a reconstituted version of the same data set, there was little to be gained by replication of the same approach. If the organization-specific blocks confirmed the underlying structure indicated from the correlation analysis, certainly the organizational type blocks would do the same.

Instead, the empirical patterns of network relations derived from the blockmodels of organizational types were compared to the logical possibilities. Two blocks were derived for each of the three interorganizational dimensions: resource exchange, formalization of agreement, and frequency of contact. Organization types were linked on each of these dimensions either positively or negatively. This created eight ( $2^3$ ) possible combinations of network patterns as shown in Figure 4.2.

The empirical patterns corresponding to those in Figure 4.2 were achieved by first listing in columns the block memberships (positive/negative) for each type on all three dimensions. Then, reading across the columns, the pattern for each organization type was noted and clustered accordingly. Each of the 29 types were clustered into one of the eight network patterns. Since the network patterns reflect positions on the three dimensions simultaneously, this analysis provides a beginning point in describing network complexity.

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**Figure 4.2 Network Patterns of Blockmodel Analysis for Type of Organization Along Three Interorganizational Dimensions**

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<u>Pattern</u>	<u>Resource Exchange</u>	<u>Nature of Agreement</u>	<u>Frequency of Contact</u>
1	+	+	+
2	+	+	-
3	+	-	-
4	+	-	+
5	-	+	-
6	-	-	+
7	-	+	-
8	-	-	-

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It should be noted that blockmodels, once achieved, cannot be directly interpreted. While cases that are associated positively generally appear in the positive block and cases that are associated negatively generally appear in the negative block, there are numerous complications which preclude direct inferences from blockmodels. First, the appearance of a case in a block does not imply that it is linked with all other cases in the block or even most other cases. Second, the designation of positive or negative does not indicate more/less, stronger/weaker, better/worse, or any other such distinction. It simply indicates different patterns of association (high/high versus high/low) among the organizations. Third, the emergence of any given case in one or another block is influenced by the actual number of linkages between cases, magnitudes of the coefficients, amount of measurement error in the variables being correlated, the distribution of positive and negative correlations in the

initial matrix, and other factors stemming from the particular research setting. Complex empirical patterns where cases have one kind of pattern with one organization and another pattern with a second organization blur distinctions between blocks. The blocks derived through blockmodeling analysis, therefore, should be viewed as a means to an end. Blocks may be interpreted with reference to the correlates of block membership or by further iterations to reveal structures of block membership.

### Cluster Analyses of Networks

The sixth and final form of analysis was a series of cluster analyses. Cluster analysis is another statistical technique, like blockmodeling, that identifies homogeneous groups or clusters of objects based on selected variables (Norusis, 1986). Cluster analysis seeks to discover and describe groups that are similar or different in some systematic way. It identifies homogeneous groups on the basis of their distance or similarity on one or more variables. Distance indicates how far apart cases are, while similarity indicates closeness. Similarity and distance are different sides of the same dimension, so it is possible that identical groupings or clusters could be identified through either type of measure. This is not to claim that any measure of difference is a mirror reflection of any other measure of similarity. But, overall, for cases that are alike, measures of distance are small and measures of similarity are large. There are numerous ways to measure distance and similarity (Lorr, 1983:22-44).

This study used squared Euclidean distances -- sum of squared differences in values for each variable -- on standardized variables. A distance measure was selected to complement the similarity measures of correlation coefficients used in the blockmodel analysis. The major disadvantage is that distances are weighted by scale matrices such that variables with larger scale values would contribute more toward identifying clusters. The use of standardized variables eliminates this problem.

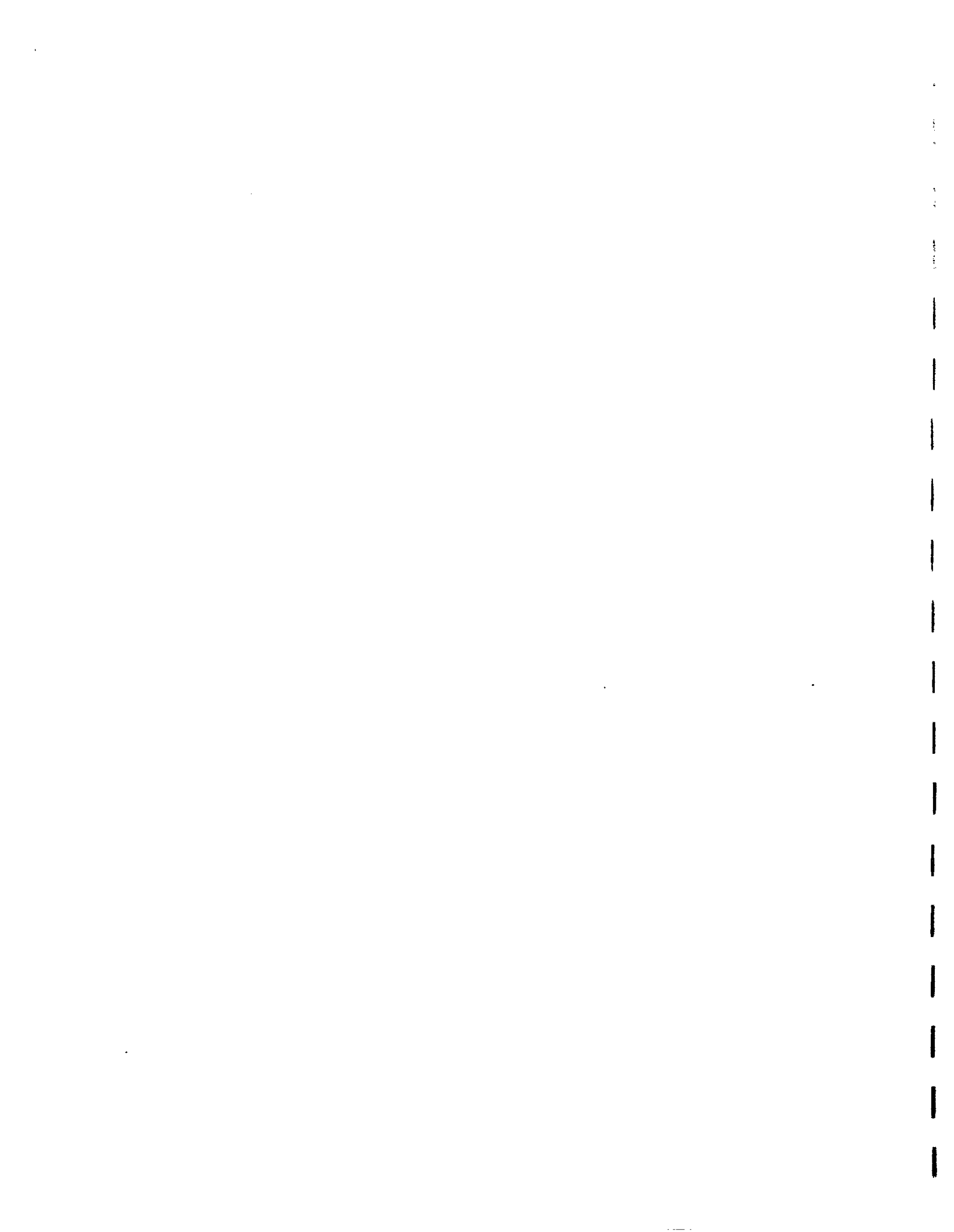
Cluster analysis was used to further establish the structure of the preparedness network. The analyses were conducted using the original population of 80 organizations which had been surveyed. It was necessary to use this data base rather than the modified population of organizations with two or more linkages because measures of the interorganizational variables had not been collected for 20 of the organizations in the modified data base.

The approach in cluster analysis followed the model used in the organization-specific blockmodel analysis. Again, following Lorr's (1983:101) recommendation to cross-confirm different methods, cluster analysis was employed to confirm the bifurcated network structure indicated with the correlation analyses. Results of the cluster analysis, like each of the other techniques, provides one kind of description of the network, and also points to new research questions.

#### Summary

This study examined disaster preparedness networks in the St. Louis metropolitan area under (a) normal day-to-day conditions, and (b) a disaster response condition described by an earthquake scenario. Qualitative data were gathered to complement quantitative data collected by mailed survey and telephone interviews. Quantitative data were modified to allow construction of both organization-specific and organization-type networks. Different network analysis procedures were employed to assess their advantages and disadvantages in describing the preparedness network.

The use of different methods and slightly modified data bases created a number of potentially important comparisons in the process of cross-confirmation. Both correlation and cluster analyses were carried out on the 80 original organizations surveyed, while blockmodeling and mapping were based on the population of organizations having two or more linkages. Correlation and blockmodeling use a measure of similarity, while the cluster analysis used a measure of distance. All of the methods and techniques of analysis contribute to understanding the networks. The similarities and differences between these methods provide a powerful point of departure in formulating research questions that can guide us to more refined and accurate descriptions of complex networks.



## CHAPTER 5

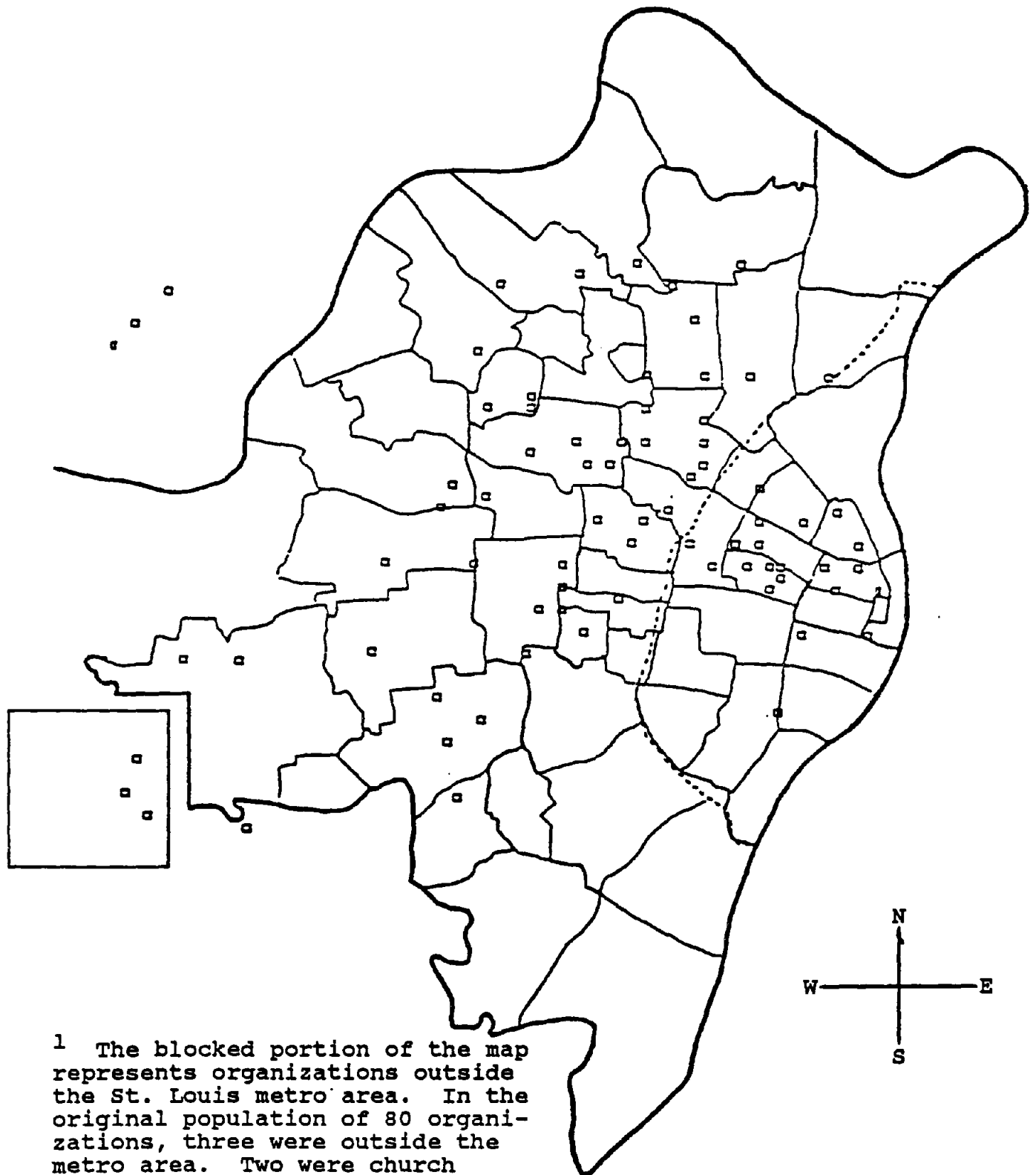
### POPULATION PARAMETERS

This chapter describes the emergency service organizations and communication organizations which were studied. Particular attention is paid to characteristics that have implications for network relations. Information is presented on the locations and distribution of organizations in the metropolitan area, the range of service delivery, organizational descriptors (type, size, formalization, expression of appreciation for volunteers), and certain features of organizational operations and preparedness. The chapter is divided into two parts, the first one reporting on social service organizations, and the second presenting information on communication organizations.

#### Emergency Service Organizations

Eighty organizations were identified during the summer of 1985 as having emergency service goals or programs. Figure 5.1 (p. 68) shows the distribution of these organizations across the St. Louis metropolitan area. Fifty-three (66%) of the organizations were located in the county, twenty-four (30%) were in the city, and three (4%) were outside of the metropolitan area. The organizations were concentrated in the near-north side of the city, and the north-east and east-central sections of the county. Forty (65%) of the sixty-two zip-code areas had at least one emergency service organization, and 18 (29%) of the zip-code areas have two to nine emergency service organizations.

**Figure 5.1 Distribution of 1985 Emergency Service Organizations Across the St. Louis Metropolitan Area.<sup>1</sup>**



<sup>1</sup> The blocked portion of the map represents organizations outside the St. Louis metro area. In the original population of 80 organizations, three were outside the metro area. Two were church affiliated agencies and one was a mental health agency which had been involved in past disaster responses in the St. Louis area.



The concentration of organizations was further highlighted by collapsing zip-codes into nine subdivisions of the metropolitan area: North City, South City, Northeast County, East Central County, Southeast County, Northwest County, West Central County, Southwest County, and out-of-the-area. Over two-thirds of the organizations were located in three of these subdivisions; 24 (30%) in East Central County, 20 (25%) in North City, and 11 (14%) in North East County.

A more refined view of emergency service availability was achieved by considering the service delivery range for each of the organizations. Seven (9%) served their neighborhood or municipality; thirteen (16%) served in their neighborhood plus others where formal agreements had been made; twenty-three (29%) served in their neighborhood and others when requested and authorized; twelve (15%) served in either St. Louis City or St. Louis County but not both; and twenty-five (31%) were prepared to serve anywhere in the metropolitan area. When compared to those prepared to serve area-wide with all of the others pooled, it was found that over two-thirds (69%) of the organizations were prepared to serve only those areas in close physical proximity to their own.

### Organizational Descriptors

The descriptors reported in this section include organizational types, size measures, formalization, and organizational expressions of appreciation to their volunteers. These variables are defined in Chapter 4 (p. 40-45).

Organizational types. The largest category of types among the 80 organizations was social service agencies (N = 23), followed by St. Louis City or St. Louis County disaster offices (N = 11), disaster offices within police departments (N = 9), religious organizations (N = 9), police departments (N = 8), fire departments (N = 8), senior citizen organizations (N = 5), youth groups (N = 4), and neighborhood organizations (N = 3).

The disaster offices, police, and fire departments emphasized services such as warning and evacuation, security and protection of property, transportation, search and rescue, medical services, debris removal, and overall managing of disaster response. The remaining organizational types emphasized the provision of food, clothing, shelter, and emergency counseling. These different emphases supported quantitatively differences noted in field observations, and

also suggested the validity of conceptualizing two primary types of organizations: social services and emergency management.

Adding the disaster offices, together with the police and fire departments, resulted in 37 emergency management organizations. Combining the churches, senior citizen, youth, and neighborhood groups with the social service agencies produced a category of 43 emergency social service organizations. This conceptualization became useful in suggesting a potentially important theme in network relations. That is, organizational type -- social service and emergency management -- related significantly to a number of variables measured in this study. For example, there are significant relationships between organizational type with geographic location and service delivery range.

All but one (97%) of the emergency management organizations were located in the county, while the social service organizations were more evenly split, with twenty (46%) located in the city, seventeen (40%) in the county, and six (14%) located outside the metropolitan area. The relationship between organizational type and location produced a gamma coefficient of .50 ( $p < .001$ ). The relationship is a result of the concentration of emergency management organizations in the county. The reason for only one emergency management organization in the city is that it represents one jurisdiction, while the county is comprised of numerous municipalities, each having some responsibility in state law for emergency management.

Service delivery range was limited to local proximity for thirty-three (89%) of the emergency management organizations, and four (11%) of them were prepared to offer service area-wide. Social service organizations were again about evenly divided, with twenty-two (51%) serving their neighborhood or municipality, and twenty-one (49%) prepared to offer service area-wide. The relationship between organizational type and service delivery range showed a gamma coefficient of  $-.77$  ( $p < .000$ ). This relationship, like the one with location, is a result of emergency management organizations operating primarily with a local orientation. This finding is particularly significant in considering preparedness for an earthquake. It would be advantageous if organizations with resources and capabilities to respond to disasters could be flexible and responsive to the areas of greatest need.

Size measures. There was great variability in sizes among the organizations. For day-to-day operations, the number of paid members ranged from 0 to 450. About 20% of the organizations were completely voluntary, without any paid

members. A little over 60% of the organizations indicated 20 or fewer paid members, with 90% showing fewer than 100. During disaster conditions, the number of paid members ranged from 0 to 5,000. Interestingly, the percentage of completely voluntary organizations increased from the day-to-day operations to about 30% under the disaster response condition. This is accounted for by a number of social service type organizations which have pre-disaster staff but do not activate or deploy staff in response to disaster. Seventy percent (70%) of the organizations indicated 20 or fewer paid members, and about 90% indicated fewer than 100.

The number of trained volunteers also varied widely. For day-to-day operations, the number of volunteers ranged from 0 to 12,000.<sup>1</sup> About 20% did not use volunteers. Sixty-five (65%) indicated 20 or fewer volunteers, and a little over 80% showed fewer than 100 volunteers. During the disaster condition, the number of volunteers ranged from 0 to 5000. About 20% indicated zero volunteers. Almost 70% showed 20 or fewer members, about 90% used fewer than 100 volunteers.

Organizational size, of course, corresponds to the combined total of paid employees and volunteers. For day-to-day operations, size ranged from 0 to 12,061. Twenty (25%) of the organizations had an average of about 5 members; another 20 (25%) maintained an average of a little over 20 members; seventeen (21%) reported an average of slightly over 60 members; thirteen (16%) had about 200 members; and eight (10%) indicated 300 or more members.<sup>2</sup>

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<sup>1</sup> Four organizations listed more than 1,000 volunteers. The largest organization was the Boy Scouts of America which reported 12,000 volunteers. The next largest was the American Red Cross with 8,500. The distribution was adjusted to remove this skewness for subsequent analysis.

<sup>2</sup> Two organizations reported zero paid members and zero volunteers. One of these organizations was a unit within a police department. The director was a full-time police officer who viewed civil defense as an extension of his regular duties. Therefore, no paid staff was assigned to civil defense and there were no volunteers. The second organization, was unable to estimate the number of volunteers because they had no formal procedure for recruiting volunteers or keeping track of them.

Under the disaster condition, size ranged from 0 to 6,000. Thirteen (16%) averaged about 7 members; 20 (25%) reported an average just under 20 members; nineteen (23%) maintained a little over 45 members; twelve (15%) indicated slightly more than 100 members; and eight (10%) showed 250 or more members. A size of zero was found for 8 (10%) of the organizations. The zero was an appropriate response from having been asked about "trained volunteers." If the question had asked for the number of general volunteers, something greater than zero would have been reported.

The organizations revealed considerable stability of their paid employees. Of the 59 organizations with paid employees, 16 (27%) of them showed a zero ratio of paid staff working less than one year to the total number of paid members. Twenty-seven (46%) of the organizations indicated a ratio of 2% to 25% which compares favorably to average turnover statistics (Price, 1977:59-61). Only three (5%) of the organizations produced a ratio of one (100%), indicating all new paid employees within the course of a year.

The volunteer membership also showed relative stability. Of the 60 organizations using volunteers, 17 (28%) revealed a zero ratio of new volunteers trained within the past year to the number of volunteers. Twenty-two (37%) of the organizations had a ratio of 6% to 25%, which was slightly higher than the ratio for paid members. Six (7%) of the sixty organizations had a ratio of one (100%), indicating a complete turnover of trained volunteers.

Formalization. The organizations reported a fairly high level of formalization. As shown in Table 5.1, the overall mean score was 2.7 on a measure that ranged from 1 to 4. These organizations tended to have established task procedures, assign everyone specific jobs, stress using proper channels, maintain written performance records, emphasize strict operating procedures, and designate an authority structure. The emergency management and social service types differed on two out of the six items measuring formalization. Emergency management organizations reported higher levels of established procedures ( $t = -3.10$ ,  $p = .003$ ), and job specifications ( $t = -3.06$ ,  $p = .003$ ). The two kinds of organizations showed approximately equal mean scores on each of the other formalization items.

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**Table 5.1 Mean Scores on Formalization Items for Social Service (SS) and Emergency Management (EM) Organizations**

<u>Formalization Characteristics</u>	<u>Overall Mean</u>	<u>SS Mean</u>	<u>EM Mean</u>	<u>2-Tail Prob.</u>
Overall formalization	2.77	2.63	2.86	.164
Set procedures	2.60	2.28	2.97	.003
Specific jobs	2.75	2.44	3.11	.003
Proper channels	3.25	3.24	3.27	.899
Written evaluations	2.70	2.77	2.62	.629
Strict procedures	2.89	2.70	3.11	.072
Central decisions	2.29	2.42	2.14	.292

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Organizational expression of appreciation for volunteers. There was a moderate level of appreciation for volunteer expressed. As shown in Table 4.2, the overall mean score was about 2.0 on a measure that ranged from 1 to 4. Between one-third and one-half of the organizations provided formal training and certification, issued awards and citations, badges and insignias, or gave parties and banquets. Two or more of these activities were offered by 48 (60%) of the organizations.

There was a significant difference between emergency management and social service organizations in their overall mean scores on appreciation ( $t = 2.09$ ,  $p = .040$ ). Two of the four variables used to construct appreciation accounted for this difference: Issuing awards and citations ( $t = 2.56$ ,  $p = .013$ ), and giving parties and banquets ( $t = 2.49$ ,  $p = .015$ ). In both cases, the positive  $t$  values indicated that social service organizations use these forms of appreciation more often than emergency management organizations. The other two forms -- training/certification, badges/insignia -- were used about the same by both organizational types, although emergency management showed slightly higher mean scores for these two forms of appreciation. These differences may suggest a viable basis for exchange between social service and emergency management organizations.

Table 5.2 Mean Scores on Volunteer Appreciation and Appreciation Related Characteristics for Social Service (SS) and Emergency Management (EM) Organizations

<u>Appreciation Characteristics</u>	<u>Overall Mean</u>	<u>SS Mean</u>	<u>EM Mean</u>	<u>2-Tail Prob.</u>
Overall appreciation	1.95	2.23	1.62	.040
Train and certify	.59	.57	.62	.647
Awards and citation	.69	.81	.53	.010
Badges and insignia	.42	.38	.47	.455
Parties and banquets	.41	.52	.25	.017

Features of Organizational Operators and Preparedness

The variables reported in this section are organizational capacity to respond to different disasters, capacity to provide services, amount of experience in disaster response, and preparedness. These are summative variables described in Chapter 4 (p. 45-48) as reflecting preparedness or an aspect of organizational operations closely related to preparedness.

Capacity to respond to different disasters. Organizational capacity to respond to disasters was moderately strong. As shown in Table 5.3, the overall average score was 4.8 on a nine-point scale indicating capacity to respond to eight different disasters: earthquake, flood, tornado, plane crash, severe heat or cold, blizzard/ice storm, fire/explosion, and hazardous materials accident. The response pattern was consistent across all eight of the disasters. Mean scores for the individual disasters ranged from 4.1 for hazardous materials accident to 5.8 for severe heat or cold. Over one-half of the organizations had a capacity level of "medium" or greater.

The pattern of consistency degenerated when organizational type was considered. Six of the eight variables used to construct the overall measure of capacity showed significant differences between emergency management and social service organizations: earthquake ( $t = -2.03, p = .046$ ), tornado ( $t = -3.37, p = .001$ ), plane crash ( $t = -6.69, p = .000$ ), blizzard/ice storm ( $t = -2.96, p = .004$ ), fire/explosion ( $t = -5.50, p = .000$ ), and toxic materials

**Table 5.3 Mean Scores on Preparedness and Preparedness-Related Characteristics for Social Service (SS) and Emergency Management (EM) Organizations**

<u>Preparedness Characteristics</u>	<u>Overall Mean</u>	<u>SS Mean</u>	<u>EM Mean</u>	<u>2-Tail Prob.</u>
Overall disaster capacity	4.78	3.72	6.00	.001
Earthquake	4.82	3.98	5.27	.050
Flood	5.29	4.56	5.57	.134
Tornado	5.55	4.14	6.30	.001
Plane crash	4.45	2.37	6.39	.001
Severe heat/cold	5.79	5.12	5.95	.187
Blizzard/ice storm	5.07	3.91	5.73	.005
Fire/explosion	5.34	3.51	6.89	.001
Toxic material	4.12	2.19	5.92	.001
Overall service capacity	3.70	2.75	4.88	.001
Food	3.32	3.86	2.70	.084
Clothing	3.06	3.74	2.27	.027
Shelter	4.34	3.70	5.08	.052
Counseling	4.11	4.74	3.36	.040
Information referral	5.95	5.98	5.92	.927
Medical	3.01	1.65	4.59	.001
Transportation	3.70	2.60	4.97	.001
Search/rescue	3.69	1.42	6.32	.001
Protect property	3.18	.63	6.14	.001
Debris removal	2.72	.81	4.95	.001
Overall management	3.99	2.07	6.22	.001
Warn/evacuate	3.80	2.56	6.11	.001
Overall experience	.61	.55	.67	.373
Flood	1.30	1.09	.70	.104
Tornado	.45	.40	.38	.927
Plane crash	.11	.07	.16	.416
Severe heat/cold	1.89	1.09	.97	.671
Blizzard/ice storm	.89	.51	.78	.237
Fire explosion	65.09	.35	1.03	.008
Toxic material	.48	.30	.59	.108
Overall preparedness	.88	.53	1.30	.001
Emergency plan	.48	.28	.70	.001
Plan update	1.01	.53	1.57	.001
Past training	1.28	.79	1.84	.001
Past simulations	1.12	.70	1.62	.001
Future training	1.08	.60	1.62	.001
Future field exercises	.68	.44	.95	.003
Know about IEMS	.55	.28	.78	.001

( $t = -6.30$ ,  $p = .000$ ). The negative  $t$  scores indicate a greater capacity for emergency management organizations than social service organizations to deal with these types of disaster. Capacity was about the same for floods and severe heat or cold.

Capacity to deliver particular services. In contrast to the ratings of capacity to respond to disaster, the capacity to deliver particular services was low. The overall average score was 3.7 on a nine-point scale that indicated capacity to deliver twelve services: food, clothing, shelter, emergency counseling, information and referral, medical services, transportation, search and rescue, security and protection of property, debris removal, managing overall disaster response, warning and evacuation.

There was considerable variation across the different services, ranging from 2.7 for debris removal to 6.0 for information and referral. There were, again, significant relationships with organizational type. A  $t$ -test of mean score differences between emergency management and social service organizations in the overall capacity to deliver services produced a negative and significant  $t$  ( $-5.67$  ( $p = .000$ )). This indicated a greater overall capacity for emergency management to deliver services than for social services to deliver services in response to disaster.

Ten out of the twelve variables used to construct capacity to deliver services revealed significant differences in the mean scores between social service and emergency management organizations. Two of these ten were positive, indicating greater capacity for the social service organizations. The rest were negative and consistent with the overall assessment. The positive  $t$  values were found with clothing ( $t = 2.31$ ,  $p = .023$ ), and counseling ( $t = 2.11$ ,  $p = .038$ ). The negative  $t$  values were found with shelter ( $t = -2.00$ ,  $p = .049$ ), medical ( $t = -4.41$ ,  $p = .000$ ), transportation ( $t = -3.89$ ,  $p = .000$ ), search and rescue ( $t = -9.48$ ,  $p = .000$ ), protect property ( $t = -10.14$ ,  $p = .000$ ), remove debris ( $t = -9.33$ ,  $p = .000$ ), manage overall disaster ( $t = -7.94$ ,  $p = .000$ ), and warning/evacuation ( $t = -7.59$ ,  $p = .000$ ). Results of these analyses provide a point of departure for appreciation of different task orientations contained in preparedness and disaster response networks.

Disaster experience. The number of times these organizations had actually responded to a disaster situation varied widely and unevenly across different types of



disasters. The 80 organizations reported a total of 5,593 actual responses to disasters during the past three years. Most of these actual responses, however, were by five organizations which together responded to 5,066 fires and explosions. Still, that left 527 disasters responded to by 80 organizations for an average of 6.6 or a little over 2 disasters per organization per year. The annual average increased to 2.6 if the twelve organizations which had not responded to any disaster were removed from the calculations.

An average measure of disaster experience was constructed by taking the average number of times each organization had responded to each of seven different disasters. The range was from 0 to 2.2, with a mean of .61. Twelve (15%) of the organizations scored zero; fifty-one (64%) scored less than 1, indicating less than 2 responses a year; seventeen (21%) scored over one. It appears that most of the actual experience in disaster response has been concentrated within only a few organizations.

Preparedness. In general, the level of preparedness was low. As shown in Table 5.3, an average of .88 on a summative scale that ranged from 0 to 2.3 was produced. The scale was constructed with seven variables: Number of disaster preparedness training sessions, simulated disaster exercises, disaster response training sessions, field exercises, familiarity with IEMS, existence of a specific emergency response plan, and updatedness of disaster plan. Fifty-three (66%) of the organizations scored below the mid-point of the scale (1.14).

A large and significant difference was found between the mean scores on preparedness for emergency management and social service organizations ( $t = -5.98$ ,  $p = .000$ ). All seven variables used to construct preparedness showed significant mean score differences between emergency management and social service organizations: Past training ( $t = -4.92$ ,  $p = .000$ ), past simulation ( $t = -3.84$ ,  $p = .000$ ), training next year ( $t = -4.82$ ,  $p = .000$ ), field exercises next year ( $t = -3.05$ ,  $p = .003$ ), familiarity with IEMS ( $t = -4.28$ ,  $p = .000$ ), having an emergency plan ( $t = -4.12$ ,  $p = .000$ ), and updating of plan ( $t = -4.16$ ,  $p = .000$ ).

Emergency management organizations had larger mean scores than social service organizations on each of the seven variables. In every aspect of this preparedness definition, emergency management organizations were better prepared than social service organizations. Again, this would appear to provide a viable basis for interorganizational relations

between these two types of organizations. Relations which increase the preparedness of particular organizations generally strengthen the overall preparedness networks.

### Summary of Emergency Social Service Organizations

There are 80 emergency service organizations in the St. Louis disaster preparedness network. About two-thirds of these are located in the county and one-third in the city. The organizations are concentrated in the near-north side of the city, and the north-east and east-central parts of the county, but a little over two-thirds of the zip-code areas have at least one emergency service organization. Over two-thirds of the organizations provide service only within their immediate vicinity.

Two major organizational types -- emergency management and social service -- were identified. Almost all of the emergency management organizations restrict service to their municipalities; about half of the social service organizations restrict service to the local neighborhood or municipality while the other half serve area-wide. There is wide variation in organizational size, but most of the organizations are small; over 70% operate with 60 or fewer paid staff and volunteers. These organizations tend to stress formalized procedures. Moderate levels of appreciation are expressed toward volunteers, and social service organizations do more for their volunteers than emergency management.

Overall capacity to respond to different disasters was rated high, but, except for floods and severe heat/cold, emergency management organizations show greater capacity to respond to disaster. Capacity to deliver service was rated low. Again, except for counseling and clothing, emergency management organizations show a greater capacity to deliver service in response to disaster.

There is wide variation in actual experience with disasters. Most of the experience is accounted for by five organizations. Excluding the five with extensive experience, there is an annual average of a little over two actual responses to disasters. Overall preparedness is low. Emergency management organizations are better prepared than social service organizations.

The differences between emergency management and social service organizations suggests possible points of exchange in building a stronger preparedness network. Two features of

social service organizations in particular could benefit emergency management: Adopting an area-wide orientation to service delivery could increase flexibility and responsiveness; increasing expressions of appreciation to volunteers could attract more volunteers to emergency service work. Three aspects of emergency management could benefit social service organizations: Offering service in response to the full variety of disaster types would increase service capacity; more frequent response to disaster events would add experience; and better preparedness efforts could increase the effectiveness of service delivery.

### Communication Organizations

It became clear early in the study that the communications network was sufficiently distinct from the social services network to require a different definition of the population and different data collection instruments and procedures. The social service network could be thought of as a partially interacting set of organizations, delivering or receiving a variety of services within a delimited geographical area. Social service organizations are also people-intensive; those with more members can serve a large number of clients or offer a wider range of services. It makes less sense to think of the communication network in these ways.

The communication network is more uniform in process -- it sends and receives information. The communication network is technologically intensive, and it is not as bounded by a geographical region. Bouncing beams off of a satellite to send or receive information from Colorado may be as easy as calling a neighbor next door. In brief, the communications network is bound more by its technology, than by its geographical location.

The research strategy has been, insofar as possible, to identify and collect data from the entire population of significant communication organizations. Because technological capability and specialized skills are necessary for communications capability, the population of key communication organizations is smaller than the population of social services organizations.

A total of 37 communication organizations were identified as possible members of the network. This list included city and county disaster offices; city and county police, fire, water, and street departments; three separate offices of the Red Cross (disaster operations, social services, and public

relations); the Salvation Army; volunteer radio groups, both CB and ham; the U.S. Weather Bureau; major commercial radio and television stations; major metropolitan newspapers; Southwestern Bell Telephone; medical emergency radio systems; Union Electric (the major electrical utility company); the State Emergency Management Agency; resources at Scott Air Force Base in Illinois; the U.S. Army Corps of Engineers; the U.S. Coast Guard; Purolator Curier; and Bi-State Transit Co. (which operates the St. Louis area bus system). For various reasons, each of these organizations was considered to be a key member of the communications population.

As the study progressed, our definition of the population changed somewhat. These changes occurred for both practical and substantive reasons. On the practical side, several major radio and television stations and one of the metropolitan newspapers were eventually dropped from the study because they failed to respond. After numerous attempts to collect data, only one newspaper company, one radio/television station, and one television station responded. Fortunately, the radio/television station which responded is the main Emergency Broadcast System (EBS) station for this area. Because the communications role of the commercial media is limited to warning and informing the general public (which, although important, is probably the least problematic function in disaster communications), and because of a clear picture of how this function occurred, it was felt that the remaining unresponsive radio, television, and print media could be dropped without undermining the study's results and conclusions.

The U.S. Weather Bureau was not included in the final population because communications from this organization were handled by the National Weather Service Volunteers, an organization which was included in the study. One commercial firm and one utility did not respond. Every other organization on the original list was retained in the study population. In addition, because they were thought to be important, the following organizations were added: a taxi cab company (which was included in St. Louis City's official disaster plan), a utility company, The Missouri Highway Patrol; and Army, Navy, and Air Force Military Affiliated Radio Systems (MARS), which are comprised of civilian volunteers attached to the military. A total of 34 communications organizations completed both the written questionnaire and the oral interview.

There was some turnover in the communications population, but the population was relatively stable. The technological basis for communications may account for this stability. Communications is a function which requires considerable

financial expenditure and a high level of technical expertise. This financial and personal investment may contribute to organizational stability for communications organizations, and also to greater stability of individual involvement. In short, it is simply not feasible for organizations and individuals to "come and go" in communications.

Location. Communications are not constrained by geographical limits as much as social services. Communications capability is available on a similar basis virtually throughout the area. On-site resources tend to be highly mobile and, except in the case of CB radios, range of information flow is generally not a constraint. During a disaster, systems are patched together as needed to create a communications net which is not greatly hindered by geographical or political boundaries. Therefore, the geographical distribution of communications organizations is not relevant to our purposes in this portion of the study.

It still may be important to know that six of the 34 organizations have headquarters outside of the metropolitan area. These are the State Emergency Management Agency, the State Highway Patrol, the State Bureau of Emergency Medical Services, and the three MARS organizations. Especially in the case of the MARS organizations, which are composed largely of volunteers, it is safe to say that not all of their equipment and personnel would be available to the St. Louis area. In a region-wide disaster, it has been estimated that perhaps one-fourth of these external resources would be available to the St. Louis area.

### Organizational Descriptors

The descriptive variables reported in this section include organizational types, funding base, size and stability measures, formalization, type of communication equipment, communication functions, recruitment and expression of appreciation for volunteers. These variables are defined in Chapter 4 (p. 40-45).

Organizational types. Of the 34 organizations in the population, allowing for multiple identifications, nine organizations classified themselves as communication monitoring units. The breakdown of these were: six as amateur radio groups, six as telecommunications organizations, five as military organizations, five as transportation organizations, four as social service agencies, four as utility companies, three as police departments, three as disaster offices, two as citizen band radio groups, two as fire departments, one as a

weather organization, one as a commercial radio station, one as a newspaper, one as a television station, and one as a medical organization.

When we assigned only one "type" to each organization and collapsed these types into two general categories based on prominence in disaster communications, we could identify primary disaster communications organizations (N=18, 53%), consisting of amateur radio, citizen band radio, police, fire, disaster offices, and the military; and secondary disaster communications organizations (N=16, 47%), consisting of commercial radio, television, newspaper, telecommunications, social services, medical, utility, and transportation organizations (See Table 5.4). These two basic types made

Table 5.4 Types of Disaster Communications Organizations

<u>Types</u>	<u>Multiple Frequency<sup>1</sup></u>	<u>Single Frequency</u>	<u>Types Collapsed</u>	<u>Frequency</u>
Amateur Radio	6	2	Primary	18
Military	5	5		
Disaster Office	3	4		
Police	3	3		
Fire	2	2		
Citizen Band	2	2		
Weather	1	0		
Monitoring Unit	9	0	Secondary	16
Telecommunications	6	1		
Transportation	5	3		
Utility	4	3		
Social Service	4	4		
Commercial Radio	1	1		
Newspaper	1	1		
Television	1	1		
Medical	1	2		

<sup>1</sup> "Multiple frequency" refers to a listing of types by organizations when they were asked to check which one or more types were applicable. "Single frequency" refers to a single best description of type assigned by researchers to each organization.

sense conceptually and fit impressions from the field, but the categories were extremely rough. Because the N was small, however, it was not feasible for quantitative purposes to construct more than two basic types.

Among the 34 organizations, 19 (56%) identified communications as the primary purpose of the organization and 15 (44%) identified communications as important but not the primary purpose. This identification does not, nor was it expected to, correlate with the type classification described above. For example, communications is the primary purpose of a newspaper company, but newspaper companies play a secondary role in disaster communications.

Funding. Regarding funding base, 9 (26%) of the organizations identified themselves as self-supporting, 14 (41%) as government supported, 8 (24%) as non-government supported, and 3 (9%) as both government and non-government supported. Thus it is possible to create a variable which divides organizations into all or some public support (N=17, 50%), and no public support at all (N=17, 50%).

Size, volunteerism, and stability. The number of paid staff during day-to-day operations ranged from 0 to 137 (mean=19), with 8 (24%) of the organizations having no paid staff. Twenty-six (76%) of the organizations had 15 or fewer paid staff. During disaster conditions, the number of paid staff ranged from 0 to 1,000 (mean=47), with 7 (21%) of the organizations having no paid staff. Twenty-five (74%) of the organizations estimated 15 or fewer paid staff during disaster conditions. Virtually all of the difference in the pre and post-disaster mean is accounted for by a single telecommunications organization which indicated 100 paid employees pre-disaster, but 1,000 paid employees post-disaster. Thus, in terms of paid staff, most communications organizations can be characterized as small and about the same in both pre and post-disaster conditions.

Turning to voluntary staff, during day-to-day operations, the number of volunteers ranged from 0 to 1,000 (mean=56), with 21 (62%) of the organizations reporting no volunteers. The general picture here is that most organizations did not use volunteers, while some used large numbers. During disaster conditions, the number of "trained volunteers" (the question explicitly mentioned training in the post-disaster condition but not in the pre-disaster condition) ranged from 0 to 2,000 (mean=105), with 15 (44%) reporting no volunteers. However, when asked how many of the trained volunteers were associated with the focal organization, the responses ranged

from 0 to 600 (mean=54), with 19 (56%) reporting no volunteers. (The rationale for asking this question on association was that some volunteers, especially amateur radio operators, might be identified by more than one organization and, insofar as possible, an attempt was made to avoid double counting.) Taking this latter measure of post-disaster volunteers, there again was not much difference between pre and post-disaster conditions.

Total organizational size (paid staff plus volunteers) was an average of 75 during pre-disaster conditions, and 102 during post-disaster conditions. In both pre and post-disaster conditions, 10 (29%) of the organizations had 50 or more members. Fourteen (41%) of the organizations increased in size during disaster response, 12 (35%) remained the same size, and 8 (24%) became smaller.

Looking at proportions of paid staff to total staff, the pre-disaster proportion ranged from .00 to 1.00 (mean=.63), with 5 organizations at .00, 18 at 1.00, and 3 not computable (cannot divide by zero). Thus, 18 of the 34 organizations were composed entirely of paid staff, which is the most striking feature of this variable. In post-disaster conditions, the proportion ranged from .00 to 1.00 (mean=.63), with 5 organizations at .00, 17 at 1.00, and 2 not computable. Thus, the post-disaster condition is almost identical with the pre-disaster condition.

Regarding stability of employees, the proportion of paid staff who had been with the organization less than one year ranged from .00 to .50 (mean=.07), with 18 organizations at .00 and 8 non-computable. Hence, the picture is one of striking stability. Turning to stability of volunteers, the proportion of volunteer staff who had been with the agency less than one year ranged from .00 to 1.00 (mean=.16), with 5 organizations at .00 and 21 non-computable. Hence, the picture is again one of stability, although volunteers were perhaps not quite as stable as paid staff.

Formalization. The communications organizations reported an even higher degree of formalization than the social services organizations. The overall mean was 3.1 on a measure that ranged from 1 to 4. Means of the five structural formalization measures varied considerably. The mean score for "central decisions" was 2.4; the mean score for "written evaluations" was 2.8; the mean score for both "specific job" and "strict procedures" was 3.3; and the mean score for "proper channels" was 3.5.



Communications equipment. Technology is a necessary and critical component of effective disaster communications. In various forms, two-way radios were listed by 31 (91%) of the 34 organizations when they were asked about type of equipment used. The next most common listing was landline telephones, which was listed by 17 (50%) of the organizations. Nine organizations (26%) listed two-way landline computers. Seven (21%) listed one-way landline computers (teletype machines), and six (18%) listed one-way radios (these were generally "beepers"). Thus, radios, telephones, and computers, both landline and radio wave, are the major technical components of disaster communications. When this same question was repeated in specific reference to a disaster situation, a nearly identical pattern emerged.

When asked how they would suggest improving disaster communications equipment "within feasible limits," 12 (35%) of the respondents listed more portable/more mobile equipment; 8 (24%) listed more and better equipment; and 6 (18%) listed improved compatibility among systems and sharing of resources. When asked the same question without regard to feasibility, 7 (21%) listed a two-way satellite hookup for all personnel. Several respondents indicated the need for computer capability that is not tied to landlines.

When asked about an emergency power source, 31 (91%) of the 34 organizations reported that they had an emergency power source. Of these, 20 (59%) said that the emergency power source was sufficient to maintain full scale operations; and an additional 8 (24%) said that they could maintain basic communications.

When asked if a structural analysis of the communications center had been undertaken to determine earthquake vulnerability, 22 (65%) of the organizations reported that no structural analysis had occurred, 2 (6%) reported a partial analysis, and 5 (15%) reported a full analysis. Thus, much of the existing communications technology may be vulnerable to a major earthquake disaster. But opinions on the degree of vulnerability differ considerably, and are highly colored by political considerations. Therefore, it is difficult to predict exactly what the communications capability of a particular organization would be following a major earthquake disaster. In the event that communications towers and landlines are disrupted, communications capability could be reduced substantially for many organizations. For example, at one point the director of the State Emergency Management Agency said: "The communications net is weak. At the state level, we depend almost entirely on the telephone." Although not intended as alarmist, this was an almost shocking statement of communications vulnerability.

Very little communications equipment was lent or borrowed. Thirty organizations (88%) said they did not borrow equipment, and 27 (79%) said they did not lend equipment. Among the few who do borrow or lend equipment, the strongest message was that there are no major problems associated with borrowing or lending.

Coordination of communication. As an extreme expression of the important role of communications technology, the following statement was heard from one official: "It's all in the communications equipment. With good equipment, you can do the job. Without good equipment, good personnel cannot do anything." While good equipment is absolutely necessary, but effective social organization of the communications function is equally as necessary. For example, in a full scale disaster exercise, communications difficulties were witnessed and, during the debriefing, communication was defined as the biggest problem area. However, none of the communication problems observed were related to the equipment, but rather to communications procedures and coordination among different communications systems which were technologically, but not socially, compatible.

Communications functions. Based on experience in the field, a much more complex perspective was developed on the communications population than was held at the beginning of the project. The communications population came to be viewed as consisting of a number of subpopulations, perhaps forming subnetworks, and perhaps loosely coupled into the larger communications network. These subpopulations were based on distinct communications functions. At the outset, six basic functions were identified: (1) notifying and warning the public, (2) communicating damage assessments, (3) initiating and coordinating disaster response at the local site, (4) coordinating disaster response between the local site and regional or national agencies, (5) communicating on a one-to-one basis with relatives and other concerned individuals, and (6) communicating with the general public regarding disaster response activities.

An attempt was made to construct a questionnaire which would capture these perceived functional differences, but it did not succeed very well. It is possible that qualitative impressions were incorrect, but it is more likely that the instrumentation was not refined enough to pick up the functional differences.

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**Table 5.5. Disaster Communication Functions**

<u>Communications Function</u>	<u>Mean Score</u> <sup>1</sup>	<u>Standard Deviation</u>	<u>Number (Percent) Involved</u> <sup>2</sup>
Coordinating Regional and Nat'l Communication	6.24	3.42	28 (82%)
Coordinating Local Communication	6.12	3.48	29 (85%)
Communicating Damage Assessment	5.58	3.84	25 (74%)
Warning the Public	5.33	3.98	24 (71%)
Communicating with General Public	5.18	3.49	27 (79%)
Communicating with Family Members (One-to-One)	3.91	3.32	25 (74%)
OVERALL <sup>3</sup>	5.38	2.17	33 (97%)

1 Involvement is measured on a ten-point scale, where zero equals "not involved at all," and nine equals "fully involved."

2 Organizations which marked a one or greater on the ten point involvement scale.

3 The overall mean rating and the total number of organizations involved

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On a ten-point scale (0 to 9) each organization was asked if they participated in various disaster communications functions. This information is reported in Table 5.5. As the

data suggest, each organization is likely to report involvement in several of the functions, with average involvement in all functions at 5.38.

Recruitment and expressions of appreciation for volunteers. Because of the study's focus on organized volunteers, a set of questions addressed volunteer recruitment, and another set of questions on what the organization does to express appreciation to volunteers. Regarding recruitment, 5 (15%) of the 34 organizations used mailings, 8 (24%) used the mass media, 10 (29%) recruited through other organizations, and 14 (41%) recruited through other volunteers. Fourteen (41%) of the organizations recruited through two or more methods.

For expressions of appreciation, 15 (44%) of the 34 organizations provided training to volunteers, 16 (47%) provided awards and citations, 10 (29%) provided badges and insignia, and 9 (26%) provided parties, picnics, or banquets. Sixteen (47%) of the organizations used two or more methods of expressing appreciation to volunteers.

#### Preparedness and Preparedness Related Characteristics

The preparedness and preparedness-related characteristics include organizational capacity to respond to different disasters, training, awareness of "Integrated Emergency Management System" (IEMS), planning, and preparedness. These variables are defined in Chapter 4 (p. 45-48).

Capacity to respond to different disasters. Questions were asked about potential involvement in various types of disasters on a six point scale ranging from 0 to 5; the overall mean was 3.84 (standard deviation .98). Information on specific types of disasters is reported in Table 5.6. Overall, involvement was moderate to high, but involvement differed noticeably by type of disaster, ranging from a mean of 4.4 for earthquakes to a mean of 2.7 for civil disturbances. Perhaps most noteworthy was the high rating for potential earthquake involvement, even though the region has not had a major earthquake since the 1890s and one of the original assumptions of the study was that the region was not "tuned in" to the possibility of a major earthquake.

Table 5.6 Potential and Actual Involvement in Disaster Communications by Type of Disaster

<u>Disaster Type</u>	<u>Potential Involvement</u> <sup>1</sup>		<u>Actual Involvement</u> <sup>2</sup>	
	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>
Earthquake	4.40	1.24	.06	.24
Tornado	4.23	1.28	1.00	2.34
Flood	4.14	1.37	.71	.91
Blizzard	3.74	1.67	.47	.90
Severe Heat/Cold	3.57	1.74	1.15	2.12
Plane Crash	3.46	1.99	.15	.44
Fire/Explosion	3.46	1.76	24.15	91.52
Toxic Material	3.11	1.91	2.03	5.54
Civil Disturbance	2.69	1.81	.03	.17
OVERALL <sup>3</sup>	3.84	.98	31.12	97.90

<sup>1</sup> Potential involvement is measured on a six-point scale, where zero equals "never involved," and five equals "fully involved."

<sup>2</sup> Actual involvement is the number of times organizations actually assisted in disaster communications during the past year.

<sup>3</sup> For potential involvement, the overall mean rating on the six point scale; for actual involvement, the mean total for all types of disaster.

When asked about actual experience in various types of disasters, the picture was markedly different. The question asked how many times the organization actually assisted with emergency communications in various types of disasters during

the past year. The mean total was 31.12 (standard deviation = 97.90). Information on specific types of disasters is reported in Table 5.6.

Most striking about these data is the fact that fires accounted for the vast majority of recent disaster experiences, and that only a few organizations accounted for most of the experiences with fires. Specifically, fires accounted for 821 (81%) of a grand total 1,011 disaster assistance experiences, and three organizations accounted for 790 (96%) of the 821 fire assistance experiences.

Twenty of the 34 organizations assisted with no fires at all during the preceding year, 18 assisted with no floods, 21 assisted with no severe heat or cold emergencies, 22 assisted with no toxic material spills, 24 assisted with no tornadoes, 24 assisted with no blizzards, 30 assisted with no plane crashes, 32 assisted with no earthquakes, and 33 assisted with no civil disturbances. In sum, there are a rather large number of organizations with limited disaster communications experience.

Training. Three questions addressed disaster training sessions and simulations. The mean number of training session during the preceding year was 7.23, with a standard deviation of 12.47. As the large standard deviation indicates, participation was not evenly distributed. Seven of the 34 organizations accounted for 184 (75%) of a total 246 training session experiences, while nine organizations had none.

The mean number of simulated disaster communication experiences during the preceding year was 16.27 with a standard deviation of 53.50. Again, participation was not evenly distributed. Five of the 34 organizations accounted for 507 (92%) of a total 553 simulation experiences, while seven organizations had none.

Looking toward the future, the mean number of anticipated disaster response communication training session for the coming year was 17.23, with a standard deviation of 47.75. The same uneven pattern appears as for past training sessions. Seven of the 34 organizations accounted for 532 (90%) of the total 589 coming training sessions, while nine organizations anticipated none.

It is noteworthy that the number of anticipated training sessions is higher than the number of past training sessions. However, when a measure of anticipated training improvement was constructed (anticipated training divided by past training), 11 organizations had a ratio of less than one, while only 7 had a ratio of greater than one. Hence, the

greater number of anticipated training sessions is accounted for by only a small number of the organizations, and 11 of 34 (32 percent) of the organizations actually anticipated less training during the coming year than during the preceding year.

Integrated emergency management system. Twenty of the 34 communications organizations reported that they were familiar with the term "integrated emergency management system" (IEMS). However, when asked in an interview how the IEMS concept applied to their work, only 12 gave an answer that could be interpreted as a correct reflection of the IEMS concept, and only 6 of these 12 answers were actually "on target." Therefore, it seems to be the case that emergency communications organizations sometimes say they know about IEMS even though they may not be very familiar with this idea.

Planning. Communication organizations are involved in planning; 28 (82%) of the 34 organizations reported that they had a specific emergency response plan to deal with the disaster scenario we presented. Among organizations which said they had such a plan, the mean number of months since the plan had been updated was 10.6, with a standard deviation of 14.53. Eleven (32%) of the organizations reported that the plan was updated within the last month or was continuously updated. When asked about adequacy of planning and coordination for disaster communications, 15 (44%) of the organizations said that planning was much less or somewhat less than adequate, while 19 (56%) of the organizations said that planning was adequate or more than adequate.

When asked in the interview how disaster planning might be improved, 13 (38%) said there should be a central coordination unit, 8 (24%) said there should be more exercises and simulations, and 7 (21%) said there should be regular meetings between emergency communications agencies.

Preparedness. A preparedness measure was constructed as an average of five other variables: the existence of a disaster plan, time since the plan was updated, training during the past year, disaster simulations during the past year, and anticipated training during the coming year. The preparedness measure ranges in value from 0 to 2.00, the mean value is 1.11, and the distribution is very near normal.

## Summary of Communications Organization

The communication network was represented with 34 organizations. The technical expertise and cost of equipment help to promote a relatively stable network. Two basic types of communication organizations were identified: (1) primary, where disaster communications is a top priority, and (2) secondary, where disaster communications is important but not the top priority. About half of the organizations were government supported, with the other half self-supporting or non-government supported.

Most communications organizations were small, and changed very little between pre and post-disaster conditions. They tended to have formalized structures; job specification, strict operating procedures, and use of proper channels are particularly stressed. The organizations made efforts to recruit volunteers and express appreciation for their contributions. While attention was given to earthquake preparedness, most experience had been with fires. Experience with different disasters was limited.

Almost all communications organizations used two-way radios, and many used telephones, landline computers, and radio wave computers. Some see reliance on landlines as a problem. While communication technology may be vulnerable to a major earthquake, most of the organizations participated in the various communication functions, which suggests flexibility and adaptiveness. There is clear awareness of the IEMS by about one-third of the communication organizations, and receptiveness to the idea by all of them. There was considerable planning and preparedness, but it was not evenly distributed.



## CHAPTER 6

### RESULTS: NETWORKS OF ORGANIZED VOLUNTEERS IN DISASTERS

This chapter describes networks of organizations concerned with emergency preparedness in the St. Louis metropolitan area. The networks are described with four separate interorganizational dimensions under two different environmental conditions: normal day-to-day operations, and disaster response. Results from different types of network analyses are presented along with their implications for knowledge development and use. The range of analysis was so extensive that only basic, sometimes only illustrative, results are reported. There is great potential for future analyses. The first part of the chapter is devoted to social service networks, and the second part deals with communication networks.

#### Social Service Networks

##### Interorganizational Variables

Four variables measuring interorganizational relations were used to describe the emergency preparedness networks: (1) number of linkages established with other organizations, (2) frequency of contacts with each organization, (3) amount of services exchanged, and (4) formalization of agreements between the organizations. Measures on each of these variables were elicited for both day-to-day operations and disaster response. This provided eight measures of interorganizational relations to use in assessing network patterns. Table 6.1 presents the mean and standard deviation scores for the interorganizational variables.

**Table 6.1 Mean and Standard Deviation Scores for Pre and Post-Disaster Measures of Interorganizational Relations**

	<u>Pre-Disaster</u>		<u>Post-Disaster</u>	
	Mean	S D	Mean	S D
Number of Linkages (range=0-5)	3.6	1.5	3.5	1.3
Frequency of Contacts <sup>1</sup> (range=1-4)	2.8	0.9	2.1	1.0
Resources Exchanged (range=0-6)	2.5	1.2	2.6	1.2
Formalization of Agreement (range=1-5)	3.1	1.2	3.0	1.2

<sup>1</sup> Different metrics used in pre-disaster and post-disaster conditions. Pre-disaster frequencies = daily, weekly, monthly, fewer than one per month. Post-disaster frequencies = continual contact, hourly, daily, fewer than one per day.

The mean scores in Table 6.1, as aggregate measures of interorganizational relations, give an overall description of the emergency preparedness network. There was an average of between three and four linkages established for each organization in the network. The frequency of contact between organizations in the network was about once a week during pre-disaster operations, and jumped to more than once a day during post-disaster conditions. An average of between two and three different kinds of services were exchanged among the organizations in the network. Interorganizational agreements tended to be verbal rather than written.

The number of organizational linkages was slightly fewer in the post-disaster condition than in the pre-disaster condition. Although the similar number of linkages in the two conditions is partly a result of using reduced listings of one to five organizations, the original listings of one to ten organizations also revealed similar mean scores: pre-disaster = 4.6, and post-disaster = 4.0.

There was more intense frequency of contact in the post-disaster condition than during day-to-day operations. The similar numerical values for the two conditions in Table 6.1 is misleading because a different metric was used in eliciting the frequency of contacts in the pre-disaster and post-disaster conditions. It was recognized that the pre-disaster and post-disaster conditions demanded different levels of intensity. The intensity levels set for day-to-day operations -- daily, weekly, monthly, fewer than one per month -- were thought to be too low to reflect the frequency of contacts under conditions of disaster response. Under the disaster response condition, frequency levels were set to range from fewer than one per day to continual contact. The data, as shown in Table 6.1, support the use of different intensity levels on the pre-disaster and post-disaster conditions. Frequency of contacts under day-to-day conditions was distributed approximately normally with a mean of 2.8 and a standard deviation of less than one. Frequency of contacts under the disaster condition was also approximately normal with a mean of 2.1 and a standard deviation of one. The average pre-disaster contact was about once a week, while the post-disaster contact was a little more than daily.

The amount of services exchanged was slightly higher in the post-disaster condition than in the pre-disaster condition, but the difference was not statistically significant. It is interesting that the difference is no greater than it was between the two conditions. Possibly the kinds of services delivered and received changed between pre-disaster and post-disaster conditions, while the overall rate of exchange remained about the same. Since our measure was a composite of six different kinds of services -- personnel, equipment and supplies, buildings or land, financial, information and referral, and training -- it obscured any differences in the kinds of services delivered and received. The mean scores of 2.5 and 2.6 indicate that these organizations delivered or received between two and three of the services in their exchanges with other organizations.

The formality of agreements between the organizations was essentially the same in the pre-disaster and post-disaster conditions. This finding makes common sense. There is no

reason expect that the occurrence of a disaster would alter the nature of interorganizational agreements. Organizations establish agreements with other organizations to reduce uncertainty in their environment. Having clear-cut agreements may be more important in disaster preparedness networks than in other kinds.

The mean scores of 3.1 and 3.0 indicate that the average interorganizational agreement involves explicit verbal agreements. The preparedness networks overall, therefore, reflect more than casual verbal agreements but they have not yet evolved to a point of establishing written formal agreements. Written agreements force greater clarity than verbal agreements, and they promote interorganizational stability when personnel are changing or unable to assume normal duties as can be expected in disaster response efforts. Formal written agreements may be particularly valuable in handling the mass assault. In voluntary organizations, the influx of personnel and expansion of organizational boundaries creates confusion as to the duties and jurisdiction of the organization in relation to others.

Networks have been described typically with reference to a single dimension, most often the number of linkages between nodes. The use of four separate interorganizational variables and two environmental conditions provided greater precision in describing the emergency preparedness networks. Networks are complicated arrangements of nodes which evolve along numerous dimensions, and which function differently under different environmental conditions. Each of the four core dimensions used to measure interorganizational relations showed different aspects of the emergency preparedness network. The distinctiveness of these dimensions is demonstrated in Table 6.2, which presents the correlation matrix for the interorganizational variables.

Nine (32%) of the twenty-eight correlations in Table 6.2 are statistically significant at the .05 level or less. Three of the nine statistically significant correlations are between pre-disaster and post-disaster measures of the same variable. That is, except for frequency of contact, each of the other interorganizational variables showed a statistically significant correlation across the pre-disaster and post-disaster conditions.<sup>1</sup> It is possible that the pre-disaster/post-disaster frequency of contact measures failed to correlate because of the use of different matrices for these two measures. Substantively, it is possible that the more intense frequency of contact in disaster response is concentrated among a small set of organizations.

**Table 6.2 Correlation Matrix of Pre and Post-Disaster Interorganizational Variables**

	<u>Pre-Disaster</u>				<u>Post-Disaster</u>		
P Linkages							
R Exchanges	-.12						
E Agreements	.06	.34*					
Frequencies	.28*	-.08	.32*				
-----							
P Linkages	.22*	.16	.26*	.26*			
O Exchanges	-.05	.57*	.10	-.14	.12		
S Agreements	-.24*	.19	.62*	.10	.07	.17	
T Frequencies	-.16	-.02	-.06	.09	-.00	.03	.02

\* p < .05

In addition to the correlations between pre and post-disaster measures of the same variables, there are three additional significant correlations between different variables across the pre/post disaster condition. First, the pre-disaster measure of contact frequency correlated at  $r = .26$  with the number of linkages established in the post-disaster condition. Organizations with more intense levels of pre-disaster contacts were connected to the larger number of organizations during disaster response. More frequent contact may serve an integration function by increasing the probability that relevant connections will be known. Second, the pre-disaster measure of formalization correlated at  $r = .26$  with the number of post-disaster linkages. Organizations with more formalized agreements were connected to a large number of organizations during disaster response.

<sup>1</sup> The pattern of correlations in Table 6.2 suggests construct validity for the four dimensions of interorganizational relations. This was confirmed with a principal components factor analysis using varimax rotation of the eight interorganizational variables. A four factor solution -- linkages, frequencies, exchanges, and agreements -- was produced. The distinctiveness of these four interorganizational variables established a basis for complex network descriptions.

Organizations with more formalized agreements probably represented those central to the network. Third, interestingly, the number of pre-disaster linkages correlated  $r = -.24$  with the post-disaster measure of formalization. Organizations with more day-to-day connections were less likely to have formalized relations during disaster response.

It may be that some of the pre-disaster linkages do not carry over into post-disaster response, and that the post-disaster network is smaller and more intense. The large number of significant correlations between pre and post-disaster measures show support for Drabek et al.'s (1981) generalization that disaster response networks are partly a function of pre-disaster linkage patterns.

The final three significant correlations reflected relationships between pre-disaster measures. First, the number of pre-disaster linkages established correlated at  $r = .28$  with frequency of contacts. Organizations with more linkages in their day-to-day operations had a larger number of contacts as well. This suggests that the network is implemented or influenced by certain subsets of organizations, rather than all participating equally. Second, the pre-disaster frequency of contacts associated  $r = .32$  with the nature of agreements. Organizations with higher frequency of contacts during day-to-day operations had more formal interorganizational agreements. High levels of contact may help to clarify interorganizational roles and thus promote a greater explication of agreements. Third, pre-disaster agreements were correlated  $r = .34$  with pre-disaster exchanges. Organizations with more formal interorganizational agreements had a larger number of services delivered or received. Formalized agreements may clarify what is to be exchanged and how such exchanges will work.

It is interesting to note that none of the variables in the post-disaster condition correlated significantly. Perhaps this is because interorganizational processes are dynamic and interactive with each other over a considerable period of time. Networks take years to develop under normal conditions. During a disaster, particularly the first 24 to 48 hours, there is little time for these developmental processes to occur. This may be why the post-disaster measures are more related to the pre-measures than they are to each other. With the disruption of normal day-to-day lines of communication and interaction during a disaster, the interorganizational activity that takes place is more a product of pre-disaster linkages, than it is a product of dynamic interaction between post-disaster forms of interaction.

## Network Descriptors

Descriptions of the network were sharpened through correlation analyses. Measures on fifteen aspects of organizational structure and processes were constructed. Five of these variables were features of organizational operation: range of service delivery, type, legal authority, expression of appreciation to volunteers, and formalization of rules. Five dealt with dimensions of organizational size: number of pre-disaster paid members and volunteers, proportion of pre-disaster volunteers, membership stability, post-disaster paid members and volunteers, and the proportion of post-disaster volunteers. The last five variables covered aspects of capacity. These were amount of experience in responding to disasters, capacity to respond to different kinds of disasters, capacity to deliver disaster-relevant services, capacity to deliver social services, and preparedness.

A correlation matrix of these fifteen variables was calculated to assess multicollinearity. Thirty-eight (36%) of the 104 correlations were .10 or less; 78 (75%) were .30 or less; 96 (92%) were .50 or less; 103 (99%) were .65 or less; one (1%), legal authority with type, was .88. With the possible exception of the association between legal authority and type, multicollinearity was not a problem for multivariate analyses with these variables. Both legal authority and type were retained in the analyses under the assumption that their high correlation reflected common variance, thus, one or the other would be washed-out in relation to the network dimensions. The next step involved an inspection of the zero-order correlations between the potential descriptors and the interorganizational network variables. Table 6.3 presents the correlation matrix of descriptor variables with interorganizational variables.

Fifty-three (44%) of the 120 correlations reported in Table 6.3 are statistically significant at the .05 level or less. Each one of the interorganizational variables correlated significantly with two to eleven of the descriptor variables: network linkages (pre=9/post=11); agreement (pre=6/post=7); exchange (pre=5/post=6); and frequency (pre=7/post=2). Except for frequency of contacts, the pattern of associations is stronger in the post-disaster condition. Moreover, while there are about as many of these significant associations in the pre-disaster condition (n=27) as in the post-disaster condition (n=26), the correlations in the post-disaster condition tend to be stronger. Twice as many moderate to strong correlations (.31 or larger) appear in the post-disaster condition (n=12) as in the pre-disaster

condition (n=6). These patterns plus the project's focus on area-wide preparedness suggested the merit of concentrating primarily on the post-disaster condition to sharpen network descriptions.

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**Table 6.3 Correlation Matrix of Pre and Post-Disaster Interorganizational Variables With Descriptor Variables<sup>1</sup>**

	<u>Linkages</u>		<u>Resource Exchange</u>		<u>Nature of Agreement</u>		<u>Frequency of Contact</u>	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	-.29*	.28*	.53*	.48*	.29*	.42*	-.09	.02
2	.10	-.21*	-.25*	-.18	-.29*	-.32*	-.12	-.05
3	.22*	-.29*	-.42*	-.38*	-.28*	-.35*	-.00	-.03
4	.35*	.10	-.18	-.05	.10	-.15	.19*	-.16
5	-.01	-.08	-.01	-.19*	-.02	-.08	-.21*	-.21*
6	-.07	-.00	-.02	-.11	.06	-.08	.18	-.03
7	.28*	.26*	.05	.18	.18	.08	.19*	.03
8	-.21*	.04	.17	.01	-.06	-.01	-.10	-.12
9	.19*	.25*	-.09	-.09	-.12	-.24*	.07	.08
10	.23*	.34*	.04	.05	.24*	.14	.32*	.03
11	.21*	.34*	-.09	.03	.14	.06	.16*	.23*
12	.03	.36*	.23	.28*	.19	.26*	.21*	.08
13	.02	.27*	.43*	.34*	.21*	.20*	.13	.02
14	.22*	.25*	-.03	.02	.05	-.00	.25*	.01
15	-.04	.49*	.35*	.41*	.30*	.40*	.13	.04

\* p < .05

<sup>1</sup> Due to the length of descriptor variable names, numbers have been listed to represent each variable. the variable corresponding with each number is as follows: 1=Organization type; 2=Service Range; 3=Legal authority; 4=Pre-disaster organization size; 5=Pre-disaster volunteers; 6=Member stability; 7=Post-disaster organization size; 8=Post-disaster volunteers; 9=Expressions of volunteer appreciation; 10=Organizational formalization; 11=Past experience with disaster response; 12=Disaster capacity; 13=Service capacity; 14=Social service capacity; 15=Level of preparedness.



More operations and capacity variables, than size variables, were associated with network dimensions. Out of the 53 significant correlations, 23 (43%) were with organizational operations variables; 21 (40%) were with capacity variables; and 9 (17%) were with size variables. Among the operations variables, type and legal authority showed the most correlations with 6 each. For the capacity variables, preparedness and capacity to deliver services had the most with 5 each. Post-disaster size had the most of the size variables with 5 correlations. Each of the remaining 10 variables, except for member stability, correlated significantly with at least one of the interorganizational variables.

The zero-order patterns present a complex picture. Each interorganizational variable shows significant correlations with a subset of the descriptors, but the number and particular combination of descriptors differ in each case. While the overall pattern suggests potential value in the operation and capacity variables, the specific variables in relation to particular interorganizational dimensions of the network showed wide variation. Additional analyses were required to draw conclusions. A strategy of multiple regression was chosen to simplify the complexity of these data and create a basis for more clearly describing the networks and drawing conclusions.

Semi-partial correlations coefficients and t-tests of significance, calculated through multiple regression equations, were used to identify the descriptor variables most strongly associated with each of the interorganizational variables. Eight forced-entry regression equations were established with the descriptors as independent variables, and the interorganizational variables as dependent variables. All fifteen descriptors were applied to the four interorganizational variables reflecting the post-disaster condition. It did not make sense conceptually, however, to use six of these descriptor variables in equations estimating interorganizational variables in the pre-disaster condition. Thus, nine descriptors were applied to the four interorganizational variables reflecting the pre-disaster condition.

The semi-partial correlations were examined for all descriptor variables in relation to each interorganizational variable separately. Those which had a magnitude of .10 or larger were entered into a new equation. The criterion of statistical significance used in the new equation and any subsequent equations was .05 or less. In other words, descriptor variables in relation to each interorganizational variable were selected only if they showed statistically

significant semi-partial correlations. Semi-partial correlations indicate the strength of association and the relative importance of each descriptor variable. Table 6.4 presents the zero-order and semi-partial correlations for each of the interorganizational variables and the key descriptors identified in the series of regression analyses.

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**Table 6.4 Zero-Order (top number) and Semi-Partial Correlations (bottom number) of Pre and Post-Disaster Interorganizational Variables With Key Descriptors Variables**

	<u>Linkages</u>		<u>Resource Exchange</u>		<u>Nature of Agreement</u>		<u>Frequency of Contact</u>	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Volunteer Appreciation		.25*				-.24*		.08
		.22*				-.26*		.22*
Level of Preparedness		.49*				.40*		
		.48*				.41*		
Pre-Disaster Volunteers								-.21*
								-.26*
Organization Type			.53*	.48*			-.09	
			.53*	.48*			-.30*	
Pre-Dis. Size	.35*							-.16
	.35*							-.24*
Service Range					-.29*		-.12	
					-.29*		-.24*	
Member Stability							.18	
							.22*	
Disaster Capacity							.21*	
							.33*	

\* p < .05

The findings in Table 6.4 demonstrate the complexity of interorganizational networks. Eight of the fifteen original descriptor variables emerged as associated significantly with one or more of the interorganizational variables. Except for type and number of pre-disaster members, however, the variables associated with the pre-disaster measures of interorganizational relations were different from those surfacing with the post-disaster measures of interorganizational relations. Three variables -- capacity to deliver emergency services, membership stability, and service delivery range -- were linked to one or two of the pre-disaster network dimensions. Three different variables, expression of appreciation to volunteers, preparedness, and the number of pre-disaster volunteers were associated with one, two, or three of the post-disaster network dimensions. Two variables, type and pre-disaster size, were associated with one or two variables in both the pre and post-disaster conditions. It appears that different kinds of descriptors are needed to understand interorganizational relations of networks operating under different environmental conditions.

Another aspect of complexity is that each interorganizational dimension of the network is associated with a different subset of descriptors. Three of the four interorganizational variables in the pre-disaster condition were associated with a single descriptor. These were linkages with size, exchanges with type, and agreement with service delivery range. Frequency, in contrast, was associated with type, service delivery range, member stability, and capacity to respond to different disasters.

This pattern was reversed in the post-disaster condition. Three of the four interorganizational variables in the post-disaster condition were associated with two or three descriptors. Both linkages and agreements were associated with expression of appreciation to volunteers, and preparedness. Frequency was associated with expression of appreciation to volunteers, proportion of pre-disaster volunteers, and pre-disaster size. In contrast, exchange was associated with type. Apparently, variables important to network relations differ depending on the network dimension of interest.

The number of pre-disaster interorganizational linkages was associated positively with pre-disaster organizational size. That is, during day-to-day operations, larger organizations were connected to a larger number of other organizations. This relationship was expected because large organizations have a greater capacity to initiate and maintain linkages with other organizations. The fact that this

relationship held in the pre-disaster network but disappeared in post-disaster response period suggests a greater concentration of effort in the post-disaster network. Support for this interpretation was strengthened with the negative associations between both pre-disaster size and pre-disaster number of volunteers with the frequency of contacts in post-disaster response. The pattern of interaction in the pre-disaster network shifted from more links to fewer, and from low frequencies of contact to more intense levels.

In the post-disaster condition, linkages was associated positively with both preparedness and expression of appreciation to volunteers. The linkages-preparedness relationship was about twice as strong as the linkages-appreciation relationship. Organizations with the most linkages in the network were also the most highly prepared organizations. This relationship would be expected for organizations that are central to the disaster preparedness network. Emergency management organizations and a few of the larger voluntary organizations were found to be much more highly prepared than the social service organizations. It makes sense that organizations central to the network would be more extensively connected throughout the network. In contrast, appreciation was found to be expressed more by social service organizations than by emergency management. The overall pattern suggests an interesting dynamic in the pattern of network interaction. These relationships indicate two different but complementary processes for involvement in the network, emergence and pre-planned linkages. Emergency management organizations were more extensively represented in the pre-planned network, while social service organizations seem to play a more emergent role.

Interorganizational exchanges were associated positively with organizational type in both pre and post-disaster conditions. Emergency management organizations had higher levels of exchange than social service organizations. Resource exchange is essential to preparedness and effective response. Networks are developed and maintained partly to facilitate resource exchange. It is expected that organizations central to the network would have higher levels of exchange. These relationships result, then, from emergency management organizations being more central in the disaster preparedness and response networks.

The nature of interorganizational agreements was associated with pre-disaster service delivery range. Organizations which serve only in a limited or local range have less formalized agreements with other organizations. This relationship, like those above with exchange, may be understood with reference to the distinction between emergency

management and social service organizations. Emergency management organizations generally served a more limited geographic range than social service organizations. Most emergency management offices were established within local municipal governments, and they served only their municipality. Social service organizations in the preparedness network tended to be the large well-established organizations, with the capacity to deliver services area-wide. Small local social service organizations were not generally part of the preparedness network, unless they had been drawn in by experience in their community. The lack of an association between agreements and service range in the post-disaster condition suggested that response activities were more problem focused and less governed by service delivery range.

In disaster response, formalization of agreements was associated negatively with appreciation and positively with preparedness. Organizations that expressed higher levels of appreciation to their volunteers were less likely to have formalized agreements in the network. On the other hand, highly prepared organizations were more likely to have formalized agreements. These are interesting findings because social service organizations tended to score higher on agreement, while emergency management organizations scored higher on preparedness. In other words, this pattern again reflected a network dynamic that resulted from the respective contributions of social service and emergency management organizations. Higher levels of preparedness facilitate effective response when organizations central to the network are coordinated. That is, since the work of each organization is partly dependent on the others doing their part, organizations central to the network establish more formal agreements. Mutual dependence is recognized and built into disaster response plans. Formalized agreements exist between emergency management organizations for disaster response, but not day-to-day operations. This is why the relationship holds in the post-disaster condition but not in the pre-disaster period.

But effective disaster response also requires particular adaptations to unanticipated aspects of the disaster. Organizations that are not central to the preparedness network, but which have the capacity to meet special needs, are likely to emerge in the network at this point. Social service organizations with cadres of volunteers and some awareness of the network are thus drawn into disaster response service, but their participation is dictated by the demands of the moment and not pre-planned formalized agreements.

Pre-disaster contact was associated negatively with organizational type and service delivery range, and positively with stability and capacity. Less frequent contact in the network occurred with emergency management organizations and with those having a limited geographical service delivery range. Higher levels of contact stemmed from organizations that have stable memberships and greater capacities to respond to different kinds of disaster. This pattern makes sense for day-to-day operating conditions.

The negative relationship between organizational type and contact frequency follows from the focus of emergency management organizations on post-disaster planning as opposed to normal business transactions. Correspondingly, since the frequency of network contacts in pre-disaster is geared more to normal business transactions, it follows that a limited (local) service range would be associated with less intense contacts across the preparedness network.

On the positive side, it was expected that stable organizations would have a higher frequency of contact in the pre-disaster network because stability fosters certainty and predictability in maintaining relations with other organizations. Also a higher proportion of new members increases the amount of attention devoted to learning internal tasks and routines. The relationship between capacity and frequency of contacts is also expected. Organizations with greater capacity to respond to different kinds of disasters are more likely to be in contact with a larger number of organizations in the network. This interpretation is consistent with the significant correlation found between the number of linkages and pre-disaster frequency of contacts.

Post-disaster frequency of contacts was associated positively with appreciation, and negatively with two different size measures: number of pre-disaster volunteers, and pre-disaster organizational size. Organizations that expressed high levels of appreciation for their volunteers had higher contact frequency than those which score low on appreciation. Without any additional information, this relationship seems straightforward and understandable. That is organizations that are high on appreciation may be thought of as more actively engaged in the network. But the relationship is probably more complicated than this interpretation suggests. First, this relationship was suppressed at the zero-order level which indicates a complex interaction between frequency of contacts, appreciation, and at least one other variable. Second, higher levels of appreciation tended to be associated with social service organizations which were less central in the network. Thus, the relationship may, in a more complex fashion, provide

additional support for the emergent role of social service organizations in the post-disaster network. More extensive analyses will be required to corroborate this point.

The negative associations with the size measures fall in line with the picture described so far. Large and labor-intensive organizations, especially those with a large number of volunteers, are involved in meeting needs that stem from the disaster, rather than by some predetermined role in disaster response. This suggests that such organizations are emergent in the network.

### Graphic Descriptions of Network Relations

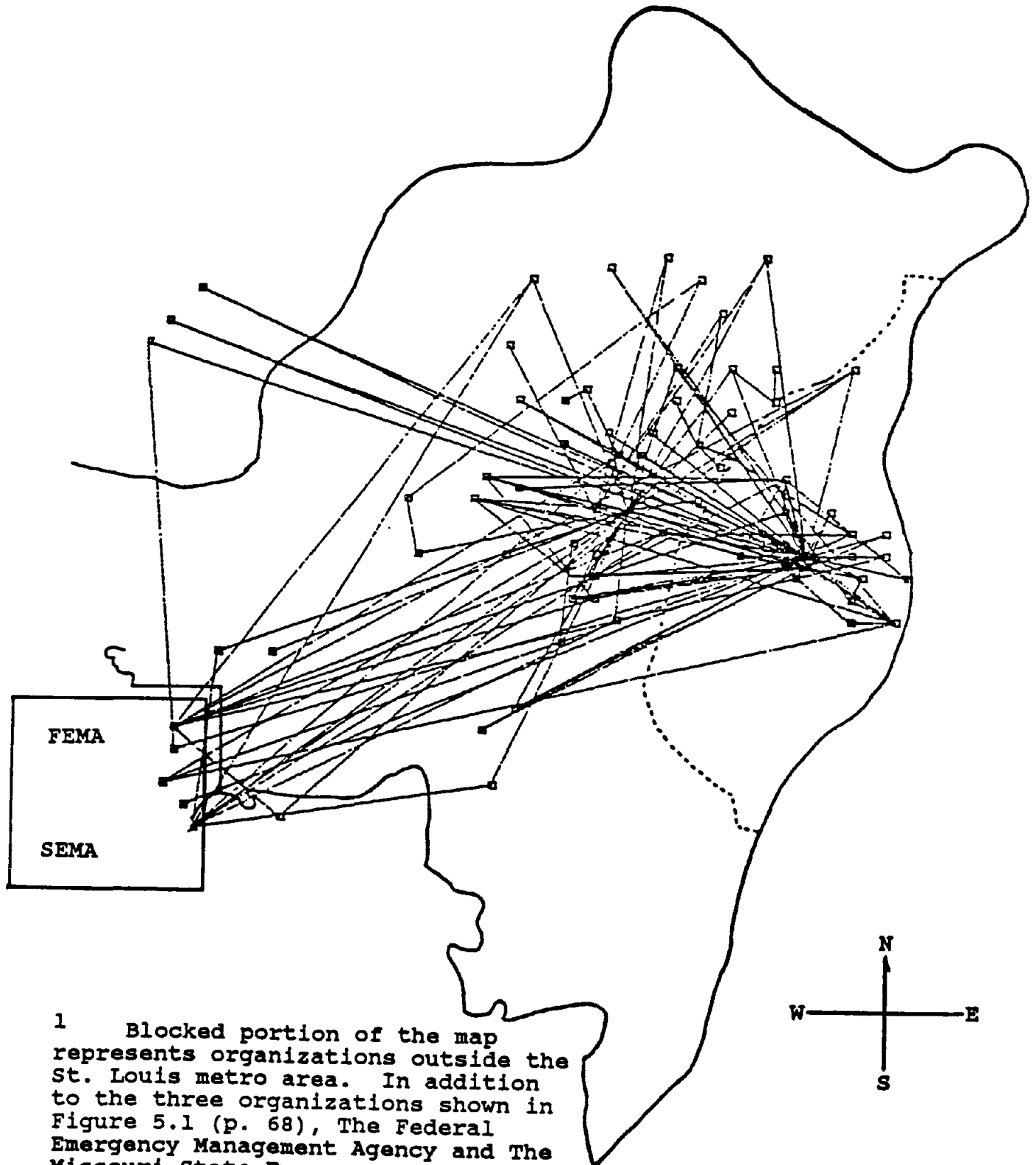
The population used for graphic presentation included 80 organizations; 60 identified in the original telephone survey and 20 revealed through the survey instrument (see Chapter 4). It is important to remember that this interorganizational network of 80 organizations differs by twenty organizations from the original population of 80 organizations. Figure 6.1 (p. 108) shows the network pattern across the St. Louis metropolitan area for the 80 organizations with two or more linkages.

The pattern displayed in Figure 6.1 summarizes the linkages between the 80 organizations in the disaster preparedness network. Each small square on the map represents an organization and its location in the metropolitan area. The lines drawn from one organization to another indicate the presence of relations between those organizations; the absence of a line indicates no relations. Different levels of intensity -- higher or lower frequency of contacts, greater or lesser formalization of agreements, more or fewer services exchanged -- are not reflected in the network displayed in Figure 6.1.

Although the network was defined by organizations having relations with two or more other organizations, there were a few instances where a single line connects one organization to another. This occurred as a special case of the minimum two or more linkage requirement: when an organization listed a relation with another organization, and the other organization listed the first organization. In these cases, the A-B relation is one link, and the B-A relation is a second link.

The linkage-only pattern provides the most dense picture of the network. Two cluster centers are apparent in the network. The thickest cluster exists in the north-west part of St. Louis City. A second cluster emerges in the north-central part of St. Louis County. The clusters indicate a bifurcated

Figure 6.1 Post-Disaster Network of Linkages  
Between 80 Emergency Service  
Organizations in the St. Louis  
Metropolitan Area.<sup>1</sup>



<sup>1</sup> Blocked portion of the map represents organizations outside the St. Louis metro area. In addition to the three organizations shown in Figure 5.1 (p. 68), The Federal Emergency Management Agency and The Missouri State Emergency Management Agency have been added.



network structure. There are linkages between organizations operating in the two cluster centers, but there are more linkages within the cluster centers than there are between them. This structure is probably a reflection of jurisdictional differences between the City and County. A single cluster center would be more efficient, but only if its legal and social legitimacy were area-wide.

More refined descriptions of the network were achieved by focusing on separate dimensions and intensity levels of interorganizational relations. Each of the three separate dimensions represented a portion of the overall linkage network, and graphing each of them one at a time highlighted a specific part of the total network pattern. Additional refinement was achieved by graphing the separate dimensions at each of the levels of intensity. The greatest clarity in describing a network pattern was produced at the higher levels of intensity where only the organizations with continuous contact, explicit agreements, and extensive exchanges were represented. For this reason, only the more intense level for each dimension is reported here. This serves to extract from the overall linkage pattern the prime outline of each separate network dimension. Figure 6.2 (p. 110) illustrates the pattern of contacts for organizations in continual contact.

The pattern of interaction among the organizations in continual contact maintains the same basic shape as the overall linkage pattern depicted in Figure 6.1. The two cluster centers remain discernible in the north-west part of the City and north-central part of the County. Interestingly, about one-half of the organizations indicated continual contact with at least one of the other organizations in the network. The network was also integrated, with all but one subset of two organizations in the north part of the City connected directly or indirectly to the central clusters.

The network graphed in Figure 6.3 (p. 111) shows the pattern of exchange for organizations that delivered or received five or six services. The exchange network is less dense than the frequency of contact network. The cluster centers can be still identified, but more so in the County than in the City, and partly because we know their location. Interestingly, the shorter links drop out of the exchange network; most of the exchange linkages are those that connect organizations at one end of the network with organizations at the other. This finding is interesting since, intuitively, one might expect higher rates of exchange among those organizations in close physical proximity.

Figure 6.2 Post-Disaster Network of Emergency Service Organizations in Continual Contact.

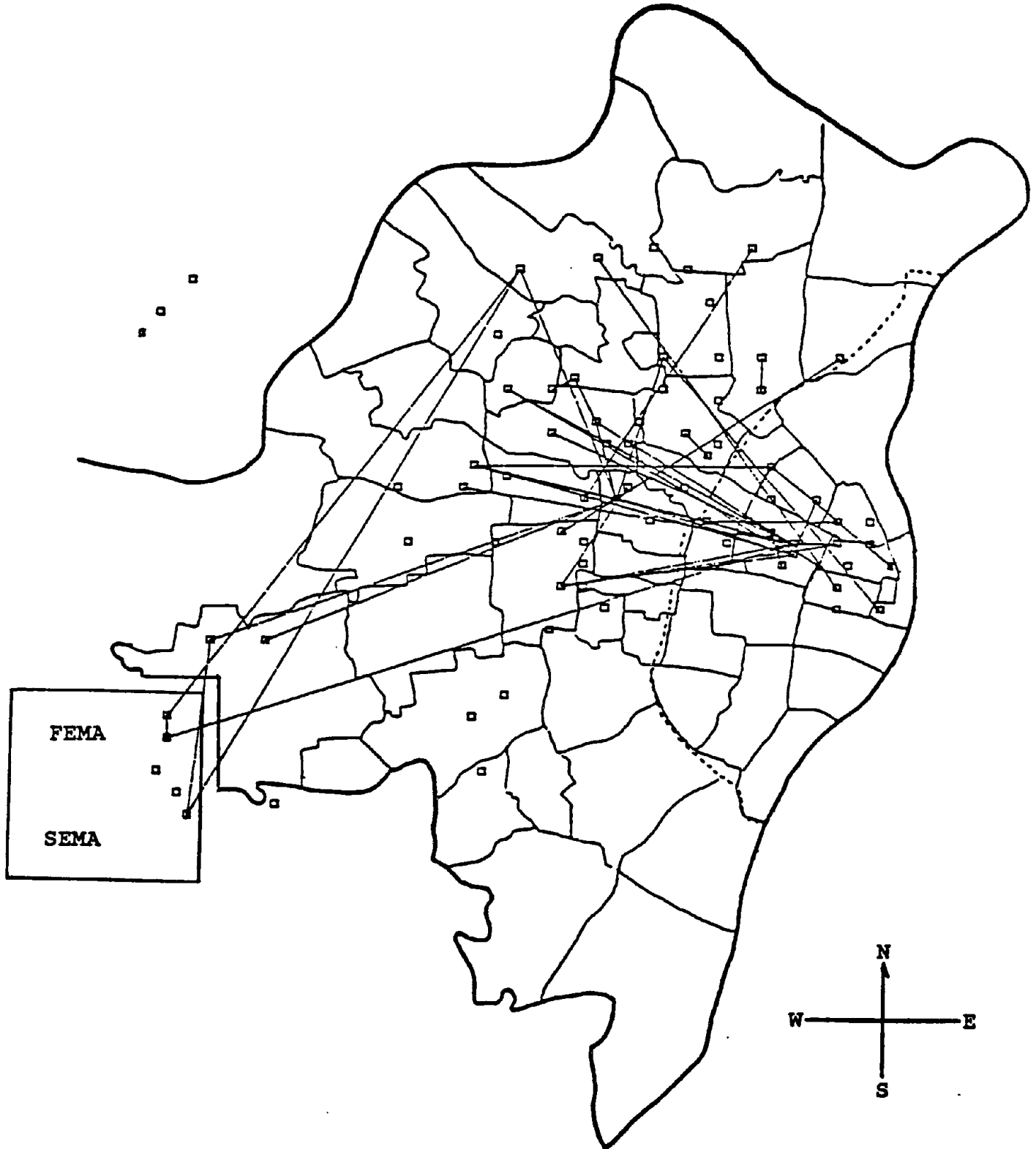
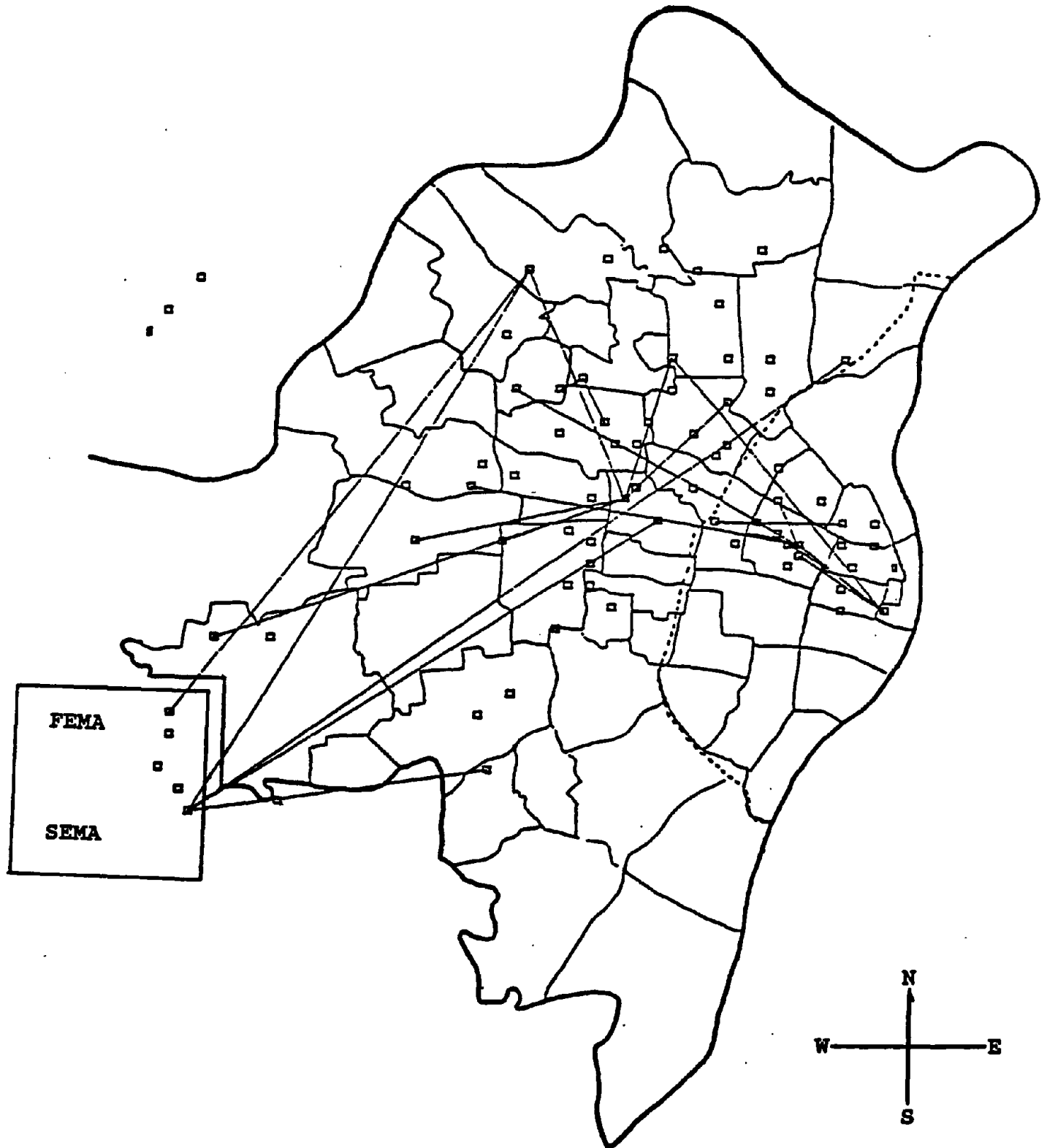


Figure 6.3 Post-Disaster Network of Emergency Service Organizations With Five or More Resource Exchanges.



The agreement network depicted in Figure 6.4 (p. 113) shows linkages between organizations having written formal agreements. Nearly half (45%) of the organizations have written formal agreement. Of these linkages over half (57%) are legally mandated agreements. The network of organizations with written agreements is more dense than either the frequency of contact or exchange networks. The two cluster centers are clearly depicted in the agreement network.

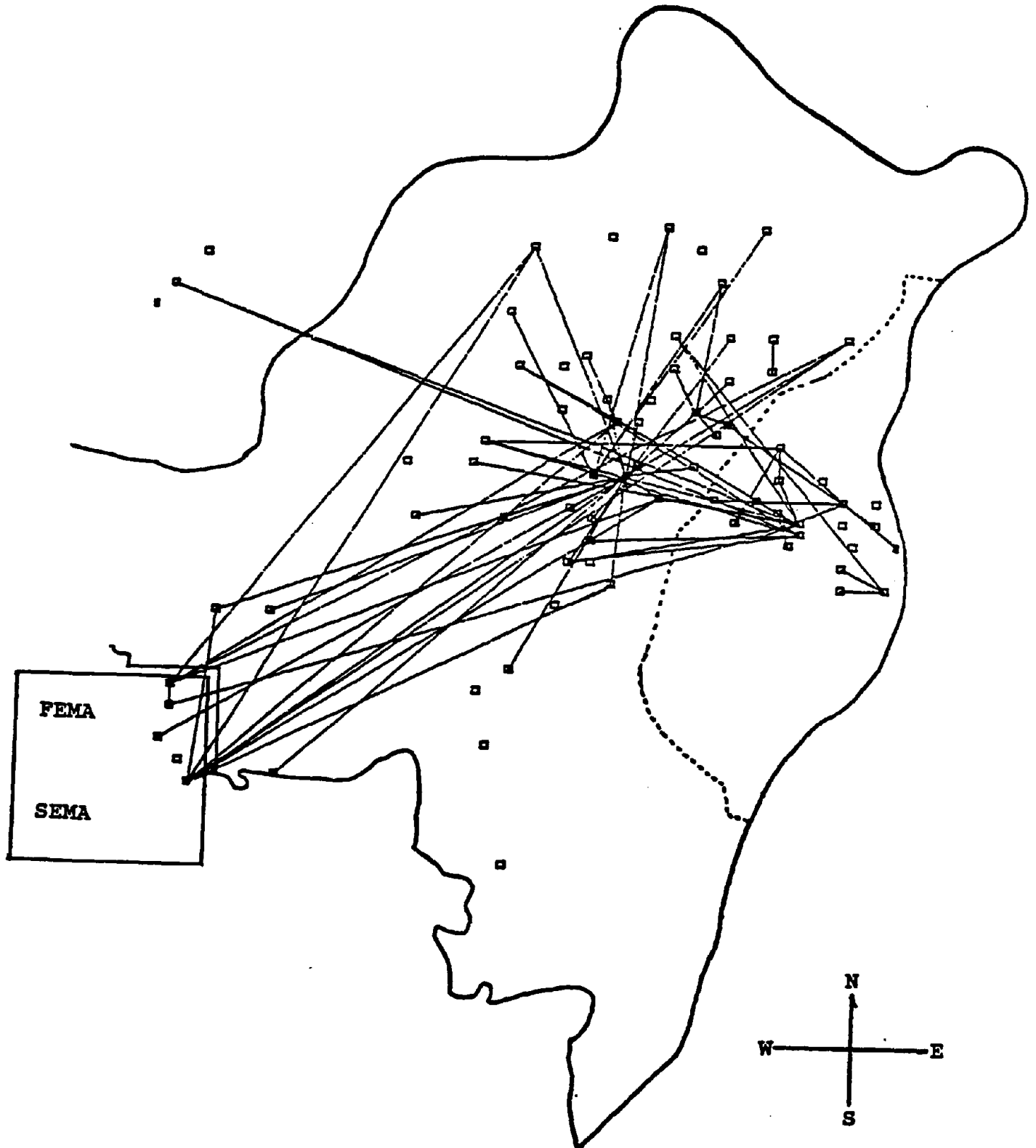
#### Network Relations Among Organizational Types

An analytical extension of the organization-specific networks was achieved by combining each particular organization into one of 29 different organizational types. Studying the network of relations among organizational types was done for several reasons. First, it extended the generalizability of the findings. The 80 organizations studied were unique to the St. Louis metropolitan area, but the 29 types represented by these 80 organizations existed in all moderate sized and larger metropolitan areas. Second, the smaller number of nodes simplified analyses of network relations. Third, the abstract designation of type allowed creative location of nodes in preparing graphic representations of the networks. This facilitated graphic arrangements that drew primary attention to the network of interorganizational relations, rather than the nodes or their geographic distribution. These advantages are apparent in Figure 6.5 (p. 114) which shows the pattern of linkages between the 29 different types of organizations involved in the disaster preparedness network.

The network relations shown in Figure 6.5 represent the linkages between two operational sets of organizations (low preparedness/high preparedness) with 29 possible types. The types were derived from organizations listed as those worked with during disaster conditions. Emergency preparedness was dichotomized at the median, with organizations having scores lower than the median being classified as low in preparedness (n=43) and those with scores above the median being high in preparedness (n=37). Thus, the larger, central nodes represent organizations with higher and lower levels of preparedness. The lines represent links between these organizations and the 29 types. Each organization listed other organizations worked with during disaster response, and the lists were converted from specific organizations to types.

Types linked to only low preparedness organizations are arranged on the left side of the diagram, while types linked only to high preparedness organizations appear on the right side. Types linked to both low and high preparedness

Figure 6.4 Post-Disaster Network of Emergency Service Organizations With Formal or Legally Mandated Agreements.



Neighborhood ○

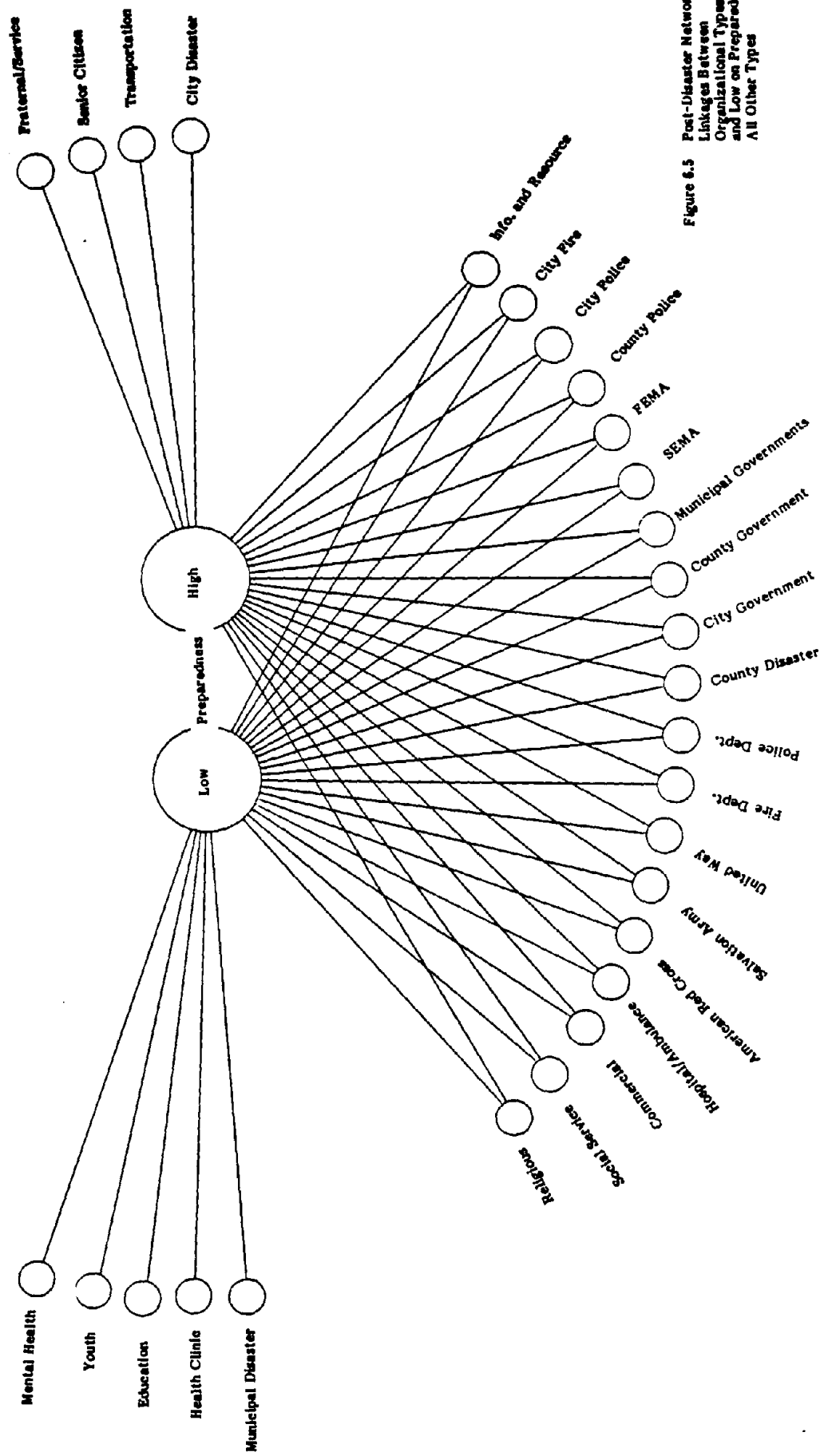


Figure 6.5 Post-Disaster Network of Linkages Between Organizational Types High and Low on Preparedness With All Other Types

organizations are arranged across the bottom of the diagram. One type is not linked to either low or high preparedness organizations in the post-disaster condition, and is placed at the top of the diagram with no lines going to it.

In examining the diagram, we see that the network is quite dense, with the 47 linkages representing about 81% of the total possible. Nineteen (66%) of the 29 types are linked to both categories of organizations.

Five types (17%) are linked only to organizations low in preparedness. At first glance, it seems odd that the municipal disaster offices should be linked only to organizations with lower preparedness scores. This could be due to the fact that organizations which have lower preparedness scores tend to be social service types which see their role in disaster response activities as secondary or ancillary to the formal emergency preparedness organizations. In addition, their responses were made with reference to the scenario of a region-wide earthquake disaster. Because these organizations are less well prepared to respond to such a disaster, they may see their links to the local municipal disaster office as being of primary importance. The fact that the municipal disaster offices are not represented by joint links indicates that highly prepared organizations recognize that in a region-wide disaster of the magnitude described in the scenario, their primary links would be with organizational types at higher levels: county, state, or federal.

Four types (14%) are linked only to organizations which have high preparedness. Organizations with higher preparedness scores also demonstrated higher levels of preplanning. Thus links to fraternal/service and senior citizen probably indicate preplanning for volunteers since these two types represent potential sources of volunteers. The link to senior citizen types could also indicate a recognition that senior citizens represent a special population with special services in the event of a major disaster. The link with transportation type organizations might also represent preplanning for special transportation needs following a major disaster.

When organization specific data were collapsed into the type categories, it was necessary to combine responses from specific organizations. As a result, each line on the diagram could represent more than one link between each type. In order to find the stronger linkage patterns among the types, the full diagram (Figure 6.5) was decomposed by systematically removing lines representing only 1, then 2, 3, and 4 linkages respectively. This produced a series of diagrams which show

changes in the configuration of the network based on the strength of links between the two categories of organizations with the 29 types.

Rather than presenting each of these diagrams, only the diagram which shows the strongest pattern of linkages is presented here. Figure 6.6 (p. 117) shows only those types with 5 or more linkages. All types with fewer than 5 linkages are placed above the pattern with no lines going to them. The larger the number of linkages, the stronger the pattern of interaction between the types. Thus, figure 6.6 represents key organizations in the network based on level of preparedness.

Figure 6.6 shows a pattern of linkages similar to Figure 6.5 only less dense. However, it is important to note changes in the configuration of the network. Now, there are three instead of four types linked only to less prepared organizations, but all three types are different from those presented in Figure 6.5. Linkage patterns between the United Way and religious organizations would be consistent with the expectation given that lower prepared organizations tend to be social service types. The link with the Federal Emergency Management Agency (FEMA) may indicate a lack of awareness of the chain of command in disaster response activities. Few organizations would be connected directly with FEMA under the disaster conditions described in the scenario. Rather, they would be linked through their local and state emergency management agencies.

Three types are also linked only to the more prepared organizations, but again they are all different from the types shown in Figure 6.5. Commercial types include such things as contractors, lumber yards, utilities, etcetera. Links between these types and the more prepared organizations may show a greater awareness of the role private and commercial organizations would play in disaster response activities. Links to municipal governments and the State Emergency Management Agency (SEMA) probably indicates an understanding of the chain of command going through the local, state, and finally federal emergency management officials.

The joint linkages have been reduced considerably to 7, about 24% of the total possible. These types can be thought of as the primary actors in the network as defined by level of preparedness. They are actually comprised of four general types -- social service, hospital/ambulance service, fire departments, and police departments -- and three specific organizations which represent types of organizations found in all moderate to large metropolitan areas -- The American Red Cross, The Salvation Army, and St. Louis County Disaster



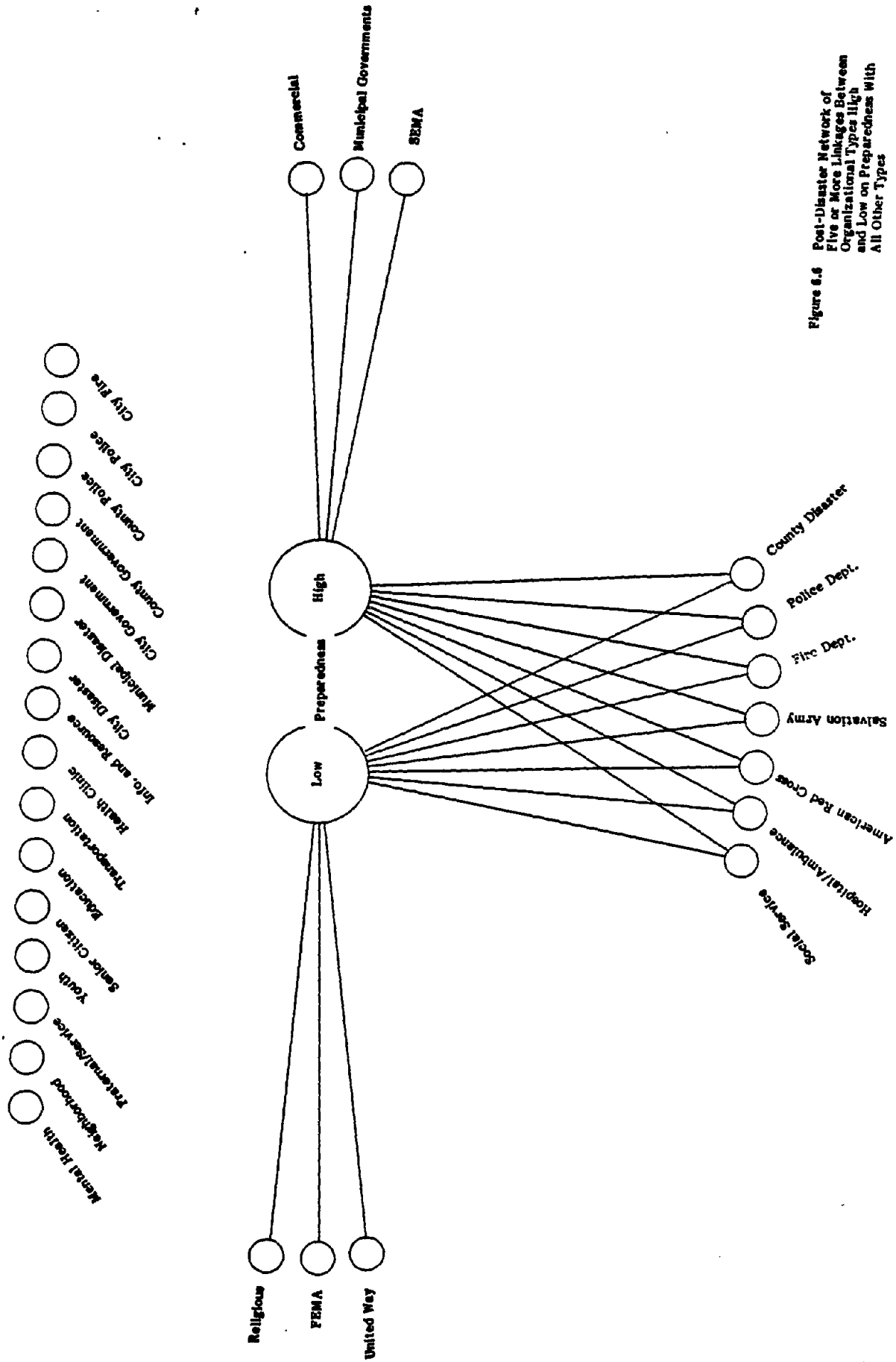


Figure 8.6 Post-Disaster Network of Five or More Linkages Between Organizational Types High and Low on Preparedness With All Other Types

Office. The Red Cross and Salvation Army are generally recognized as key actors in disaster response activities. The St. Louis County Disaster Office is in this network because a large part of the St. Louis metro area is located in St. Louis County and, therefore, the county disaster office is an important source of information and resources for local emergency management officials in municipalities located throughout the county.

It is interesting to note which types dropped out of the network under the criteria of 5 or more links. St. Louis County Government and Police Department fell out of the network largely because their operation would be subsumed by the county disaster office in the event of a major disaster. Thus St. Louis County Disaster Office would become the point of contact for all county government activities. The St. Louis City government, disaster office, police and fire departments probably dropped out because their jurisdictional boundary ends at the city limits. While they may represent a densely connected subnetwork of the larger network, their individual links do not exceed the criteria of 5 or more.

In addition to preparedness, four other descriptors were found to be associated with the four interorganizational variables in the post-disaster condition. These were volunteer appreciation, type of organization, organization size, and proportion of total members that are volunteers (See Table 6.4, p. 113). The same process used to produce the diagrams for level of preparedness was followed in graphically presenting these variables.

Volunteer appreciation. Volunteer appreciation was assessed by asking organizations how appreciation for volunteers was demonstrated. Four ways of expressing gratitude to volunteers were listed and respondents were asked to check the ones appropriate for their organization. These were then summed to give an overall measure of volunteer appreciation for each organization, which ranged from 0 to 4. For the purpose of diagramming linkages between types based on appreciation, the scores were dichotomized so that organizations with scores of 0 or 1 were classified as low in volunteer appreciation (n=32) and organizations with scores of 2 to 4 were classified as high in volunteer appreciation (n=48). One reason organizations might be low in volunteer appreciation is that they do not maintain a large cadre of volunteers or have a mechanism for recruiting and mobilizing volunteers.

As in Figure 6.5, the central nodes in the diagram represented low and high levels of volunteer appreciation. The full linkage pattern diagram shows 45 links between types,

78% of the total possible. Seventeen (59%) of the 29 types are linked to both categories of organizations.

Two types (7%) are linked only to organizations with low volunteer appreciation: youth organizations and municipal disaster offices. Nine types (31%) are linked only to organizations with high levels of appreciation. With the exception of St. Louis City Police and Fire Departments, they represent organization types which are normally associated with some form of human service function (mental health, senior citizen, health clinic, etc.). While police and fire can be considered human service organizations as well, they are seen here as emergency service organizations.

The diagram of only those types with 5 or more links shows 16 (55%) of the types are not part of the network at this level of interaction. No types are linked only to organizations with low volunteer appreciation, and four (14%) are linked only to organizations with high volunteer appreciation. These include religious organizations, the United Way, FEMA, and St. Louis County Police Department.

Nine types (31%) are linked to both low and high appreciation organizations. It is interesting to note that these nine include the seven types represented in Figure 6.6 plus SEMA and municipal governments. This demonstrates consistency in the key types in the disaster response network.

Type of organization. As described in Chapter 4, organization type was achieved through a process of collapsing specific organizations into general types. The result was a nominal variable representing the two major types of organizations identified in the population -- social service (n=43) and emergency management (n=37). Diagrams were drawn to show linkages between these two types and the other 29 types listed as those worked with during disaster conditions.

The diagram of full linkage patterns shows 18 (62%) of the 29 types were linked to both social service and emergency management organizations. Nine (31%) were linked to only social service organizations, and one (3%) was linked to only emergency management organizations. The 46 linkages represented in the diagram are about 79% of the total possible.

It appears that at this level of interaction, social service type organizations maintain a much larger number of unique links to types than do emergency management organizations. Of the nine types linked only to social service organizations, all with the exception of municipal disaster offices, could be considered social service

organizational types. This is probably due to the fact the social service organizations have a much broader mandate for service provision during day-to-day conditions than emergency management organizations. At this level of interaction, linkages in the post-disaster condition are probably similar to day-to-day conditions.

The diagram of 5 or more linkages shows 17 (59%) of the types have no links at this level of interaction. Three (10%) types are linked only to social service organization. All three could be classified social service organizations as opposed to emergency service organizations: United Way, religious, and social service organizations. There are also three (10%) types linked only to emergency management organizations. All three are types normally associated with emergency services during a disaster: police departments, municipal governments, and SEMA.

Six (21%) types are linked to both social service and emergency management organizations. Five of these types are the same as those identified by joint links in the preparedness and appreciation diagrams. The new one added is FEMA, which probably indicates that both social service and emergency management organizations recognize that a region-wide disaster of the magnitude described in the scenario would require assistance from the Federal level.

Organization size. Two measures of organization size were used in the study, one for pre-disaster (day-to-day) conditions and another for post-disaster conditions following the scenario. Each organization was asked to list the number of paid staff and the number of volunteers their organizations would have under the two conditions. Organization size was computed by adding the number of paid staff and the number of volunteers to give us an overall organization size.

Pre-disaster organization size was found to be significantly related to frequency of contact in the post-disaster condition. While this might at first seem odd, the post-disaster size variable was computed as the combined total of paid staff and trained volunteers, not total volunteers. To the extent that some organizations have large cadres of untrained volunteers, the pre-disaster measure of size may actually be a better estimate of organization's size in the post-disaster condition.

It has been found that many disaster response organizations are small in size, being made up of fewer than a dozen paid staff and a handful of volunteers (Quarantelli, 1985). In order to produce the types diagrams, the pre-disaster size variable was dichotomized with organizations

having 20 or fewer total staff and volunteers being classified as small (n=34) and those with more than 20 as large (n=46). The two central nodes then represent organizations from the sample which are either large or small.

The full linkage diagram shows that two (7%) types are linked to only small organizations and 8 (28%) are linked only to large organizations. This would seem to run counter to the notion that most disaster response organizations are small. Eighteen (62%) of the types are linked to both small and large organizations.

The diagram of 5 or more linkages shows 15 (52%) of the types are not linked into the network. No types are linked only to small organizations, while 6 (21%) are linked only to large organizations. Again, this seems to contradict the idea that disaster response organizations tend to be small. Eight (28%) of the types are linked to both large and small organizations. Seven of these types are represented in the previous diagrams. The only new type is religious organizations.

Proportion of volunteers. Proportion of volunteers is also a pre-disaster measure. It was computed by dividing the number of volunteers an organization has by the total number of paid staff and volunteers. It represents the proportion of the total organization membership that are volunteers. To produce the diagrams, the variable was dichotomized as 50% or fewer volunteers being small (n=36) and over 50% volunteers being large (n=44). The central nodes in the diagram therefore represent small or large proportions of volunteers.

The full linkage diagram shows that 2 (7%) of the types are linked only to organizations with small proportions of volunteers while 6 (21%) are linked to organizations with large proportions of volunteers. Twenty (70%) of the types are linked to both organizations with small and large proportions of volunteers.

The diagram of 5 or more links shows a quite different linkage pattern than the full linkage diagram. At this level of interaction, no types are linked only to organizations with large a proportion of volunteers. There are still two types linked only to organizations with small proportions of volunteers, however, they are both different from the full linkage diagram. Ten (34%) types are linked to both organizations with small and large proportions of volunteers. All 10 of these types are present on at least one of the four previous diagrams of this level of interaction. Half of them were represented on all four of the previous diagrams and 80% were represented on 2 or more. Thus, a good deal of

consistency can be seen among those organizations which show up as key organization types in the network. They include social service organizations, hospitals/ambulance services, American Red Cross, Salvation Army, Fire Departments, Police Departments, St. Louis County Disaster Office, and City Governments of the municipalities in St. Louis County.

### Blockmodel Analysis of Post-Disaster Networks

Four interorganizational variables served as the basis for the blockmodel analysis. Most blockmodeling analysis has focused only on whether or not a link exists between two organizations. Little attention has been given to varying magnitudes of links along key interorganizational dimensions. Blockmodel analysis was performed on all four interorganizational dimensions: existence of linkage, resources exchanged, frequency of contact, and formalization of agreement.

As discussed in Chapter 4, blockmodel analysis provided an alternative method to confirm the network structure revealed through correlation analysis. Correlational analysis indicated that the population contained two fairly distinct types of organizations -- social service and emergency management -- and that patterns of network interaction were more highly concentrated within these types as opposed to between them. Thus, it was reasonable to expect the blockmodeling to result in two blocks, one predominated by social service organizations and the other by emergency management organizations.

Before moving to the results, one additional point should be made. While these blocks are assumed to represent organizations which are "structurally equivalent," this does not mean they are linked to each other in any way. Structural equivalence refers to similar patterns of network interaction. Just because organizations are in the same block does not mean they cooperate or coordinate their activities, or even that they are connected to one another (Drabek et al., 1981).

Organization-specific blocks. Results of the blockmodel analyses is to compare the proportion of social service and emergency management organizations in each of the blocks. Table 6.5 presents this information.

For each network dimension, the positive blocks are dominated by emergency management organizations and the negative blocks are dominated by social service organizations. This supports the findings of the correlation analysis which showed a bifurcated network structure of two major types of

organizations -- social service and emergency management. Moreover, the findings show striking consistency across the four interorganizational variables. The proportion of emergency management organizations in the positive blocks range from 4 points (from .69 to .73), and the proportion of social service organizations in the negative blocks range 5 points (from .63 to .68). Such consistency across four independent dimensions provides evidence for two basic forms of structural equivalence.

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**Table 6.5 The Proportion of Social Service and Emergency Management Organizations in Each Block for Four Interorganizational Dimensions**

Blocks	<u>Linkages</u>		<u>Resource Exchange</u>		<u>Nature of Agreement</u>		<u>Frequency of Contact</u>	
	+	-	+	-	+	-	+	-
Emergency Management	.71	.36	.69	.37	.73	.26	.71	.32
Social Service	.29	.64	.31	.63	.27	.74	.29	.68
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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Although each of the blocks are dominated approximately by two-thirds to one-third by one type or another, it is important to not oversimplify the idea of structural equivalence by reducing it to a pattern of association with a single nominal measure of organizational type. It does appear that organizational type is an important variable in attempting to describe and understand the dynamics of network interaction. But, it also appears that there is more to learn by extending the blockmodel analysis.

Further blockmodeling of these data may draw out evidence regarding patterns of integration between social service and emergency management organizations. Splitting out the blocks successively may reveal key "linking pin" organizations around which the network pivots. Additional blockmodeling may illuminate the consistent distribution of organizational types. The consistent two-thirds to one-third distribution

may reflect a system or network imperative of some kind. Knowing which organizations appear consistently in positive or negative blocks across different dimensions and which ones appeared in mixed combinations, would provide one way to begin assessing dynamics of these distributions. Finally, it seems likely that analyzing structurally equivalent blocks in relation to variables such as organizational size, proportion of volunteers, preparedness, and others will further increase understanding of network dynamics. The initial blocks provide interesting and useful confirmation of a bifurcated network structure. The greatest value of the blockmodel results may be in the questions that are raised.

Organizational types blocks. The same procedure was followed in doing blockmodel analysis on the organization types data, with one exception. No analysis was performed to show blocks based on linkages. Since the process of collapsing resulted in some types being connected by multiple links, the cell values in the matrix varied considerably. Some types had only 1 or 2 links while others had 15 or more links. Because of this great variation in number of linkages between type, it was decided to not construct the matrix and perform the blockmodel analysis on the linkage only data.

Table 6.6 shows the network patterns among organizational types obtained from performing blockmodeling analysis along three interorganizational dimensions. As noted in Chapter 4, there are several problems with interpreting blockmodels once they have been achieved. In examining Table 6.6, a couple of points should be remembered. First, the appearance of a case in a block does not imply that it is linked with the other organizations in the network. Rather, it suggests that organizations in that block are structurally similar along some dimension. Second, the designation of positive and negative blocks cannot be interpreted to mean that the types in one block are stronger/weaker, or better/worse along some dimension than the organizations in the other block.

The findings in Table 6.6 show that each of the eight logical network patterns is represented by two or more organizational types. This suggests potential utility for the logical framework. Although all eight logical patterns are represented, they are not represented equally. The distributions range from two to six cases. Interestingly, half of the patterns, 3 (+ - -), 4 (+ - +), 5 (- + -), and 6 (- - +), have two or three organization types each, and half, 1 (+ + +), 2 (+ + -), 7 (- + +), and 8 (- - -), have four to six organizational types each.



**Table 6.6 Blockmodel Network Patterns Among Organizational Types Across Three Interorganizational Dimensions**

<u>Organizational Type<sup>1</sup></u>	<u>Resource Exchange</u>	<u>Nature of Agreement</u>	<u>Frequency of Contact</u>
Social Service	+	+	+
Religious	+	+	+
Fraternal/service	+	+	+
Educational	+	+	+
Youth	+	+	-
Commercial	+	+	-
Health Clinic	+	+	-
St Louis County Gov.	+	+	-
United Way	+	+	-
Mental Health	+	-	-
Transportation	+	-	-
Municipal Disaster Office	+	-	-
Municipal Governments	+	-	+
SEMA/ State Agencies	+	-	+
Senior Citizen	-	+	-
St. Louis City Police	-	+	-
FEMA/Federal Agencies	-	-	+
Salvation Army	-	-	+
Fire Departments	-	+	+
Police Departments	-	+	+
Hospitals/Ambulances	-	+	+
Information/Resources	-	+	+
St. Louis City Disaster Off.	-	+	+
St. Louis County Disaster Off.	-	+	+
St. Louis City Gov.	-	-	-
St. Louis County Police	-	-	-
St. Louis City Fire	-	-	-
American Red Cross	-	-	-

<sup>1</sup> While originally there were 29 organizational types in the analysis, the table lists only 28 types. This is because one type, neighborhood organizations, dropped out of the network under the post-disaster condition.

Except for pattern 4 (+ - +), the network patterns with the fewest organizational types contain more negative associations. Each of the other three patterns indicate a profile of two negative and one positive associations on the network patterns. These three patterns also show a mix of social service and emergency management types, and an even greater mix of two more refined sets of organizational types. While the basic pattern of structural equivalence is known, the implications from this clustering are unclear.

The network patterns with the most organizational types show a clear contrast to those with the fewest types. Except for pattern 8 (- - -), they have a profile of at least two positive associations across the three network dimensions. Pattern 8 (- - -) is fully consistent as is pattern 1 (+ + +). In addition, these four patterns are differentially represented by social service or emergency management types. Pattern 1 is all social service types, four out of five in pattern 2 are social service types, 4 out of six in pattern 7 are emergency management, and 3 out of 4 in pattern 8 are emergency management. The American Red Cross is the only exception in pattern 8, however, it is a special kind of social service organization with very close ties to disaster response activities.

Although the particular combinations within these patterns appear to make sense, it would be premature to infer aspects of network dynamics from these patterns. The most important result from these blockmodel analyses is the documentation of systematic variation within the network. This documentation sets the stage for addressing specific questions of network structure and process.

#### Cluster Analysis of Post-Disaster Networks

Cluster analysis offered another method to confirm the network structure revealed through the correlation analyses. Cluster analysis was conducted on all four of the interorganizational variables: linkages, resources exchanged, frequency of contact, and formalization of agreement. Two important differences exist between the blockmodel and cluster analysis. First, the cluster analysis was based on the original population surveyed, while the blockmodel analysis used the modified network population consisting of organizations having two or more linkages. Second, the cluster analysis employed the distance measure of squared Euclidean differences between cases on each of the

interorganizational variables, while the blockmodel analysis was carried out with correlation coefficients as a measure of similarity.

Results of the cluster analysis are presented in Table 6.7. They are presented in the same way as the blockmodel results, comparing the proportion of social service and emergency preparedness organizations.

**Table 6.7 The Proportion of Social Service and Emergency Management Organizations in Each of Two Clusters for Four Interorganizational Dimensions**

Cluster	<u>Linkages</u>		<u>Resource Exchange</u>		<u>Nature of Agreement</u>		<u>Frequency of Contact</u>	
	1	2	1	2	1	2	1	2
Emergency Management	.61	.31	.22	.70	.28	.55	.47	.55
Social Service	.39	.69	.78	.30	.72	.45	.53	.45
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Five out of the eight clusters reveal a differential distribution of emergency management and social service organizations. Three of these show a larger concentration of social service organizations: 69% in linkage cluster 2, 78% in resources exchanged cluster 1, and 72% in formalizations of agreement cluster 1. Two have a larger concentration of emergency management organizations: 61% in linkage cluster 1, and 70% in resources exchanged cluster 2. This supports the idea of a bifurcated network structure which surfaced in the correlation analysis.

Each of the frequency of contact clusters and one of the formalization of agreement clusters show, however, approximately equal distributions. Concentrations of emergency management and social service organizations range from 45% to 55% across these three clusters. These findings fail to support the notion of a bifurcated network structure. It is possible that integration of the two major network structural components is executed through a high level of

cross-type frequency of contacts for a particular form of agreement. Further analysis will be necessary to test this hypothesized function of the network pattern.

## Communication Networks

### Interorganizational Variables

Four variables measuring interorganizational relations were used to describe emergency preparedness communications networks. These variables were (1) number of linkages with other organizations, (2) frequency of contacts with other organizations, (3) number of different forms of communication with other organizations, and (4) formalization of agreements among the organizations. Each of these variables was measured in both pre and post-disaster conditions. This provided eight measures of interorganizational relations to use in assessing network patterns. Table 6.8 presents the mean and standard deviation scores for the interorganizational variables.

The mean scores in Table 6.8 are aggregate measures of interorganizational relations in disaster communications. There was an average of four to five linkages for every organization in the communications network, both pre and post-disaster. This number of linkages was approximately one more per organization than for the social services network. Frequency of contact in pre-disaster conditions was about once per day, and in post-disaster conditions moved somewhat closer to once per hour. Variance in frequency of contact diminished in post-disaster conditions. This mean frequency was higher than for the social services network, especially for the pre-disaster measure. An average of two to three different methods of communication were used in both pre and post-disaster conditions. Interorganizational agreements tended to be explicit, but verbal rather than written. Formalization of agreements for the communications network was almost identical to the social services network.

As noted in the previous discussion of the social services network, interorganizational relationships are extremely complex social phenomena. Most studies have selected a single dimension along which to study such networks. The present study uses four separate interorganizational measures and two environmental conditions (pre and post-disaster) in order to come a bit closer to the actual complexity of these networks. The four separate interorganizational variables measure different aspects of the

emergency preparedness network. Distinctiveness of these dimensions for the communications network is demonstrated in Table 6.9, which presents a correlation matrix of the interorganizational variables.

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**Table 6.8 Communications Network: Mean and Standard Deviation Scores for Pre and Post-Disaster Measures of Interorganizational Relations**

	<u>Pre-Disaster</u>		<u>Post-Disaster</u>	
	Mean	S D	Mean	S D
Number of Linkages <sup>1</sup> (range=0-5)	4.4	0.9	4.4	0.8
Frequency of Contact <sup>2</sup> (range=1-5)	3.3	1.1	3.6	0.5
Communication Methods (range=0-7)	2.5	1.2	2.6	1.4
Formalization of Agreements (range=1-5)	3.2	1.4	3.1	1.4

<sup>1</sup> The number of linkages was elicited with a range of 0-10. However, because many organizations did not list more than five linkages, the range was restricted to 0-5. This also is consistent with how the linkage variable is reported for the social services network.

<sup>2</sup> Frequency of contact had a range of five levels in pre-disaster conditions (monthly, weekly, daily, hourly, and continual contact). For post-disaster conditions, the range was restricted to four levels, omitting "monthly" because it was not believed to be relevant.

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**Table 6.9 Communications Network: Correlation Matrix of Pre and Post-Disaster Interorganizational Variables**

	<u>Pre Disaster</u>				<u>Post Disaster</u>		
Number of Linkages							
Nature of Agreement	.26#						
Methods of Communication	.26#	-.02					
Frequency of Contact	.17	.25#	.34*				
-----							
Number of Linkages	.49*	.09	-.25#	.23			
Nature of Agreement	.49*	.72*	.08	.19	.11		
Method of Communication	.09	.09	.80*	.17	-.36*	.16	
Frequency of Contact	.05	.24#	.10	.08	-.16	.02	.09

\*  $p < .05$   
 #  $p < .10$ <sup>1</sup>

<sup>1</sup> The higher probability level ( $p < .10$ ) is included with with all of the correlational analyses of communication data because the number of communication organizations was small (N=34).

Twelve (43%) of the 28 correlations in Table 6.9 are significant at  $p < .10$  or lower. However, three of these correlations are between pre and post-disaster measures of the same variable, and these relationships are expected. Of the remaining nine correlations, only three are significant at  $p < .05$  or lower. While the variables have some

interrelationships, they are independent enough to be used as separate dimensions. The fact that these same interorganizational variables exhibited independence in the study of social services networks (above) further supports this conclusion. In fact, with independence of the variables established for social services, the relationships which appear here can be viewed as interesting findings.

For example, the strong ( $r = .49$ ,  $p < .01$ ) relationship between number of pre-disaster linkages and formalization of post-disaster agreements suggests that organizations having more linkages also have more explicit and more written agreements with the organizations they communicate with during a disaster response. A weaker ( $r = .26$ ,  $p < .10$ ) relationship between pre-disaster linkages and pre-disaster agreements reinforces this result. However, it is interesting that formalization of agreements is not related to post-disaster linkages. The picture which emerges from these results is that organizations tend to make formal agreements when they communicate with more organizations on a day-to-day basis. However, more post-disaster linkages are not associated with more formal agreements. Perhaps the partially-emergent nature of disaster response precludes a relationship between linkages and agreements from occurring. There may be limits to this form of rational planning in situations of high uncertainty.

In pre-disaster conditions, number of communications methods was positively associated with frequency of contact ( $r = .34$ ,  $p < .05$ ). It seems logical that more methods of communication would be associated with more frequent contact, however, this relationship does not hold in post-disaster conditions. The most likely explanation is that some methods of communication (e.g., written) do not play as great a role during disaster response, while other methods of communication (especially two-way radio) take on a much greater importance. In other words, under post-disaster conditions, the methods of communication might be restricted, but the frequency of contact might be as high or even higher. This interpretation is consistent with another significant finding, the negative relationship between post-disaster linkages and the number of post-disaster communication methods ( $r = -.36$ ,  $p < .05$ ). Apparently, organizations with more post links tend to have fewer post communications methods. This further reinforces the conclusion that some forms of communication take on much greater prominence during a disaster response. In fact, the organizations which undertake the most communication apparently use fewer communication methods.

Also of interest is the absence of a significant relationship between pre and post-disaster frequency of contact (while the other three interorganizational variables

correlated very significantly in the pre and post conditions). A similar result occurred for the social service network and it was possible to attribute the result to the different metrics used for frequency of contact scales in the pre and post conditions. However, for communications organizations, the pre and post scales used the same metric. Why then is no relationship found? Apparently, organizations which have a high level of contacts during day-to-day operations are not the same organizations which have a high level of contact during a disaster response.

In sum, it can be said that disaster response occurs in a highly turbulent, uncertain environment. Both organizations and forms of communication take on new roles and responsibilities in this environment, and there are limits to the degree of formalization and rational planning which can occur to facilitate these new roles.

### Network Descriptors

Network descriptions were further sharpened through correlation analysis.<sup>2</sup> Measures of 15 aspects of organizational structure and process were constructed. These 15 variables can be divided into three groups.

Five variables dealt with organizational operations. Three of these were general features of organizational operation: prominence in disaster communications, public vs. private funding, and formalization. Two additional variables dealt specifically with organization-volunteer relations: number of recruitment methods for volunteers, and number of ways of showing appreciation to volunteers.

Five variables dealt with staff size and composition: size of paid staff pre and post-disaster, size of volunteer staff pre and post-disaster, and an estimate of extent of volunteerism pre-disaster. Due to skewed distributions, it was not possible to use the numerical measure of extent of voluntarism or turnover (stability) variables in the analysis.

The last five variables covered aspects of capacity: number of communications functions, capacity for involvement in different kinds of disasters, past experience in different

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<sup>2</sup> For the communications network, only correlational forms of network analysis were undertaken.



kinds of disasters, improvement in disaster training, and preparedness (a composite measure of training and planning variables).

A correlation matrix of these 15 variables was calculated to assess multicollinearity. Eighteen (17%) of the 105 correlations were .10 or less; 75 (71%) were .30 or less; 96 (91%) were .50 or less; and 98 (93%) were .65 or less. Among the correlations which were above .50, all were inter-correlations between number of paid or volunteer staff both pre and post-disaster, the extent of volunteerism, and recruitment and appreciation of volunteers. These relationships were expected. All of the variables were kept in the analysis at this point under the assumption that the highly intercorrelated variables would be later eliminated with the planned multivariate analyses.

The next step involved an inspection of the zero-order correlations between the potential descriptors and the interorganizational network variables. Table 6.10 presents the correlation matrix of descriptor variables with interorganizational variables.

Thirty-two (27%) of the intercorrelations reported in Table 6.10 are statistically significant at .10 or less. Each of the interorganizational variables correlated significantly with at least one of the descriptor variables: number of linkages (pre=2/post=6); nature of agreement (pre=6/post=5); number of communication methods (pre=3/post=5); and frequency of contact (pre=4/post=1). Overall, there were a couple more significant correlations post-disaster (n=17) than pre-disaster (n=15), and there were more correlations of .30 or higher post-disaster (n=14) than pre-disaster (n=10). To the extent that a pattern exists for these results, it is somewhat similar to the pattern for the social service network (reported earlier in this chapter).

Of interest is the almost total absence of significant relationships for post-disaster frequency of contact (only one at  $p < .10$ ). What makes this finding especially noteworthy is that a very similar pattern occurred for the social services network (only two significant relationships, both at  $p < .05$ ). Why should so many descriptor variables be so unrelated to post-disaster frequency of contact for both the social services and communications network? One possible explanation for the communications network is that the variance for post-disaster frequency of contact is so restricted (standard deviation=0.5; see Table 6.8) that statistically significant

Table 6.10 Communications Network: Correlation Matrix of Pre and Post-Disaster Interorganizational Variables with Descriptor Variables<sup>1</sup>

	<u>Linkages</u>		<u>Method of Communication</u>		<u>Nature of Agreement</u>		<u>Frequency of Contact</u>	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	-.22	-.06	-.20	-.20	-.42*	-.47*	-.44*	-.05
2	.11	-.22	.38*	.40*	.57*	.47*	.41*	.18
3	-.04	-.16	.15	.37*	-.09	.05	.26#	-.21
4	.06	.30*	-.39*	-.33*	.09	.10	-.04	-.19
5	.10	.21	-.06	.01	-.03	.13	-.05	-.24#
6	-.16	-.05	.20	.16	-.17	-.13	.27#	-.02
7	.07	.34*	-.13	-.11	.24#	.15	.13	-.13
8	.08	.42*	-.30*	-.26#	.13	.14	-.07	-.17
9	.10	.15	.20	.22	-.16	-.02	.20	-.17
10	.25#	.37*	-.08	-.09	.37*	.30*	.16	-.06
11	.30#	.30*	.01	.02	.09	.35*	.03	-.23
12	.02	.36*	-.03	.01	-.04	.10	.14	-.19
13	.00	.08	-.04	.03	.10	.11	.15	.15
14	.15	-.02	.15	.25#	.41*	.22	.12	.16
15	.18	.10	.01	.18	.23#	.48*	.05	-.02

\* p < .05

# p < .10

<sup>1</sup> Due to the length of descriptor variable names, numbers have been listed to represent each variable. The variable corresponding with each number is as follows: 1-Prominence in emergency communication; 2=Funding type; 3=Organizational formalization; 4=Methods of volunteer recruitment; 5=Expressions of volunteer appreciation; 6=Pre-disaster paid staff size; 7=Pre-disaster number of volunteers; 8=Pre-disaster extent to which volunteers are used; 9=Post-disaster number of paid staff; 10=Post-disaster number of volunteers; 11=Number of communication functions performed; 12=Level of involvement in disasters; 13=Past experience with disaster response; 14=Improvement in training this year over last year; 15=Level of preparedness.

relationships do not emerge. However, the same cannot be said for the social services network (standard deviation=1.0, see Table 6.1). If variance is not the problem, it can only be concluded that frequency of post-disaster contact is simply not related to the descriptor variables used in this study, and possibly not to any set of predictor variables. It was already discovered (Table 6.9 above) that post-disaster frequency of contact is not related to pre-disaster frequency of contact. These findings together suggest a strongly emergent quality for post-disaster frequency of contact.

Also of interest, for both social services and communications, post-disaster linkages show a large number of significant relationships with descriptor variables. This pattern may indicate that organizations undertake day-to-day operations and preparedness activities with an eye toward post-disaster linkages. If this is an accurate interpretation, it provides empirical verification of the importance of experience, planning, and so forth. Just as post-disaster frequency of contact appears to be largely emergent, linkages may be largely anticipated and planned in advance.

This tension between planning and emergence is perhaps the single most critical issue in disaster preparedness and response. Results of this study suggest that the planning/emergence issue is complex. That is, some aspects of post-disaster networks appear to be more planned, while others appear to be more emergent. Moreover, the similarity between the pattern of the social services network and the pattern of the communications network supports the idea that, regardless of network type, some interorganizational dimensions may be more planned (linkages), while others may be more emergent (frequency of contact).

Related to the above, the communications network described in Table 6.10 has nine "matched" significant relationships in the pre and post-disaster conditions. In other words, on nine occasions, a descriptor variable was significant in both the pre and post-conditions. These matches might be expected, and they indicate that the same variable associations pertain before, as well as after, a disaster strikes. This is an indication that the networks which function following a disaster are not totally emergent, but rather are built on preceding relationships. However, it is also interesting that eight of the significant relationships in the post condition are not matched in the pre condition. Hence, an equally strong statement could be made supporting the emergent nature of the post-disaster network.

Turning to the descriptor variables, the organizational operations variables had a total of 14 significant relationships (mean = 2.8), with public funding leading this category at five significant relationships out of a possible eight. This finding is similar to the prominence of "legal authority" as a descriptor in the social services network (Table 6.3). The prominence variable (primary vs. secondary disaster communication organization) had three significant relationships, all with  $r > .40$  and  $p < .01$ . This corresponds with the organizational "type" variable in social services network, which was also very important.

The size, proportion, and stability descriptor variables had a total of ten significant relationships (mean = 2.0). However, the three volunteer variables, number of volunteers pre and post and extent of volunteerism, accounted for nine of the ten significant relationships in this category. This finding is a departure from the pattern in the social services network, where the volunteer variables do not achieve as many significant relationships. Could it be that volunteers are more important in communications than in social services?

The capacity variables had a total of eight significant relationships (mean = 1.6), with the involvement and experience in disasters variables together accounting for only one of the significant relationships.

As with the social services network, the overall zero-order pattern is complex and additional analysis was necessary to draw conclusions. A strategy of multiple regression was again chosen to eliminate statistically overlapping results and reduce the complexity.

Semi-partial correlation coefficients and t-tests of significance, calculated through multiple regression equations, were used to identify the descriptor variables most strongly associated with each of the interorganizational variables. Eight forced-entry regression equations were established with the descriptors as independent variables and the interorganizational variables as dependent. All 15 descriptors were applied to the four interorganizational variables reflecting the post-disaster condition. It did not make sense conceptually, however, to use three of these descriptor variables in analysis of the pre-disaster interorganizational variables. Thus, 12 descriptors were applied to the four pre-disaster dependent variables. The semi-partial correlations were examined for all descriptor variables in relation to each interorganizational variable separately. Those which had a magnitude of .10 or larger were entered into the equation. The criterion of statistical significance of semi-partial correlations used in the new

equation and any subsequent equations was .10 or less. Semi-partial correlations indicate the strength of association and the relative importance of each descriptor variable. Table 6.11 presents the zero-order and semi-partial correlations for each of the interorganizational variables and the key descriptors identified in the series of regression analyses.

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**Table 6.11 Communications Network: Zero-Order (top number) and Semi-Partial (bottom number) Correlations of Pre and Post-Disaster Interorganizational Variables With Key Descriptors**

	<u>Linkages</u>		<u>Method of Comm.</u>		<u>Nature of Agreement</u>		<u>Frequency of Contact</u>	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Prominence in Communication							-.47*	-.44*
							-.37*	-.44*
Funding Source					.57*			
					.52*			
Volunteer Recruitment			-.39*	-.33*				
			-.51*	-.49*				
Volunteer Appreciation			-.06	.01				
			.33#	.36*				
Involvement in Disasters		.36*						
		.36*						
Training Improvement					.41*			
					.34*			
Level of Preparedness							.48*	
							.39*	

\* p < .05  
# p < .10

The findings in Table 6.11 help clarify the communications interorganizational network, and also demonstrate the complexity of the network. Seven of the fifteen original descriptor variables emerged as associated significantly with one or more of the interorganizational variables. Two of the seven descriptor variables had only post-disaster relationships; two had only pre-disaster relationships; and three had both pre and post-disaster relationships. Specifically, preparedness and involvement in different types of disasters were associated only with post-disaster interorganizational variables. Public funding and improvement in training were associated with two of the pre-disaster interorganizational variables. Prominence in disaster communication (primary vs. secondary), number of methods of volunteer recruitment, and number of methods of expressing appreciation to volunteers are each associated with one pre- and one post-disaster interorganizational variable. As with the social services network, different kinds of descriptors are needed to understand interorganizational relations under different environmental conditions.

Looking at the categories of descriptor variables, "organizational operations" was the most well represented category (Table 6.11), with a total of seven significant relationships with the interorganizational variables. Four of these were for volunteer recruitment and appreciation. Thus, the strength of volunteer variables in communication network associations remain. The "staff size and composition" category has no significant relationships at all. And the "capacity for disaster communications" category has three significant relationships.

Also of interest, in only two cases was there a significant relationship both pre and post-disaster for a given descriptor variable and a given interorganizational variable. Number of methods of volunteer recruitment was negatively associated with number of methods of disaster communication, both pre and post-disaster, and number of methods of expressing appreciation to volunteers was positively associated with the same interorganizational variable, both pre and post-disaster. Regarding recruitment, it might be concluded that the organizations which do not recruit volunteers at all (e.g., police, disaster offices) also have the largest range of communications possibilities. However, this conclusion does not seem consistent with the finding that organizations with more communication methods also do more to express appreciation to volunteers. This result is difficult to explain, and is even more confusing in light of the strong ( $r = .72$ ) positive zero-order correlation between the recruitment and appreciation variables. Perhaps, more interesting than an exact explanation of these

relationships is the finding that there are only two such associational consistencies for the same variables both pre and post-disaster. This result indicates that the post-disaster network is even more emergent than the correlational analysis (Table 6.10) indicated. The reader may recall that there was only one such relationship for the social services network (see Table 6.4), which reinforces this conclusion.

Looking at other significant "organizational operations" relationships, the prominence in disaster communications variable is associated negatively with pre-disaster frequency of contact and post-disaster formalization of agreements. This finding is probably explained in large part by the number of volunteer organizations which are prominent in disaster communications, especially the ham and CB groups and the militarily-linked MARS groups. These volunteer organizations tend not to communicate regularly with other organizations on a day-to-day basis and tend not to work under formal agreements during a disaster response. The public funding variable is positively associated with pre-disaster formal agreements because many of these organizations have publicly mandated formal relationships with other organizations.

Turning to the significant relationships in the "capacity" category, estimated capacity to become involved in various types of disasters is positively related to the number of post-disaster linkages, which seems to make sense. Improved training is positively related to more pre-disaster formal agreements, possibly because much of the improvement in training is occurring in public agencies, through the expanded training efforts of Missouri SEMA. Preparedness is positively related to post-disaster formal agreements, which is not surprising because the preparedness variable incorporates planning, and planning often leads to more formal agreements.

Significant relationships are scattered across the interorganizational variables, although it is perhaps noteworthy that pre-disaster linkages and post-disaster frequency of contact have no significant relationships. The absence of relationships for frequency of contact has already been discussed. The absence of significant relationships for pre-disaster linkages is more of a surprise, although this category had only two zero-order significant relationships (Table 6.10). Looking at the other interorganizational variables, we can conclude only that significant relationships are rather evenly distributed and, therefore, that the variables important to network relations differ depending on the network dimension of interest.

Although these results may, at first glance, appear scattered, and perhaps, therefore, inconsequential, the amount of variance explained by the relationships in Table 6.11 provides a different picture. The two relationships under pre-disaster formal agreements by themselves yield a multiple R of .66 ( $R^2 = .44$ ). The two relationships under pre-disaster methods of communication by themselves yield a multiple R of .51 ( $R^2 = .26$ ). The two relationships under post-disaster formal agreements by themselves yield a multiple R of .61 ( $R^2 = .37$ ). And the two relationships under post-disaster methods of communication by themselves yield a multiple R of .49 ( $R^2 = .24$ ). Thus, these relationships are explaining rather large portions of the variance in the interorganizational variables. The fact that these relationships tend to be "all over the map" is not a comment on the lack of definitiveness of the results, but rather is a reflection of the complexity of the interorganizational relationships.

In general, the sometimes similarity of patterns across the social services and communications networks is another noteworthy feature of the results reported in this chapter. The two networks display rather similar interorganizational patterns even though they represent two different populations and were assessed using two different questionnaires at two different points in time. The similarity of patterns is suspect in uncovering some basic features of disaster preparedness networks, even though these networks are exceedingly complex and interpretation of the findings remains, at this point, somewhat speculative.

#### A Note on Cooperation and Conflict

In addition to the network information described above, an attempt was also made to assess cooperation and conflict in the communications network. This assessment was primarily through observation in the field and use of several open-ended items on the communications interview guide. Overall, there appears to be a strong value placed on cooperation, participants in the network say that organizations cooperate effectively, and generally this appears to be the case.

When asked to give an example of cooperation, 17 of 34 respondents gave a reply that could be classified as "sharing resources," generally personnel or equipment resources. Eight gave a reply that could be classified as "monitoring and relaying information." Five gave a reply that could be classified as "coordination and management." Three organizations gave some other reply. It is interesting that "sharing resources" was mentioned so frequently. As noted in Chapter 5, communications equipment, by itself, is seldom lent



or borrowed. Communications personnel tend to stay with their equipment. What tends to occur is that personnel and equipment, as a unit, are shared among organizations.

This sharing of resources takes two basic forms. In one form, volunteers such as ham operators almost literally become part of another organization during the disaster response. For example, the National Weather Service Volunteers go to the U.S. Weather Bureau and provide both the personnel and the equipment to support the Weather Bureau's communication function.

The second form of cooperation is more interorganizational. Organizations maintain their individual identities but function cooperatively in communications through a Emergency Operations Center or some other coordinating mechanism. This meshing of resources is a major characteristic of disaster communications and is especially prominent in coordination of the response at the local level, where a wide variety of communication organizations and technologies may be patched together to form a system or "net." For example, St. Louis County now has a mobile communications trailer which is capable of patching together the technologies of many different organizations.

When asked to describe factors that facilitate cooperation, 11 of the 34 respondents gave a reply that could be classified as a "spirit of cooperation." Eight others gave a reply that could be classified as "central coordination." And 10 additional replies were scattered among other factors, such as "planning and designation of responsibility," "simulations and exercises," and "compatibility of equipment." It is interesting that 11 organizations first mentioned "spirit of cooperation," rather than less normative, more tangible factors such as central coordination or disaster exercises. The question was not intended to tap this normative dimension, and its strong appearance indicates that the value of cooperation is well-established in disaster communications in St. Louis, or at least people are trying to convince one another that this is the case.

The second strong theme in "factors that facilitate cooperation" has to do with central coordination and designation of responsibility. This theme has emerged repeatedly throughout the period of the research project. In part, it was thought that this theme arises from the formal, hierarchical nature of the organizations which dominate disaster response (the FEMA-SEMA structure, police departments, fire departments, the National Guard, etc.). These organizations heavily emphasize authority and fixed procedures. However, this emphasis may not always be helpful

in preparing for disasters. Due to lack of warning and the violent nature of many disasters, key authority figures or key authority organizations may not be available to direct the response. Disasters require an authority structure that is flexible enough to adapt to unforeseen events.

When asked to give an illustration of conflict in disaster communications, 11 said that there was no conflict. Six gave a reply that could be classified as "lack of clearly defined channels of authority." Four mentioned problems in "access to frequencies" or a "need for more frequencies." And 11 other replies were scattered among other types of conflict, such as "lack of awareness of each other's function," "jurisdictional conflicts," and "lack of coordination among communications agencies." It is striking that 11 respondents said there was "no conflict." This is believed to be plain Pollyanna. Some degree of conflict in disaster communications is nearly inevitable, and, for one reason or another, some respondents either were overlooking conflicts or did not wish to mention them.

Among the examples of conflict which were mentioned, central authority again emerges as a prominent theme, and a technological issue, access to radio frequencies, is mentioned. As indicated in Chapter 5, the technological basis for disaster communication is absolutely critical. Without proper equipment and access to frequencies, communication cannot be effective. However, research results once again suggest that technological considerations are not the primary issue in disaster communications. There is always room for improvement in the equipment -- and the equipment is always being improved. But this by itself is only a necessary, not sufficient, prerequisite to effective communications. Social and political factors determine how successfully the technology is used.

When asked to describe what could be done to reduce potential conflict, 11 respondents gave replies that could be classified as "more emphasis on planning and coordination." Six mentioned "more frequencies" or "greater access." Four suggested a "central coordinating unit." And three additional respondents gave replies which were scattered among other suggestions. The prominence of "planning and coordination" is very positive here. There is no doubt that more planning and coordination is needed. And it can be hoped that more rigidly structured concepts such as "clearly defined authority" or "central coordinating unit" did not emerge at the top of the list.

Overall, a remarkable degree of cooperation was found in disaster communications. The jurisdictional issues which were mentioned in the first chapter (city vs. county, municipalities vs. county) are undoubtedly barriers to communications planning, and, hence, limit preparedness, but there is little indication that these factors would be barriers to actual communication when a disaster occurs. Rarely was it heard of organizations purposefully acting in their self-interest, or for narrow political purposes, to the detriment of an overall response effort. When the time comes, people and organizations tend to work together.

### Subnetworks by Communication Function

Relatively early in the study of the communications network, a more complex view of what disaster communications were all about was developed. It was seen that these communications occur for a variety of distinct purposes, and the perception was that different communication functions often had different actors. It was suspected that different communication functions were organized into identifiable subsystems or subnetworks, perhaps loosely coupled into an overall disaster communications network. If this picture could be substantiated, it was felt that a significant contribution to how disaster communications were typically conceptualized was being made.

As it turns out, full success was not gained in substantiating this more complex communication pattern. However, a possible problem was in the sensitivity of the instrumentation. We believe that the communications network might be usefully viewed as interrelated subnetworks. In this section, the observations and original conceptualization are briefly described, and quantitative results are viewed which speak to this issue.

Based on experience in the field, six possible subnetworks were identified. These were (1) notifying and warning the public, (2) communicating damage assessments, (3) initiating and coordinating disaster response at the local site, (4) coordinating disaster response between the local site and regional and national agencies, (5) communicating on a one-to-one basis with relatives and other concerned individuals, and (6) communicating with the general public about disaster response activities. It may be helpful to discuss each of these in turn:

Notifying and warning the public. If there is forewarning in a disaster situation, the communication function of notifying and warning the public appears to be

carried out primarily by government agencies such as the the U.S. Weather Bureau. The Bureau acts through the Emergency Broadcast System (EBS), which in turn operates through commercial radio and television stations. In the case of weather disaster, amateur radio operators play a key role as trained "spotters" of tornadoes and severe weather. Another "channel" of warning goes through local disaster preparedness offices and into siren or loud speaker systems, if these exist. This function would seem to be fairly well-defined and organizational participants are well-known. And, although procedures for this function tend to be standardized, the warning function does not always go completely smooth. For example, one (unsubstantiated) report that the key EBS station in the St. Louis area had been known to take advantage of its position by "scooping" the disaster story before sending it out to other stations in the EBS system.

It might be useful to note here that another important communication function, public awareness and education, also occurs prior to disaster but is different from warning. Public awareness and education occurs over an extended period of time. This function, although not dealt with in this study, involves yet a different subset of organizations including, for example, the school system.

Communicating damage assessments. The first major communication function following a disaster is to assess and report the extent of damage, both physical and human. This function is very critical because, based on damage reports, appropriate resources can be mobilized. Unfortunately, early information on damage tends to be unreliable. One official put it this way: "Immediately after a disaster, 50 percent of the information is inaccurate." Therefore, the major disaster response agencies have established specific, structured damage assessment procedures, and people are trained in these procedures. Official damage assessment and communication is carried out primarily through the office of the local disaster official, who reports to the county, which reports to SEMA, which reports to FEMA, as needed. On the human side, the Red Cross has similar procedures for assessing and reporting the extent of human need through its hierarchical structure.

Initiating and coordinating the response at the local site. Initiating and coordinating the response at the local site involves communication among several organizations, led by the office of the local disaster official. Generally through an Emergency Operations Center (EOC), representatives of the mayor's office, the emergency preparedness office, police, fire, water department, street department, and the Red Cross coordinate the local response. Amateur radio operators often support this major communication function and may be

trained as back-ups on all of the communications equipment. Participating organizations are designated in advance and have generally practiced their response activities. The EOC will generally have a large status board so that all parties are visually informed of major problem areas, deployment of resources, etc. Radio communication is formed by a team of dispatchers, generally in an area separate from other activities to facilitate clear transmission of messages. The system has to be well planned, yet flexible, because it must respond to unexpected events and coordinate unexpected resources.

Outside of the EOC, at disaster problem areas, communication may be more chaotic. Typically, more information comes into the EOC than goes out. Updating on the status of events is a continual problem. In some cases, volunteer citizen band communication groups may be helping with the response and these may not be well-integrated into the overall communications system.

In a full-scale disaster simulation in one community, there was an opportunity to watch an EOC in operation. One of the most striking features about this simulation was the extent to which organizations understood their respective roles in the response. Communication was not always perfect - indeed, communication was identified as the major problem in the simulation debriefing -- but key actors knew what was supposed to happen, even if events sometimes interfered with a textbook response.

Coordinating the disaster response between the local site and regional and national agencies. If a disaster is more severe, local officials (in St. Louis County, for example) would call in the County Office of Civil Preparedness, if still more severe, SEMA would be called, and if needed, FEMA would be asked to direct the response. In a major earthquake disaster, for example, it is likely that FEMA would direct the response. As mentioned above, the Red Cross has a similar hierarchical structure of local, regional, and national responsibility. This hierarchical response arrangement requires effective communication between the local site and state, regional, and national offices. This critical communication function appears, in important respects, to be different from actual coordination of the local response. Typically, there are problems in communication across levels within the same mega-organizational structure.

Communicating on a one-to-one basis with relatives and other concerned individuals. In any major disaster event, there is an immediate need on the part of thousands of individuals and families to communicate with relatives or

others who may be concerned about their well-being. This communication "traffic" immediately clogs existing telephone lines. Several organizations play important roles in facilitating this communication function. These are the telephone company, amateur radio groups, and the Social Services Department of the Red Cross. The latter regularly performs individual communication services for military personnel around the world and, in a disaster event, these resources are used for individual civilian communications.

Communicating with the general public about the response effort. After the response is underway, the general public must be informed about the extent and severity of damage, current risks, precautions they should take, areas to avoid, and how they might help those who are more severely affected. Once again, this communication function occurs primarily through the commercial media (radio, television, newspapers), but unlike the warning function, EBS does not play a role. Disaster response organizations contact the local media (or vice versa). A well-planned EOC, for example, will have a person and telephone assigned to the media. In the case of the Red Cross, information going to the general public about needed supplies, financial resources, and so forth goes through the Public Relations Office to radio and television stations.

It was also observed that this function of communicating with the public often serves another communication purpose. Organizations, both public and private, use these opportunities to project a positive public image. Indeed, there are occasions when organizations compete for recognition from the media. Perhaps, it is no accident. For example, that Red Cross communicates with the public through an office called "Public Relations."

Quantitative results on subnetworks. What appeared to be the communications "reality" from observations in the field was not well reflected in quantitative results. On a ten-point scale (0 to 9) each organization was asked to rate the extent to which they were involved in each of the six disaster communication functions described above. As expected, of course, the organizations would fall into different functional categories. However, instead, organizations tended to rate themselves highly on a number of different functions (these results are reported in Chapter 5). Not surprisingly, therefore, the six functions were highly intercorrelated -- 11 (73%) of the 15 zero-order correlations were significant at  $p < .10$  or less. With such a high degree of intercorrelation, analyses could not be carried out with the variables as they were.

A close look at the correlation matrix led to the following decisions: (1) "Initiating and coordinating the disaster response at the local level" was combined with "initiating and coordinating the disaster response at the regional and national level." This new variable was called "coordinating response." (2) "Notifying and warning the public" was combined with "communicating with the general public." This new variable was called "communicating with the public." (3) "Communicating one-to-one with relatives" was omitted because it was intercorrelated with all of the other five variables. And, (4) "communicating damage assessments" was omitted because it was intercorrelated with the newly created "public" variable. Following these rather harsh but necessary simplifications, only two communication function variables remained: coordinating response and communicating with the public, but at least these were statistically distinct.

At this point, the story becomes more encouraging. First, the two communication function variables were correlated with 14 of the descriptor variables (the descriptor variable "number of communication functions" was omitted because this variable was a composite of the communication function variables). Ten (36%) of the 28 zero-order correlations were significant at  $p = .10$  or less. In no case did both communication function variables correlate in the same direction significantly with a given descriptor variable. The largest correlations were "communicating with the public" with "involvement in disasters" ( $r = .54$ ,  $p < .001$ ), and "coordinating response" with "preparedness" ( $r = .48$ ,  $p < .01$ ). The former indicates that organizations which communicate with the public do so for all types of disasters. The latter indicates that organizations which coordinate disaster response also undertake the most training and planning.

Turning to the interorganizational variables, six (38%) of a possible 16 zero-order correlations were significant at  $p = .10$  or less. Three of these were pre-disaster conditions and three were post-disaster conditions. In no case did both communication function variables correlate in the same direction significantly with a given interorganizational variable. The largest correlations were "coordinating response" with "post-disaster formalization of agreements" ( $r = .56$ ,  $p < .001$ ), and "communicating with the public" with "post-disaster frequency of contact" ( $r = -.49$ ,  $p < .01$ ). The former indicates that organizations which coordinate response also have the most formal agreements. The latter indicates that organizations which communicate with the public tend not to communicate with other organizations very frequently during disaster response.

At this point, there is evidence that these two communication functions, coordinating the response and communicating with the public, are undertaken by different subsets of organizations and are each significantly related to several but different descriptor and interorganizational variables. This finding, while not terribly dramatic, provides empirical support for the idea of subnetworks in disaster communications. With a more refined conceptualization and different design of the questionnaire, it is thought to be likely that a larger number of functional subnetworks could be identified.

### Summary

Each of the techniques employed had advantages and disadvantages. Correlation analyses had particular merit in sorting out some of the network complexities and identifying potentially useful variables, but these analyses provide a compartmentalized picture of the network. Graphic depictions on representational maps provided excellent overall impressions of the networks, however, these descriptions are static and limited to two or three variable accounts. Abstract graphic depictions provided greater control in illustrating aspects already understood; they would have little, if any, use in exploratory research.

Blockmodel and cluster analyses offer alternative methods to discover homogeneous groupings within networks, but both are complicated and difficult to interpret. Identifying blocks and clusters is only a first step in network analysis, and therefore these techniques must be seen as a means to an end, not an end in themselves. What they do offer is a kind of window into the data and if carried far enough they may provide insight for the development of causal models for future interorganizational network analyses.



## CHAPTER 7

### CONCLUSIONS

The research described in this report leads to many possible conclusions. Some of these conclusions are quite well-founded, while others are more speculative. In this final chapter, we present a limited number of conclusions that are well-founded. Conclusions are presented in three areas: (1) theoretical contributions, (2) recommendations for future research, and (3) practice guidelines.

#### Theoretical Contributions

A major objective of the project has been to take steps toward development of theory for understanding disaster preparedness. Drabek et al. (1981) observe that, "Management of such differentiated and loosely coupled emergent networks must be viewed as a unique and legitimate problem for which existing theories of private firms and public bureaucracies have limited applicability." A major objective has been to use the empirical foundation of the study to suggest theoretical perspectives that may be helpful in understanding and developing knowledge in this area. The five most important ideas for theory construction are suggested.

- 0 Conceptualize different networks for the various preparedness functions.

Social services and communications are two distinct, although interrelated, networks. This point may seem elementary, but it was not anticipated at the beginning of the project and it has implications for how disaster preparedness

networks are conceptualized. Because there are a number of important and distinct functional areas in disaster preparedness and response, the overall network is no doubt a very complex structure. A promising direction might be to combine elements of functional and neo-functional sociological theory (Parsons and Shils, 1951; Alexander, 1981-84) with network analysis. Political-economy views of organizations (Zald, 1970; Wamsley and Zald, 1973; Benson et al., 1973; Benson, 1975) may also contribute to assessing power and position among functional subnetworks.

**0 Inter-relate multiple network dimensions.**

Results of the study leave no doubt that a given network looks very different depending upon which interorganizational variable is being considered. Moreover, each interorganizational variable is associated with different sets of organizational variables. In short, networks are composed of multiple dimensions which are associated in complex patterns. In light of this, it is a gross oversimplification to conceptualize networks along only one interorganizational dimension, as many studies have done. Nor should it be taken for granted, as Benson et al. (1973) seem to suggest, that several interorganizational dimensions are likely to be "balanced." That is, if one is "adequate," others are likely to be adequate as well. We have found no such consistency. The complexity of multiple interorganizational dimensions is difficult to handle in a research project, but doing so enhances both the theoretical and practical possibilities for useful results.

**0 Shift from organization-specific to organization-type networks to expand the basis of comparison and generalizability.**

Network patterns are defined by organizations having a relationship along several dimensions. The complexity of the network pattern increases as new linkages are added. Because of the complexity of describing and graphically presenting organization-specific patterns, it was found that collapsing specific organizations into types provided a useful extension of organization-specific analysis. The organizational types network extends generalizability of the findings because organizational types are common to all moderate and large metropolitan areas. In addition, the smaller number of nodes simplifies the analyses of network relations which makes it easier to understand complicated patterns. The shift from

organization-specific to general types for analysis of larger networks, therefore, holds promise for generalizing findings of networks.

- 0 Use idea of "planned emergence" to integrate planned and emergent features of disaster response networks.

The importance of emergent networks, as suggested by Drabek et al. (1981), has been further documented. But, in a disaster situation, the multiorganizational network which operates will be to some extent planned and to some extent emergent. The concept of "planned emergence" refers to a network's capability to emerge in a variety of forms depending upon the characteristics of the emergency situation. Theoretically, this idea can be related to network improvisation and to the concepts of emergent systems and temporary organizations (Quarantelli, 1977; Gillespie and Perry, 1976).

However, unlike some of the earlier conceptualization of emergence by observers such as Clifford (1956), Form and Nosow (1958), Warheit (1968), and Brouillette (1971), results of the present study indicate that the disaster response pattern is not altogether informed and spontaneous. Large and basic structures of the response are both formal and planned. Therefore, looking at these systems as totally emergent is a misrepresentation. Disaster response systems are both planned and emergent. This conceptualization is consistent with the findings of Raker and Friedsam (1960), M & H Engineering and Memphis State University (1974), and Drabek et al. (1981; 1982).

Planning vs. emergence suggests issues of balance and integration. The appropriate balance of planning and emergence in any given situation depends on both the degree of predictability and the expected impact of a disaster event. To the extent that a hazard is predictable, there is a greater potential for the planned component of networks to become highly developed. And to the extent that a predictable hazard is expected to be of major proportions (catastrophic), there is greater incentive to develop the planned component of multiorganizational response. Emphases on both planning and emergence facilitates integration of the different forms.

- 0 Conceptualize optimal levels of network development.

In many respects, the emergency social services network in St. Louis is not well developed. While this is not a great surprise, it does seem inconsistent with the crisis nature of

many social service activities. Social workers are often trained in crisis intervention techniques and these skills would be especially useful in disaster situations. Yet, some organizations which provide these services do not view their organization as disaster-relevant. This finding suggests the idea of network development vs. underdevelopment. Underdevelopment might be defined as a situation where available resources are not effectively incorporated into the network. It seems likely that some interorganizational networks use resources better than others. Of course, networks can also be overdeveloped. In preparedness networks, much attention is placed on cooperation and coordination, with an emphasis on developing more and more linkages between the organizations in the network. More linkages are better to the extent that they serve a useful purpose and mechanisms are in place to effectively and efficiently use them. More theoretical work is needed in conceptualizing optimal levels of network development.

#### Recommendations For Future Research

Many of the suggestions that could be made for useful directions in interorganizational research have already been made by others (Drabek et al. 1981; Gillespie and Miletic, 1979b; Mulford, 1984). The recommendations offered here are limited to the most important ones stemming directly from the findings of this study. The study provides clear evidence to suggest several productive directions for future research.

- 0 More research should be done to confirm and refine the concept of "Integrated Emergency Management System" (IEMS).

A surprising finding in the current project was that the vast majority of organizations in both the social services and communications networks did not greatly differentiate their preparedness by type of disaster. The idea of an Integrated Emergency Management System (IEMS) seems to be operative in St. Louis. Except for civil disturbances and chemical spills, the networks are about equally prepared regardless of disaster type. Therefore, it may not be particularly useful to undertake future studies which attempt to differentiate networks by type of disaster. It makes more sense to conceptualize studies and organize findings in relation to common resources than in relation to different disaster agents. Area-wide studies of networks are needed to identify structural patterns conducive to further promotion of IEMS.

- 0 More studies of organization-specific networks should be done using ordinal and interval level measures of interorganizational relations.

Interorganizational instrumentation was developed to be straightforward and easy to complete, yet provide a precise basis for network analysis. The instrument developed is a contribution to network research methodology. Each organization was asked to list, in order of importance to them, at least two and no more than ten of the most important organizations with which they work, first on a day-to-day basis and then during a disaster response. Three questions followed this list and were located in close proximity so that the original list could be referred to, organization by organization. Moreover, the three interorganizational variables were designed with scales of four to seven response points or categories. The instruments allow collection of network data on an organization-specific basis and with ordinal and interval measures for each interorganizational variable. Although the analysis to date only "scratches the surface," the data collected with this instrument permit more refined network analyses than has been possible with instruments reported thus far in the literature (Morrissey et al., 1982).

- 0 Studies of preparedness networks should use disaster scenarios to provide a uniform basis for examining perceived response patterns.

The advantages of using a disaster scenario outweigh the disadvantages, and, with additional research, comparisons between actual and perceived response networks would be possible. The disaster scenario was useful in eliciting "post-disaster" information. At first there was skepticism about the validity of scenario-based responses, so special attention was given to making this portion of the questionnaire as valid and realistic as possible. "Worst case" scenario methodology was rejected in favor of a region-wide moderate disaster scenario -- an earthquake -- because (a) it was believed that most of the organized volunteer groups would report a complete lack of preparedness if presented with a catastrophic disaster, thus restricting variance in our measures, and (b) the wide-scope moderate disaster would maximize the need for interorganizational coordination across the social, political, and economic boundaries of the metropolitan area. To assure validity, the

earthquake scenario was written in line with the empirical damage assessment literature and was pre-tested with local emergency management officials.

- 0 More time than is usually allocated in survey research should be allowed to collect data on network populations.

Because the research goal was to describe network characteristics, it was necessary, insofar as possible, to assess the entire population of organizations. This required (1) immersion/familiarity with the field, and (2) persistence. Numerous calls were made, letters sent, new questionnaires were sent when old ones had been "lost," personal visits to offices were made, meetings were attended to contact people, and one person's home was visited. This process of data collection is very time consuming and, therefore, researchers doing network studies which examine entire populations of organization should allow for this in developing their study plans.

- 0 Longitudinal studies of networks are needed to capture dynamic qualities and assess the effects of changes in key roles or organizations.

The design of the current project was cross-sectional. It was intended to describe interorganizational networks, but not to trace changes in those networks over time. Although the organizations in the network were relatively stable, some changes in key positions were encountered. As a result of this dynamic quality, network characteristics are likely to be different when assessed at different points in time. This raises the questions of how much, in what ways, and in what patterns these network changes occur. The only way to systematically address these questions is through longitudinal research designs in which the same networks are assessed at different points in time.

#### Applied Conclusions and Practice Guidelines

In a bluntly worded comment in the Natural Hazards Observer, La Valla and Stoffel (1983) note that "much time, effort, and money continues to be spent on natural hazards research. Unfortunately, however, the volumes of valuable research findings and conclusions often are not disseminated to, or are ignored by, the emergency coordinators, planners, responders, and the general public who could benefit." La

Valla and Stoffel then detail some of the problems in using disaster research findings. These include: (1) results that are too "scientific" or too vague for practitioners; (2) limited dissemination of research findings; (3) resistance on the part of practitioners to dissemination of research results for political or personal reasons; (4) frustration, and hence resistance, on the part of practitioners who perceive that scarce dollars are spent on research rather than practice; (5) perceptions on the part of emergency managers that much research is only for the self-gratification of the research community; and (6) emergency management and training programs often do not use research results. These and other sharp criticisms are often heard among the emergency management practice community. In the research reported here, recognition has been given to the potential pitfalls between research and practice and efforts have been taken to reduce the problems and enhance the usefulness of results.

Involvement in the field during the course of the project brought not only sensitivity of the concerns of emergency managers, but also an enhancement of credibility among practitioners. Skepticism of research was encountered at the beginning of the project, however, with continued meetings, listening, and explanation and discussion of our work, the project moved into a position of acceptance and trust. In fact, after a time, the project team developed a reputation of always being at any meeting where emergency management was discussed. These hundreds of hours in the field were well spent. As a result of this commitment to relevance for the practice community, it is believed that the project will be able to more effectively meet its final objective: to interpret and transfer research findings to emergency managers through the development of practice guidelines.

- 0 The critical role of volunteers should be more clearly recognized and more sophisticated systems for identifying, recruiting, training, motivating, using, and rewarding volunteers should be developed.

Results of the study confirm that organized volunteers are a critical resource in disaster preparedness. Because of the uncertainty of disaster occurrences, it is unrealistic and potentially wasteful to rely only on paid staff to respond to an event which may or may not occur. While paid staff may be seen as the first line of defense in a disaster situation, effective preparedness for either social services or communications clearly does not and cannot occur without volunteers. The Red Cross does a very good job in this area. However, there are other, perhaps complementary, models worth considering. As mentioned in the introductory chapter, some

countries have initiated systems of civilian national service in which disaster relief is one of the service options (Sherraden and Eberly, 1982; Landrum, 1982). At the public policy level, a nationwide Disaster Corps might be one institutional mechanism to overcome inadequacies in training and channeling voluntary efforts in disaster response.

- 0    **Emergency social services planning should make a greater effort to identify resources, contact peripheral or potential service providers, and facilitate their entry into the preparedness network.**

Some social service organizations are much more involved than others. In general, the network is underdeveloped in the sense of taking advantage of existing resources. Related to this observation is the need to know which of the peripheral organizations are likely to emerge to assist in social services, even though they may not now be part of the day-to-day network.

One of the clearest findings in the social services network was the difference between emergency management organizations and social service organizations. This bifurcation surfaced in virtually every type of analysis undertaken. One clear example in the field was the split between emergency managers and social service providers on the newly-formed Disaster Resource Council. In this situation, social service organizations felt that it was necessary to meet separately so that they could address their concerns. This seemed, in some ways, to defeat the purpose of the Disaster Resource Council, which was intended to draw different organizations and functions together.

The study found that emergency management and social service organizations have something to offer each other in promoting preparedness. Emergency managers demonstrated a greater understanding of the chain-of-command through the various levels of governmental agencies involved in disaster responses. On the other hand, social service organizations seem to be much more adept at recruiting, training, and motivating volunteers. Communication and training mechanisms should be developed which allow these types of organizations to work together and draw on each other's strengths.

- 0    **Because the spirit, if not the letter, of the IEMS concept is well-established, it should be used as a basis to launch increased development of a full area-wide disaster preparedness network.**



Apparent familiarity with the IEMS concept was more widespread than anticipated, but when asked to describe what IEMS means, some organizational representatives were not able to give an accurate definition. These, typically, were the social service personnel. This was not the case among emergency management officials, who were generally knowledgeable about IEMS. The active training program of The Missouri State Emergency Management Agency (SEMA) has been effective in introducing IEMS to emergency managers. Even among organizations that did not know about IEMS, however, the spirit of this concept was widespread. That is, most organizations said they were prepared to respond to many types of disasters. We did not find different networks for different types of disasters. As one official of the Red Cross put it, "a disaster is a disaster."

- 0 Emergency managers in the St. Louis area should review and consider flexible response systems which take into account the jurisdictional blindness and uncertainty of disaster situations. Such a system should be adopted and its use should be regularized through application to many different situations, large and small.

The theoretical concept of planned emergence has direct practical implications, both descriptively and prescriptively. There is great fluidity in preparedness networks and the circumstances of a particular disaster determine, in many ways, how roles knit together to form a response pattern. Planned emergence describes a system of disaster response which is a planned, yet flexible, system which can assume different patterns depending on the needs and constraints of a particular emergency situation. One example of such a structure is the Incident Command System (ICS) model which has been adopted in California (Boise Interagency Fire Center, 1983). This system is based on prescribed roles and is designed so that different individuals and organizations can be assigned to different roles as needed. While the ICS model was developed as an integrated response approach to range and forest fires which burn across jurisdictional boundaries, it can easily be adapted to all disasters, large and small, so that the system can be commonly used and accepted. This regular use of a planned-emergent system is vital to its acceptance in a major disaster situation.

- 0 Continuation of multi-state planning in the central United States is desirable. Missouri SEMA should enhance efforts in joint City-County planning in the St. Louis metropolitan area. St. Louis County should make a greater effort to communicate constructively with

emergency managers in the municipalities. The Red Cross and other leading service providers should clarify with local units of government their role(s) and anticipated procedures in a disaster situation.

This report has noted several categories of political fragmentation which interfere with disaster preparedness. These jurisdictional barriers are long-standing and they will not be easily overcome, however, continued efforts to forge cooperation across political boundaries is of the greatest importance. In addition, there are competing authority/responsibility issues beyond those of governments, particularly between the large voluntary organizations and local governments. There are different opinions about who is responsible for what, when, and how that responsibility will be implemented.

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**APPENDIX A**

**CONTACT SHEET**

**Agency Name** \_\_\_\_\_

**Street Address** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**Telephone** \_\_\_\_\_ **Authority:** Local, state, federal, or private

**Contact Person** \_\_\_\_\_

1. Has your agency ever provided emergency services to the community during a disaster? (For example, in response to earthquake, tornado, flood.)

Yes \_\_\_\_\_

2. What role does your agency play in emergency response to natural disasters? (For example, food, shelter, clothing, damage, assessment, communications, etc.)

a)

b)

c)

d) multiple

3. Does your agency provide specific services in emergency communications or social services?

a) Emergency communications. (For example, early warning, coordinating response efforts, damage assessment and reporting, search and rescue, etc.)

b) Emergency social services. (For example, reuniting families, referral and linkage to professional services, child care and supervision, counseling, etc.)

Name of Organization \_\_\_\_\_

Address \_\_\_\_\_

City & Zip Code \_\_\_\_\_

Contact Person \_\_\_\_\_ Phone Number \_\_\_\_\_

**This identifying information has been drawn from our records.  
Please correct any part of it that is incorrect.**



WASHINGTON  
UNIVERSITY  
IN ST. LOUIS



NATIONAL  
SCIENCE  
FOUNDATION

## QUESTIONNAIRE DISASTER VOLUNTEER PROJECT\*

Washington University  
George Warren Brown  
School of Social Work  
Box 1196  
St. Louis, MO 63130  
889-6613

This questionnaire has been designed to collect information about emergency social services in the St. Louis metropolitan area. Two kinds of information are requested: (1) information about your organization and the services it delivers, and (2) information about how your organization works with other organizations involved in emergency services.

The questionnaire asks about the day-to-day activities of your organization as well as what happens when disaster strikes. The first twenty questions focus on day-to-day activities and ask for information about your organization and also its relations with other organizations in the community. Then, there are thirteen questions about your organization and its relations with other organizations during a disaster.

\*Short Title for "Mapping Networks of Organized Volunteers for Natural Hazard Preparedness," a project funded by the National Science Foundation, Societal Response to Earthquake Hazards Mitigation Program, Grant No. CEE-8314421.

## SECTION I

### INFORMATION ABOUT YOUR ORGANIZATION DURING DAY-TO-DAY (NON-DISASTER) OPERATING CONDITIONS

The first set of questions below concerns characteristics of *your* organization or unit. The word "organization" is used to refer to those units (divisions, departments, groupings or total organizations) that are prepared to respond to disaster. The questions in this section ask for information that describes your organization during day-to-day conditions or at its lowest level of readiness to respond in the event of a disaster. Please be candid in giving responses that accurately represent your organization.

1. Which of the following types most accurately describe your organization? Check more than one if appropriate.
  - a. social service agency \_\_\_\_\_
  - b. mental health agency \_\_\_\_\_
  - c. neighborhood organization \_\_\_\_\_
  - d. religious organization \_\_\_\_\_
  - e. fire department \_\_\_\_\_
  - f. police department \_\_\_\_\_
  - g. city or county disaster office \_\_\_\_\_
  - h. hobby club or recreational club \_\_\_\_\_
  - i. service club or organization \_\_\_\_\_
  - j. military unit \_\_\_\_\_
  - k. youth group or youth organization \_\_\_\_\_
  - l. senior citizen organization \_\_\_\_\_
  - m. school or university \_\_\_\_\_
  - n. commercial enterprise \_\_\_\_\_
  - o. transportation service \_\_\_\_\_
  - p. fraternal organization \_\_\_\_\_
  - q. health clinic \_\_\_\_\_
  - r. hospital \_\_\_\_\_
  - s. other (please describe):
    1. \_\_\_\_\_
    2. \_\_\_\_\_
    3. \_\_\_\_\_
2. Is the main office of your organization in (a) the City \_\_\_\_\_ or (b) the County \_\_\_\_\_?  
If it is in the City go to question 2a. If it is in the County go to 2b.
  - 2a. If your organization is located in the city, where is your organization prepared to offer its services? Check the most appropriate response.
    - a. only in this neighborhood \_\_\_\_\_
    - b. in this neighborhood and in others where formal agreements exist \_\_\_\_\_
    - c. in this neighborhood and in others when requested and authorized \_\_\_\_\_
    - d. anywhere in St. Louis City \_\_\_\_\_
    - e. anywhere in the metropolitan area (Missouri side) \_\_\_\_\_
  - 2b. If your organization is located in the county, where is your organization prepared to offer its services? Check the most appropriate response.
    - a. only in this municipality \_\_\_\_\_
    - b. in this municipality and in others where formal agreements exist \_\_\_\_\_
    - c. in this municipality and in others when requested and authorized \_\_\_\_\_
    - d. anywhere in the county \_\_\_\_\_
    - e. anywhere in the metropolitan area (Missouri side) \_\_\_\_\_
3. Which of the following most accurately describes the funding base of your organization? Please select only one.
  - a. government sources \_\_\_\_\_
  - b. non-government sources \_\_\_\_\_
  - c. both government and non-government sources \_\_\_\_\_
4. Which of the following most accurately describes the legal authority directing your organization?
  - a. public (governmental) authority \_\_\_\_\_
  - b. private not-for-profit \_\_\_\_\_
  - c. private for-profit \_\_\_\_\_
  - d. both public and private \_\_\_\_\_

5. Given the goals of *your* organization, what is the capacity of your organization or unit to respond to the following types of disasters? Assume that it is noon on a weekday in mid-March. Please circle the appropriate number for capacity level of each type of disaster listed.

	capacity									
	no		low		medium		full			
a. earthquake	0	1	2	3	4	5	6	7	8	9
b. flood	0	1	2	3	4	5	6	7	8	9
c. tornado	0	1	2	3	4	5	6	7	8	9
d. plane crash	0	1	2	3	4	5	6	7	8	9
e. severe heat or cold	0	1	2	3	4	5	6	7	8	9
f. blizzard/ice storm	0	1	2	3	4	5	6	7	8	9
g. fire/explosion	0	1	2	3	4	5	6	7	8	9
h. hazardous materials accident	0	1	2	3	4	5	6	7	8	9
i. other (please list):										
1. _____	0	1	2	3	4	5	6	7	8	9
2. _____	0	1	2	3	4	5	6	7	8	9
3. _____	0	1	2	3	4	5	6	7	8	9

6. During the past three years, how often has *your* organization or unit actually responded to the following types of disasters? Please enter the number of times responded for each:

- a. earthquake \_\_\_\_\_
- b. flood \_\_\_\_\_
- c. tornado \_\_\_\_\_
- d. plane crash \_\_\_\_\_
- e. severe heat or cold \_\_\_\_\_
- f. blizzard/ice storm \_\_\_\_\_
- g. fire/explosion \_\_\_\_\_
- h. hazardous materials accident \_\_\_\_\_
- i. other (please list):
- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

11. How does *your* organization express its appreciation to the volunteers who work for your organization. Please check each that applies:

- a. provide formal training and certification \_\_\_\_\_
- b. give awards, citations or individual letter of recognition \_\_\_\_\_
- c. provide badges, insignia or identifying apparel \_\_\_\_\_
- d. give parties, picnics or banquets for recognition of service \_\_\_\_\_

7. During day-to-day operations, how many members in your organization are paid a salary for their work? \_\_\_\_\_

8. How many of the paid members that you listed in question 7 have been with your organization for less than one year? \_\_\_\_\_

9. How many of the regularly active members in your organization are volunteers? \_\_\_\_\_

10. How many of the volunteers listed in question 9 have been with your organization less than one year? \_\_\_\_\_

12. During the past three years, how many different times has a representative of your organization participated in a training session related to disaster preparedness? \_\_\_\_\_

13. During the past three years, how many different times has a representative of your organization participated in simulated disaster exercises? \_\_\_\_\_

14. During the coming year, how often will a representative of your organization participate in a disaster response training session? \_\_\_\_\_

15. During the coming year, how often will your organization participate in a field disaster exercise? \_\_\_\_\_

16. Are you familiar with the meaning of the term "Integrated Emergency Management System"? Yes \_\_\_\_\_ No \_\_\_\_\_



## SECTION II

### INFORMATION ABOUT RELATIONS BETWEEN YOUR ORGANIZATION AND OTHER ORGANIZATIONS DURING DAY-TO-DAY OPERATIONS

Now we have a few questions concerning the relationships between *your* organization and *other* organizations in the community. First we ask you to list each particular organization that you deal with on a day-to-day basis. Then, for *each* of the organizations you list, we ask three questions (18, 19, 20) about the day-to-day relationships between your organization and each one listed in question 17.

17. Please list, *in the order of importance to your organization*, the names of at least two and no more than ten of the most important organizations that your organization works with on a day-to-day basis.

- |          |          |
|----------|----------|
| a. _____ | f. _____ |
| b. _____ | g. _____ |
| c. _____ | h. _____ |
| d. _____ | i. _____ |
| e. _____ | j. _____ |

In responding to the next three questions, please keep the organizations in the order you listed them in question 17 so that your responses to questions 18, 19, and 20 match with those in question 17. For example, if you listed the Boy Scouts as the most important organization you deal with in 17a, then your responses to 18a, 19a, and 20a should each refer to the Boy Scouts.

18. Please check the services delivered and received by your organization in its dealings with each of the organizations listed in question 17.

#### SERVICES DELIVERED AND RECEIVED FROM OTHER ORGANIZATIONS

Personnel	Equipment & Supplies	Building or Land	Financial	Information & Referral	Training
a. _____	_____	_____	_____	_____	_____
b. _____	_____	_____	_____	_____	_____
c. _____	_____	_____	_____	_____	_____
d. _____	_____	_____	_____	_____	_____
e. _____	_____	_____	_____	_____	_____
f. _____	_____	_____	_____	_____	_____
g. _____	_____	_____	_____	_____	_____
h. _____	_____	_____	_____	_____	_____
i. _____	_____	_____	_____	_____	_____
j. _____	_____	_____	_____	_____	_____

19. Please check the nature of agreements between your organization and each organization listed in question 17.

**NATURE OF AGREEMENT**

	<b>Awareness But No Agreement</b>	<b>Casual Verbal Agreement</b>	<b>Explicit Verbal Agreement</b>	<b>Written Formal Agreement</b>	<b>Legally Mandated Agreement</b>
a. _____	_____	_____	_____	_____	_____
b. _____	_____	_____	_____	_____	_____
c. _____	_____	_____	_____	_____	_____
d. _____	_____	_____	_____	_____	_____
e. _____	_____	_____	_____	_____	_____
f. _____	_____	_____	_____	_____	_____
g. _____	_____	_____	_____	_____	_____
h. _____	_____	_____	_____	_____	_____
i. _____	_____	_____	_____	_____	_____
j. _____	_____	_____	_____	_____	_____

20. Please check the response that best describes the frequency of contacts made between your organization and each organization you have listed in question number 17.

**FREQUENCY OF CONTACTS**

	<b>Fewer Than One Per Month</b>	<b>Monthly</b>	<b>Weekly</b>	<b>Daily</b>
a. _____	_____	_____	_____	_____
b. _____	_____	_____	_____	_____
c. _____	_____	_____	_____	_____
d. _____	_____	_____	_____	_____
e. _____	_____	_____	_____	_____
f. _____	_____	_____	_____	_____
g. _____	_____	_____	_____	_____
h. _____	_____	_____	_____	_____
i. _____	_____	_____	_____	_____
j. _____	_____	_____	_____	_____

## SECTION III

### INFORMATION ABOUT YOUR ORGANIZATION DURING DISASTER CONDITIONS

The remaining questions concern the activities of your organization *during* a disaster. A description of a particular disaster, an earthquake, has been provided to help make the information you give us about your organization more useful. Please read carefully the following description of an earthquake and answer the questions *as if this particular disaster actually happened*.

#### DESCRIPTION OF EARTHQUAKE

The earthquake happened on a weekday in mid-March at 6 p.m. The shaking was present only for a few minutes, though the effects lasted for several days (delayed structural collapse, fires, etc.). Although the potential for an earthquake had long been known, there was little forewarning and no visible signs of the impending disaster. All sections of the metropolitan area have been affected. One-fourth of all physical structures have been damaged to some degree, and one-in-ten have been rendered unlivable or unsafe. One in one-hundred have partially or fully collapsed. People have sustained injuries by falling down or by being hit with falling debris. Broken bones, cuts and lacerations are the most common injuries. About ten percent of the population have been mildly injured, requiring care but not hospitalization. About one percent of the population has sustained serious injury and will need immediate care. About ten percent of all telephone lines are broken, and one in ten of all street intersections have been blocked by flooding, breaks, obstructions, and bridge damage or collapse. It is now 18 hours after the initial impact of the earthquake (noon the next day).

21. Does your organization have a specific emergency response plan to guide its operation in a disaster like the one described above?

No \_\_\_\_\_ Yes \_\_\_\_\_ If yes, how long has it been since the emergency response plan has been reviewed and updated? Years \_\_\_\_\_ Months \_\_\_\_\_

22. For the earthquake described above, what is the capacity of *your* organization to deliver the following services? Please respond to each type of service listed:

	capacity									
	no		low			medium			full	
	0	1	2	3	4	5	6	7	8	9
a. food	0	1	2	3	4	5	6	7	8	9
b. clothing	0	1	2	3	4	5	6	7	8	9
c. shelter	0	1	2	3	4	5	6	7	8	9
d. emergency counseling	0	1	2	3	4	5	6	7	8	9
e. information and referral	0	1	2	3	4	5	6	7	8	9
f. medical services	0	1	2	3	4	5	6	7	8	9
g. transportation	0	1	2	3	4	5	6	7	8	9
h. search and rescue	0	1	2	3	4	5	6	7	8	9
i. security and protection of property	0	1	2	3	4	5	6	7	8	9
j. debris removal	0	1	2	3	4	5	6	7	8	9
k. managing overall disaster response	0	1	2	3	4	5	6	7	8	9
l. warning and evacuation	0	1	2	3	4	5	6	7	8	9
m. (Please describe):										
1. _____	0	1	2	3	4	5	6	7	8	9

23. Looking *only* at social services in a major disaster situation, what is the capacity of your organization to deliver the following social services? *Please circle the appropriate capacity level for each type of service listed.*

	capacity									
	no	low			medium			full		
a. emergency assistance to special populations (children, elderly, disabled, etc.)	0	1	2	3	4	5	6	7	8	9
b. emergency counseling	0	1	2	3	4	5	6	7	8	9
c. information about other emergency services in the community	0	1	2	3	4	5	6	7	8	9
d. managing overall emergency social services	0	1	2	3	4	5	6	7	8	9
e. other (please list):										
1. _____	0	1	2	3	4	5	6	7	8	9
2. _____	0	1	2	3	4	5	6	7	8	9
3. _____	0	1	2	3	4	5	6	7	8	9

24. For the earthquake described above, how many *paid* staff would be working with your organization (that is, people who are actually paid by your organization to provide disaster relief services)? *Please enter the number of paid staff: \_\_\_\_\_*

25. In your estimation, how many trained volunteers would your organization be able to mobilize to help in responding to this disaster? *Please enter the number of trained volunteers \_\_\_\_\_*

26. The following statements may be more or less true for your organization in emergency situations. Please circle the appropriate response for each statement as it would apply during disaster operations for the earthquake described on the previous page.

	True	Partly True	Partly False	False	Not sure
a. Whatever situation arises, we have procedures to follow in dealing with it.	1	2	3	4	0
b. Everyone has a specific job to do.	1	2	3	4	0
c. Going through proper channels is constantly stressed.	1	2	3	4	0
d. The organization maintains a written record on everyone's job performance.	1	2	3	4	0
e. We follow strict operating procedures at all times.	1	2	3	4	0
f. Whenever we have a problem, we turn to the same person for an answer.	1	2	3	4	0

## SECTION IV

### INFORMATION ABOUT RELATIONS BETWEEN YOUR ORGANIZATION AND OTHER ORGANIZATIONS DURING DISASTER CONDITIONS

Here we have repeated the questions concerning the relationships between *your* organization and *other* organizations in the community. Now you are asked to respond as if involved in the earthquake described in Section III (a summary description is provided below). We would like you to list the important organizations you would deal with during this disaster. Three questions about your relations with those organizations are asked.

#### SUMMARY DESCRIPTION OF THE EARTHQUAKE

Scope:	Regional
Speed of Onset:	Sudden
Time of Year:	Mid-March
Duration:	Short
Groups Affected:	All Sectors of Region
Predictability:	Low, Little Forewarning
Damage Extent:	Widespread, 25% of Structures
Mild Injuries:	Widespread, 10% of Population
Serious Injuries:	Widespread, 1% of Population

27. Please list, *in order of importance to your organization*, the names of at least two and no more than ten of the most important organizations that your organization works with during disaster conditions.

- |          |          |
|----------|----------|
| a. _____ | f. _____ |
| b. _____ | g. _____ |
| c. _____ | h. _____ |
| d. _____ | i. _____ |
| e. _____ | j. _____ |

In responding to questions 28, 29, and 30, please keep the organizations in the order that you listed them in question 27 so that your responses to questions 28-30 will correspond with those in question 27.

28. Please check the services delivered or received by your organization in its dealings with each of the organizations listed in question 27.

#### SERVICES DELIVERED OR RECEIVED FROM OTHER ORGANIZATIONS

Personnel	Equipment & Supplies	Building or Land	Financial	Information & Referral	Training
a. _____	_____	_____	_____	_____	_____
b. _____	_____	_____	_____	_____	_____
c. _____	_____	_____	_____	_____	_____
d. _____	_____	_____	_____	_____	_____
e. _____	_____	_____	_____	_____	_____
f. _____	_____	_____	_____	_____	_____
g. _____	_____	_____	_____	_____	_____
h. _____	_____	_____	_____	_____	_____
i. _____	_____	_____	_____	_____	_____
j. _____	_____	_____	_____	_____	_____

29. Please check the nature of agreements between your organization and each organization listed in question 27.

**NATURE OF AGREEMENT**

	<b>Awareness But No Agreement</b>	<b>Casual Verbal Agreement</b>	<b>Explicit Verbal Agreement</b>	<b>Written Formal Agreement</b>	<b>Legally Mandated Agreement</b>
a. _____	_____	_____	_____	_____	_____
b. _____	_____	_____	_____	_____	_____
c. _____	_____	_____	_____	_____	_____
d. _____	_____	_____	_____	_____	_____
e. _____	_____	_____	_____	_____	_____
f. _____	_____	_____	_____	_____	_____
g. _____	_____	_____	_____	_____	_____
h. _____	_____	_____	_____	_____	_____
i. _____	_____	_____	_____	_____	_____
j. _____	_____	_____	_____	_____	_____

30. Please check the response that accurately describes the frequency of contacts made between your organization and each organization you have listed in question number 27.

**FREQUENCY OF CONTACTS**

	<b>Fewer Than One Per Day</b>	<b>Daily</b>	<b>Hourly</b>	<b>Continual Contact</b>
a. _____	_____	_____	_____	_____
b. _____	_____	_____	_____	_____
c. _____	_____	_____	_____	_____
d. _____	_____	_____	_____	_____
e. _____	_____	_____	_____	_____
f. _____	_____	_____	_____	_____
g. _____	_____	_____	_____	_____
h. _____	_____	_____	_____	_____
i. _____	_____	_____	_____	_____
j. _____	_____	_____	_____	_____

**The final three questions ask you about expected relations with other organizations during disaster conditions.**

**31. Briefly describe a situation or event that illustrates a typical example of *cooperation* between your organization and another during a disaster response.**

**32. Briefly describe a situation or event that best illustrates *conflict* you might anticipate between your organization and another as you pursue your emergency response activities.**

**33. Briefly describe what could be done to *reduce the potential conflict* described in question 32.**

**THANK YOU**

