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DISASTER PREPAREDNESS AND
RESPONSE: RESEARCH FINDINGS AND
GUIDANCE FROM THE SOCIAL
SCIENCE LITERATURE*

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*Paper prepared for the US-RCO Workshop on Natural Disaster
Reduction, Taipei, Taiwan, ROC, June 24-26, 1993.

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FROM THE SOCIAL SCIENCE LITERATURE**

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INTRODUCTION

The management of disasters typically is described as consisting of four phases: mitigation, preparedness, response, and recovery. **Mitigation** consists of "policies and actions taken before an event which are intended to minimize the extent of damage when an event does occur" (Drabek, Mushkatel, and Kilijanek, 1983: 12). Such measures include land-use regulations; decisions about where to locate particular facilities, settlements, and activities; the application of design and engineering principles to make structures disaster-resistant; and other policies and activities enacted beforehand to minimize the life-safety hazards, damage, and social disruption resulting from disasters.

Preparedness measures are the "second line of defense" against disaster; their objective is to enhance the ability to respond when a disaster occurs. Preparedness activities include formulating emergency plans; testing and exercising those plans; providing training for disaster responders and the general public to improve their understanding of what to do in a disaster; communicating with the public, government officials and other audiences about levels of disaster vulnerability and what to do to reduce that vulnerability; and other related activities. The preparedness process involves attempting to anticipate what problems are likely to emerge in future disaster situations and to devise ways to address those problems. Both mitigation and preparedness take place in the pre-disaster context.

Disaster response activities are actions taken at the time a disaster strikes (or prior to impact, if the event is predicted or forecasted) that are intended to reduce threats to life-safety, secondary hazards, and losses occasioned by the event. These include: warning, evacuation, protection of lives and property, search and rescue; care of those who are injured; the provision of emergency shelter for victims; damage assessment; debris removal; and other activities that take place during the post-impact emergency period.

Disaster recovery involves longer-term efforts to (1) reconstruct and restore the disaster-stricken area, e.g. through repairing or replacing homes, businesses, public works, and other structures; (2) deal with the disruption that the disaster has caused in community life and meet the recovery-related needs of victims; and (3) mitigate future hazards.

Although the four phases may appear to be stages in a sequence, they actually overlap and merge. For example, decisions that have an impact on disaster recovery are often made very soon after a disaster strikes, while the emergency response is still ongoing, and as noted above, the recovery period following one disaster is often a time for considering how to mitigate losses from future events.

The two disaster phases that this paper considers--preparedness and response--are the phases that have been studied most by disaster researchers and the ones about which the most has been learned. No single paper can give an adequate rendering of

all research findings in the areas of disaster preparedness and response. Rather than attempting to do so, this paper will discuss in general terms some of the more important, well-substantiated research findings in the two areas while providing references that will enable interested persons to delve more deeply into the various topics covered.

The paper begins with a brief discussion of disaster research in the U. S.: how it got started, how it is currently organized, and what types of topics are studied by U. S. researchers. The paper then goes on to discuss and synthesize research findings on preparedness and response. Much of the published research done to date has been done by U. S. researchers in U. S. settings, and this is the literature with which this author is most familiar. That is unfortunate, because we can never claim to truly understand social processes like disaster preparedness without studying them in a wide range of societal and cultural settings. Wherever possible, preparedness and response studies conducted in other countries and by non-U. S. researchers will be discussed.

THE STUDY OF DISASTERS IN THE SOCIAL SCIENCES

Disaster research as a social science subspecialty began the U. S. in the early 1950s. The emphasis during that period was on generating findings about human behavior under situations of collective stress that could be extrapolated to conditions of war. The U. S. government, which sponsored this early research, wanted to be able to anticipate how people would respond during and after nuclear attack. Disaster events were seen (probably incorrectly)

as a "natural laboratory" in which patterns of human response under conditions of extreme stress could be discovered.

The first large-scale sociological investigations of community crises were conducted by the National Opinion Research Center at the University of Chicago, roughly between 1950 and 1954. That research focused on individual and group behavior in natural and technological emergencies (see Fritz and Marks, 1954, for a discussion of this work). In the mid-1950s, the Disaster Research Group at the National Academy of Sciences/National Research Council also conducted empirical studies in disaster situations. Summaries of this earlier work, which focused on the responses of individuals, groups, and larger social units (e.g., organizations, communities) can be found in Fritz (1961), Barton (1969), and Dynes (1970).

The major sociologically-oriented center, the Disaster Research Center (DRC), was established in 1963 at the Ohio State University and moved to the University of Delaware in 1985. DRC has made a number of important contributions to the understanding of emergency preparedness and response; its research focuses primarily on the disaster preparedness and response activities of groups, organizations, interorganizational networks, rather than on individual behavior. Over the years, various topics related to emergency preparedness and response have been emphasized in DRC research. Examples include: organizational adaptation, communication, and decision-making in crisis situations (Drabek and Haas, 1969; McLuckie, 1970; Brouillette and Quarantelli, 1971;

Dynes and Quarantelli, 1977); disaster as a factor in organizational change (Anderson, 1966; 1972); disaster response activities of crisis-relevant organizations and groups (Anderson, 1970; Warheit, 1970; Dynes and Quarantelli, 1977; Wenger, Quarantelli, and Dynes, 1986; 1989); and the provision of emergency medical services in disasters (Tierney and Taylor, 1977; Quarantelli, 1983; Tierney and Quarantelli, 1989). DRC focuses on preparedness and response issues related to both natural and technological disasters; in the latter area, past and recent studies include research on chemical emergencies (Tierney, 1981; Quarantelli, 1984b; Gray and Quarantelli, 1985; Quarantelli and Gray, 1986; Quarantelli, 1991) and on major oil spills (Tierney and Quarantelli, 1992). DRC has its own book, monograph, and report series, which currently contains approximately five hundred items.

In the U. S., a number of other organizations and social science disciplines have been actively involved in studying the social aspects of disasters. Researchers who are or have been affiliated with the Natural Hazards Research and Applications Information Center at the University of Colorado at Boulder represent various academic fields, including geography, sociology, and economics. Hazards Center researchers have tended to focus broadly on how societies "adjust" to hazards, rather than only on preparedness and post-disaster response; the range of adjustments considered by these researchers includes land-use management, warning systems, disaster insurance, and post-disaster relief and rehabilitation (White and Haas, 1975). In contrast with the "all-

hazards" perspective taken by DRC, the Hazards Center's work focuses almost exclusively on natural phenomena. Studies conducted by Hazards Center researchers include large-scale surveys of the magnitude of natural hazards and on alternative adjustment strategies (White, 1974); studies on long-term community recovery from natural disasters (Haas, Kates, and Bowden, 1977); cross-cultural studies of hazard vulnerability and management strategies (Burton, Kates, and White, 1978); and research on the economic impact of disasters (Cochrane, 1975). Dennis Mileti and John Sorensen, who were associated with the Hazards Center in its early years, have become recognized experts on public warning response and evacuation processes (to be discussed below). Through its workshops, held annually for the last eighteen years, its extensive publications program, its newsletter Natural Hazards Observer, and its electronic mail network, "Disaster Research," which links practitioners and disaster researchers worldwide, the Hazards Center is a major disseminator of disaster-related information and research findings.

There are several other newer research centers in the U. S. that study disasters. The Center for Technology, Environment, and Development (CENTED) at Clark University in Worcester, Massachusetts, staffed mainly by geographers and specialists in public policy, is concerned with the social construction of risk, societal response to risky technologies, and the relationship between disasters and development. CENTED has conducted research on both the Bhopal (Bowonder, Kasperson, and Kasperson, 1985) and

Chernobyl catastrophes (Goble, Hohenemser, and Kasperson, 1987). A good overview of CENTED's approach to disaster analysis is contained in the book Perilous Progress: Managing the Hazards of Technology (Kates, Hohenemser, and Kasperson, 1985). At the Office of Hazard Studies, which is in the School of Public Affairs at Arizona State University, faculty members from a range of social science disciplines have studied a number of disaster-related topics, including warning and evacuation processes in disasters (Perry, 1983; Perry and Mushkatel, 1984).

The Hazards Assessment Laboratory (HAL) at Colorado State University, which like the Office of Hazards Studies was established during the 1980s, is also heavily involved in conducting studies on disaster warning and forecasting, particularly warnings and predictions related to earthquakes (see Mileti and Fitzpatrick, 1992; 1993; Mileti and O'Brien, 1992; Mileti, Fitzpatrick, and Farhar, 1990; 1992). The Hazards Reduction and Recovery Center (HRRC), located in the School of Architecture at Texas A&M university, was founded in 1989. Researchers associated with HRRC come from a variety of academic disciplines, including sociology, urban and regional planning, and structural engineering. HRRC has a strong focus on development issues, and much of the Center's current work involves research on disaster response and recovery in the Caribbean countries (c.f., Berke and Wenger, 1991; Berke, et al., 1992).

Not all U. S. social scientists who study disasters are affiliated with research centers; in fact, the majority are

independent scholars working in academic settings or in non-university-based research centers such as Oak Ridge National Laboratories in Tennessee and Battelle Human Affairs Research Center in Seattle, Washington. Outside the U. S., there are also a number of scholars who have had a long-term, sustained interest in disaster research; Japan and Italy, for example, have rather large contingents of disaster scholars (for a compilation of Japanese research on disasters, see Yamamoto and Quarantelli, 1984). The Asian Disaster Preparedness Center (ADPC) at the Asian Institute of Technology in Bangkok plays an active role in disaster training and education. With assistance from ADPC, the Asian Development Bank recently published two comprehensive volumes on hazard reduction (Carter, 1991; Asian Development Bank, 1991). In 1989, ADPC hosted a seminar that brought together U. S. disaster researchers and social scientists from developing Asian countries who had been conducting research on disasters, or who were interested in doing so, to (among other things) develop an agenda for social science research in the region (for a report on the seminar, see Dynes, 1989).

The International Sociological Association's Research Committee on Disasters is a professional organization that facilitates communication, coordination, and collaboration among scholars in this worldwide network. The Research Committee publishes a journal, The International Journal of Mass Emergencies and Disasters as well as a newsletter, Unscheduled Events. The Committee sponsors meetings of various types, the largest of which

is a series of sessions held every four years at the World Congress of Sociology. The next meeting of this type is scheduled for July, 1994, in Bielefeld, Germany.

As a result of the activities of centers like those discussed above and of other researchers in the U. S. and around the world, there now exists a substantial knowledge base concerning the social response to hazards and disasters. Among the most important efforts at summarizing and codifying that knowledge are those of Mileti, Drabek, and Haas (1975), Quarantelli and Dynes (1977), Drabek (1986) and Nigg and Mileti (1993). The remaining sections of the paper review some of the more well-researched topics in the areas of emergency preparedness and response.

DISASTER PREPAREDNESS

Many activities associated with disaster preparedness, such as disaster planning and disaster drills and exercises, can be engaged in by various social units: families and households; organizations; communities; supra-community entities such as states and regions; and entire societies. Other activities, such as public education and risk communication, are typically the responsibility of government. Despite these differences, it is possible to discuss preparedness in a general sense and to indicate what factors appear to encourage or to impede preparedness efforts. This section begins with a general discussion on features of effective preparedness efforts. It then considers (1) factors that affect preparedness levels and willingness to prepare; and (2) risk

communication and effective ways of communicating risk to the public.

Principles of Disaster Planning

Criteria for Adequate Disaster Planning

To be effective, preparedness activities must be based on correct assumptions about post-disaster needs and on basic principles of human behavior. Research suggests that many response-related problems have their origins in planning that makes incorrect assumptions about how disasters should be managed.

Quarantelli (1982) has identified ten general principles of good disaster planning that can be applied to most (if not all) planning efforts, whether carried out by governments, private-sector organizations, or other social units. Those principles are summarized below:

1. Planning is a continuous process. Planning does not consist of developing written plans, which are then considered "finished;" rather, it is an ongoing process that involves a continuing effort to assess vulnerability and improve response capability.
2. Planning involves attempting to reduce the unknowns in the anticipated disaster situation. No planning effort can anticipate everything that will occur when disaster strikes, but good plans can at least identify major problems that are expected and attempt to devise solutions. Because everything about a future disaster situation cannot possibly be known, it is impossible to pre-plan every aspect of the response, and flexibility is an absolute necessity.
3. Planning aims at evoking appropriate actions. Rather than aiming at a rapid response, planning should emphasize acting correctly--even if that means doing nothing until adequate information is available. "It is far more important in a disaster to obtain valid information as to what is happening than it is to take immediate actions...Planning, in fact, should help delay impulsive reactions" (Quarantelli, 1982: 23-24).
4. Planning should be based on what is likely to happen. While catastrophic and worst-case disasters do occur, preparedness

efforts should focus first on disaster scenarios that are typical and probable. Plans should be based on empirically-grounded assumptions about how members of the public will respond in emergency situations, rather than on "common sense" ideas or myths about disaster behavior. There is considerable continuity between how people behave during non-disaster times and how they behave in disasters. Rather than developing plans that require people to do things differently, planners should take this continuity into account.

5. Planning must be based on valid knowledge. Three kinds of knowledge are critical: knowledge of how people are likely to respond in emergency situations; knowledge of the hazard itself and of associated vulnerabilities; and knowledge concerning the resources needed to respond to the hazard.

6. Planning should focus on general principles. One reason for keeping plans focused on principles is that "a complex and detailed plan is generally forbidding to most potential users and tends to be ignored" (Quarantelli, 1982: 24). A second reason is that, since disaster situations shift and evolve rapidly, no plan can ever hope to cover all contingencies. Responding in a disaster situation always involves unexpected and unanticipated challenges, so plans must allow for flexibility.

7. Planning is partly an educational activity. Good preparedness involves not only the development of plans but also efforts to ensure that all relevant community or societal sectors are brought into the planning process. The parties involved in the process must be educated on what the hazards are, how the plans will address the problems that are expected, and what their disaster roles will be.

8. Planning always has to overcome resistance. The benefits that can be derived from preparedness activities are not self-evident. Disaster planning always requires some form of change in behavior, and change is often difficult to bring about. Government officials, business officials, and community residents have many priorities other than disaster planning, and societal and community needs are invariably greater than the resources that are available. Thus, getting preparedness measures developed, adopted, and accepted involves overcoming barriers that are often quite formidable.

9. Planning must be tested. It is virtually a foregone conclusion that disaster plans that are not rehearsed and exercised will either not be used at all or will fail in an actual disaster situation. All types of coordinated action require rehearsal; this is especially true for the coordination that is needed following a disaster.

10. Planning is not management. Disaster planning develops general principles and strategies for action during emergencies; emergency management attempts to apply those principles and strategies in the disaster setting. Because disasters always contain elements that are not anticipated in plans, the actions that are ultimately taken by managers may not be covered in any plan.

In related work, Quarantelli (1988) discusses other important criteria for disaster planning. First, planning must recognize that disasters are qualitatively different (rather than merely quantitatively different) from smaller events such as accidents or "routine" emergencies. In contrast with these lesser events, disasters place community systems under extreme stress; responders face new and different demands; and many more and sometimes unfamiliar organizational actors (e.g., central government agencies, outside relief agencies) are involved. Thus planning for disasters cannot be merely an extension of planning for everyday emergencies.

Second, while disaster agents (e.g., floods, earthquakes, landslides, and other natural and technological phenomena) differ from one another and typically require specialized resources, planning efforts should be generic, rather than agent-specific, largely because the same general tasks will need to be planned for regardless of type of disaster. There will always be a need, for example, for caring for the sick and injured, damage assessment, and the provision of shelter to displaced victims, regardless of the cause.

Third, planning is most effective when it is integrated rather than fragmented. That is, rather than having various organizations

and governmental entities (medical-care organizations, law-enforcement agencies, fire agencies, local governments) develop disaster plans on their own, it is far better for these different sectors to engage in collective preparedness efforts. This principle applies not only to the development of formal disaster plans, but also to disaster exercises and to training activities. (For related discussions, see Dynes, Quarantelli, and Kreps, 1981; Quarantelli, 1992).

Models for Disaster Planning and Response

U. S. disaster researchers have identified two contrasting approaches to disaster planning, which they term the "command and control" and "emergent human resources" or "problem-solving" models. The "command and control" model treats disaster management like a military exercise. It assumes (1) that in a disaster situation governmental and other responding agencies must be prepared to go into the disaster setting and take over management and control of the situation--since residents in the affected area will be helpless and overwhelmed; (2) that disaster response activities are best accomplished through centralized direction, control, and decision-making; and (3) that in an adequate response, ideally a single person is in charge, and relations among the various responding organizations are arranged hierarchically. This approach to disaster planning is generally viewed as unrealistic and not borne out by data on how people and organizations actually behave in disaster situations.

In contrast, the "emergent human resources" or "problem-solving" model is based on the notion that communities and societies are resilient and resourceful. Even in areas that are very hard-hit by disasters, considerable local response capacity is likely to remain. The model assumes that good preparedness planning builds on existing community institutions and support systems, rather than trying to create an entirely new structure to handle disasters. Thus, in the planning phase, the emphasis should be on identifying existing groups, organizations, and institutions that are capable of taking a leadership role in hazard management, and then enhancing their capacity to do so. The model also recognizes that when a disaster occurs, responding agencies must be flexible if they are to be effective and that flexibility is best achieved through a decentralized response structure that solves problems as they occur, rather than by a "top-down" decision-making structure. (For more extensive discussions of these two approaches and their implications, see Dynes, 1993; Dynes, forthcoming).

Factors that Affect Preparedness Capability and Willingness to Prepare

A considerable amount of research has focused on what encourages societies, communities, organizations, and households to emphasize emergency preparedness. Hazard awareness is one obvious factor that contributes to preparedness, but the relationship between objective risk levels, awareness, and preparedness is not at all straightforward. The objective risk people face from a given hazard is not necessarily associated with the perception of

risk (Drabek, Mushkatel, and Kilijanek, 1983; Mushkatel and Nigg, 1987); a considerable amount of research suggests that residents of disaster-prone communities may not be any more concerned about hazards than those who live in safer areas.

Awareness is generally higher for disaster agents that recur frequently. For example, in the central U. S., residents are very aware of tornado and flood hazards, but are not particularly concerned about the earthquake threat, although very large earthquakes have occurred and will recur in that area. Personal experience with a hazard generally causes hazard perceptions to be more accurate (Mileti, et al., 1975). Concern with a particular type of hazard can increase as a result of mass media attention or a major emergency; for example, the 1984 Bhopal chemical disaster raised public awareness of chemical hazards in the U. S. and stimulated considerable activity aimed at reducing those hazards, including the passage of new legislation.

Even when people aware of a natural or technological threat, this awareness does not necessarily translate into action. For example, research on household preparedness for earthquakes in Southern California, an area where awareness of the earthquake hazard is high, indicated that the overwhelming majority of residents had done relatively little to prepare for earthquakes. Less than 10% of the households surveyed reported taking preparedness actions like storing food and water or getting together with neighbors to plan what to do if an earthquake should occur (Turner, Nigg, and Paz, 1986).

One possible reason for this lack of willingness to prepare is that people believe that their probability of being personally affected by a disaster is low; they do not "personalize" the risk (see discussion below), and other matters that are more pressing on a day-to-day basis take priority. Another reason awareness doesn't always stimulate greater preparedness is that people may not be knowledgeable about potentially effective preparedness strategies. To cope with the probability of disaster, people have to know what they can do to reduce their vulnerability. One U. S. study on insurance, for example, found that people knew of the existence of flood and earthquake insurance, but nearly two-thirds of residents in high-risk areas didn't know they were eligible to purchase coverage, and a majority of those surveyed didn't have accurate information on how much the coverage would cost (Kunreuther, 1978).

Both hazard awareness and preparedness are associated with the sociodemographic characteristics of individuals and households, particularly income and education. U. S. studies suggest that nonminorities and persons with higher socioeconomic status tend to be better prepared for disasters than others. People who are poor and marginal have fewer resources to spend on mitigation and preparedness and less access to institutional sources of information on hazards and how to reduce them (Sims and Bauman, 1972; Perry and Mushkatel, 1984; Turner, et al., 1986). This is particularly unfortunate, since in disasters the poor typically face greater threats to life safety and property than those who are better off economically, and they also have more difficulty

recovering from disasters (Bates, 1982; Cuny, 1983; Kasperson and Bowonder, 1989).

Disaster experience tends to lead to an increase in commitment to preparedness on the part of both households and communities. Direct experience helps to personalize the threat. At the community level, Drabek's (1986: 55) extensive survey of the literature concludes that "[t]he greater the frequency that communities experience disasters, the more extensive will be their disaster planning efforts."

Unfortunately, however, disaster experience does not in and of itself lead to effective planning. Repeated experience with a particular disaster agent (e.g., seasonal flooding) sometimes engenders the growth of a "disaster subculture," in which households and communities simply accept and learn to live with the hazard and accept losses (Weller and Wenger, 1973). Communities that have extensive experience with a particular hazard may also shape their preparedness measures to deal with that one hazard, while ignoring other potential--and potentially more serious--types of disasters. For example, a community that experiences frequent flooding, but that had its last damaging earthquake fifty years ago, may engage in extensive flood preparedness but discount the "low probability/high consequence" earthquake hazard.

Even when dramatic disaster events highlight the need for preparedness, sustained hazard reduction efforts not likely to occur without the involvement of organized interests that act as "champions" or advocates. Such groups mobilize support, help

overcome resistance and opposition, do the scientific and technical work necessary to establish a basis for hazard reduction, draft legislation, design programs, and try to keep disaster preparedness on the political agenda. In the U. S., the role of "champion" is often assumed by professional groups (e.g., engineering societies), scientists, public officials, and grass-roots citizens' advocacy groups.

Obviously, the role taken by government is critical in encouraging (or discouraging) preparedness activities. Government appears to take a more active role in preparedness and other hazard reduction efforts when societal and community resource levels are high, making hazard reduction "affordable" and when organized interests exist that actively promote preparedness and call attention to lapses. Additionally, the governmental system must have the capacity to enact and to enforce hazard reduction policies. One reason that the implementation of hazard reduction policies is so difficult is that many national, state, and local governments lack that capacity. (For discussions that focus on the U. S. situation, see Rubin, Saperstein, and Barbee, 1985; May and Williams, 1986; and May, 1991).

Risk Communication

To be effective, preparedness efforts obviously must be based upon scientifically sound risk assessments. Without fundamental research the hazards a society or community faces, their likely severity, recurrence periods, and loss potential, it will not be possible to develop valid, realistic planning scenarios.

Additionally, as hazards and their associated vulnerabilities are identified, there is a need to communicate that information to the public--that is, to measure objective risk levels and then educate members of the public in ways that enable them to understand the hazards they face, take that information seriously, and act to reduce their vulnerability. Risk communication can occur in various contexts: in the pre-disaster, preparedness phase; in the warning phase, prior to disaster impact; and after impact, as information is provided about secondary or ongoing hazards (e.g., earthquake aftershocks). Risk communication activities will necessarily differ across these contexts. However, certain basic principles appear to hold for all forms of risk communication. This section will briefly discuss the communication of risk in the preparedness phase--that is, when there may be no apparent threat, and where the emphasis is on increasing public awareness of hazards and recommending preparedness actions.

Communicating with the public about risks is difficult for various reasons. Scientists themselves often disagree about the probability and likely severity of different hazards, and this lack of consensus can cloud risk communication efforts. Members of the public may be unable to distinguish scientifically credible sources of hazard information from less credible ones. Dramatic disaster events can lead people to be overly concerned about certain hazards. Judgments about risk levels can be shaped more by an awareness of the potential consequences of an event than by its historic record of occurrence, as is the case for nuclear power

plant meltdowns in the U. S. Both industrialized and developing societies are characterized by considerable geographic mobility. As people migrate and resettle, they leave familiar areas--and familiar hazards--for less familiar ones. The hazard-related knowledge they gained through living in their former communities may now be relevant in their new environments, and they may be unaware of the new risks they face. Risk information must compete for attention with numerous other types of information that may be more salient to the public. And even when public education makes people more aware of hazards, they still may not take protective actions. (For a thorough review of the literature on risk communication, see Covello, Slovic, and von Winterfeldt, 1987).

Not a great deal of empirical research has been conducted on the factors that make for effective public education programs focusing on hazards. Studies that have been conducted suggest that efforts to communicate with the public about natural and technological hazards have had mixed results, both in raising awareness and in stimulating protective action. Developing successful risk communication programs is evidently quite difficult to do. Mileti and his collaborators at the Hazards Assessment Laboratory in Colorado (Mileti, Fitzpatrick, and Farhar, 1990; Mileti and Fitzpatrick, 1992) suggest that successful risk communication is based on four general principles: (1) risk communication is a process and that the impact of such communications cannot be understood unless the risk "message" is placed in context along with other such communications; (2) risk

communication involves interaction among source and message characteristics (e.g., source credibility, frequency of repetition, specificity, type and number of channels used to disseminate information) with the characteristics of members of the target audience(s)--their sociodemographic characteristics, experience with the hazard, proximity to the hazard, etc.; (3) risk perception is multidimensional, involving hearing, understanding, believing, and personalizing the risk; and (4) what people do when they receive risk information is the result not only of the information itself, but of other processes and activities people subsequently engage in, such as evaluating the risk information provided, seeking additional information from various sources, and discussing the risk information in informal settings.

In their study of how community residents responded to a public education campaign that was associated with a moderate-term earthquake prediction "experiment," Mileti and his collaborators found that people were more likely to remember the prediction, understand and believe it, consider the earthquake a personal risk, and take protective action if they: (1) saw the various risk communications they had received as consistent with one another; (2) remembered details of the earthquake prediction, such as projected magnitude and damage potential; (3) remembered specific guidance they had been given to protect themselves against earthquake damage; (4) recalled receiving risk communications through several different channels; the printed word (e.g., brochures) is particularly important, because people refer back to

these printed sources over time; and (5) perceived the messages as having come from many respected information sources, such as official sources and scientists, as well as from relatives and other informal information sources. (For other findings and practical implications of this research, see Mileti, Farhar, and Fitzpatrick, 1990; Mileti, Fitzpatrick, and Farhar, 1992; Mileti and Fitzpatrick, 1993).

In related work, Love (summarized and paraphrased in Covello, Slovic, and von Winterfeldt, 1987: 57-58) has suggested that the following are attributes of effective risk communication programs:

"The communication should be clear, understandable, informative, accurate, and concrete.

The source of the communication should be perceived as credible and reliable.

When the target population is not homogeneous, the message should be presented in several ways, each specifically designed for one segment of the target population.

Whenever possible, the target population or representatives of it should be closely involved in the planning and implementation of the program. The earlier the involvement, the better...

Multimode presentation is considered to be more effective than single-mode presentation. This applies to both mass-media programs and to programs designed for smaller target populations. In the latter situation, face-to-face, two-way communication is also advocated.

Feedback about behavior change and its consequences in lowering risk is highly effective, and should be used whenever possible.

Incentives or rewards are thought to be effective in inducing change.

Repetitions of the message are desirable to a point; too many repetitions are ineffective or even deleterious. The optimal number of repetitions is not known."

With respect to whether fear appeals should be used in risk communication..."the message should be interesting; vividness has been shown to aid learning... [but research] results are mixed concerning the effects of fear arousal."

DISASTER RESPONSE

Like disaster preparedness, disaster response is a major area for social science inquiry. Considerably more is known about this phase of disaster than about the other three. This section will briefly summarize the literature on three aspects of disaster response (1) public response to disaster warnings and evacuation notices; (2) typical responses by the public in disaster situations; and (3) organizational adaptation in disaster situations.

Public Warning Response and the Design of Warning Systems

U. S. social scientists have been extensively involved in research on the warning process and on factors that affect public compliance with warnings. This section of the paper follows logically from the section above on risk communication, because many of the same principles that apply to risk communication in general also apply to disaster warnings. The issuing of warnings can be conceptualized as a special type of risk communication--one in which time is a much more important factor, but also one in which dramatic physical evidence (e.g. data on heavy rainfall, earthquake foreshocks, storm-tracking radar) may be present, making the message more credible to those receiving it.

Mileti and Sorensen, who have studied the warning process for a range of different disaster agents, describe the receipt of

disaster warning information by members of the public as involving a sequence that includes: hearing the warning; understanding the contents of the warning; believing that the warning is credible and accurate; personalizing the warning as one that signals personal danger to oneself or one's family; confirming that the warning is true and that other people are taking it seriously, usually through additional contacts with family members, friends, and recognized authorities; and responding by taking protective action (see Mileti and Sorensen, 1990; Sorensen, 1993). Lindell and Perry (1992) describe a similar sequence, involving four stages: risk identification (deciding whether the risk exists); risk assessment, (deciding whether protection against the risk is actually needed); risk reduction, (deciding whether it is feasible to take protective action); and protective response (deciding what action to take). Both these models make it quite clear that issuing warnings that will be taken seriously and acted on far from an easy process.

In the U. S., warning systems for different hazards use different types of hardware and technologies, e.g., siren systems, the mass media, and occasionally technologies like Tone Alert Radio. These technologies differ in various ways, such as speed and ease of dissemination, ease with which the warning can be heard and understood by the public, and the expense associated with their installation and operation; which technology is chosen depends upon what planning officials expect it to do and how quickly, as well as what is practically feasible. However, regardless of what warning method is selected, the literature consistently concludes that

warning technologies are only one element in the warning system.

As Sorensen notes (1993:4)

A key overriding principle that has continued to emerge from 25 years of warning research is that an integrated warning system maximizes public protection. Integration refers to the melding of scientific monitoring and detection with an emergency organization that utilizes warning technologies coupled with social design factors to rapidly issue an alert and notification to a public at risk. Thus warning systems must be considered as having scientific, managerial, technological, and social components which are linked by a variety of communication processes. A breakdown in process can result in ineffective warning even if each individual component is properly performing their [sic] internal role.

Like much of the research discussed in this paper, studies on warning response have been mainly conducted in the U. S. Nevertheless, general findings from this work are obviously applicable to other societies. For example, as was noted above in the section on risk communication, the populations receiving warning messages typically are heterogeneous, rather than homogeneous. Different subgroups within a population will tend to receive warning information through different sources, will vary in their tendency to believe warnings issued by different sources, and will behave differently after receiving the warning (Perry and Mushkatel, 1984; 1986).

Second, characteristics of the disaster agent itself have a bearing on warning response. Rapid-onset disasters can be very problematic, because the entire risk-assessment and decision-making process must occur within a very limited time. Warnings about hazards that are unfamiliar or infrequent will elicit different behavior than warnings about hazards with which the public has had

ongoing experience; often, the initial response in the former case is disbelief. Warnings that are not accompanied by clear environmental cues (e.g., the smell of chlorine, the presence of high winds or heavy rain) may also tend to be discounted.

Third, all warning efforts must overcome what social scientists refer to as the "normalcy bias," or the tendency for people to hold to the belief that "nothing unusual is happening" even when environmental cues and warning messages suggest the contrary. Drabek (1986: 73) notes that "members of threatened populations will seize upon any 'vagueness' in a warning message which allows them to reinterpret the situation in a nonthreatening fashion." To counteract the normalcy bias, warning systems must use as many different channels and media as possible, messages must be as concrete and precise as possible, and warnings must be repeated with increasing degrees of urgency.

Finally, warning systems will work best where they form one element in a more comprehensive program of working with people on hazard awareness and preparedness issues. As Aguirre (1993: 3) notes:

effective warning systems help people develop a tradition, a custom, a collective acceptance of hazards in their lives, so that testing and modification of warning systems becomes a significant part of their lives...The challenge is to reshape public perceptions, attitudes, and customs towards the acceptance of individual responsibility for disaster preparedness and away from a unidirectional approach which makes people passive recipients of the information generated by experts and the services of government bureaucracies.

Evacuation

Frequently, the objective of issuing a warning is to encourage people to evacuate as a way of protecting against the hazard. The evacuation process is a well-researched topic in the U. S. literature, and several compilations of research findings exist (Quarantelli, 1984a; Vogt and Sorensen, n.d.; Sorensen, Vogt, and Mileti, 1987).

Models of the Evacuation Process

Various empirical and conceptual models of evacuation behavior have been proposed in the literature. Sorensen and Richardson (1984) developed a causal model that attempted to explain evacuation decisions made following the nuclear power plant accident at Three Mile Island in 1979. In this model (which was subsequently validated in studies of other emergencies), the decision to evacuate is the result of the direct and indirect influence of ten different factors: hazard characteristics, situational constraints, perceived threat, the information provided, concern over risk, coping ability, attitudes toward risk managers, demographic characteristics, risk sensitivity, and social ties (see Figure 1 on page 29).

Perry and Mushkatel (1984) present an empirically-based model of evacuation decision-making in which the most important proximate factors influencing the decision to evacuate are the family context in which the warning is received (that is, whether household members are together or separated at the time the warning to evacuate is given); belief in the warning message; a sense of

personal risk; and whether or not the household has a plan or at least a general idea of how it will go about evacuating. These key factors are in turn influenced by other variables. For example, belief in the warning message is influenced by credibility of the source of the warning message, warning content, environmental cues that signal danger, and ability to confirm the warning through other sources (see Figure 2 on page 29).

The evacuation model formulated by Quarantelli (1984a), which is more of a conceptual or analytic model, suggests that five sets of factors are important for understanding evacuation behavior: the community context, which includes available resources and existing preparedness planning efforts; threat conditions e.g., characteristics of the disaster agent, how the threat is defined residents; resultant social processes at the community and organizational levels, such as efforts at communication, decision-making, and task-allocation; patterns of behavior, such as the issuance of warnings, the evacuation activities themselves, and sheltering behavior; and the impacts or consequences those actions have for future preparedness and response activities.

All three models suggest similar frameworks for conceptualizing the evacuation process: an evacuation warning or order, no matter how clear, scientifically-based, specific, urgent, and authoritative, is nevertheless embedded in a particular social context and ongoing set of social processes; the message itself is only one element in the decision to evacuate. Such decisions are affected by the broader community context (e.g., overall levels of

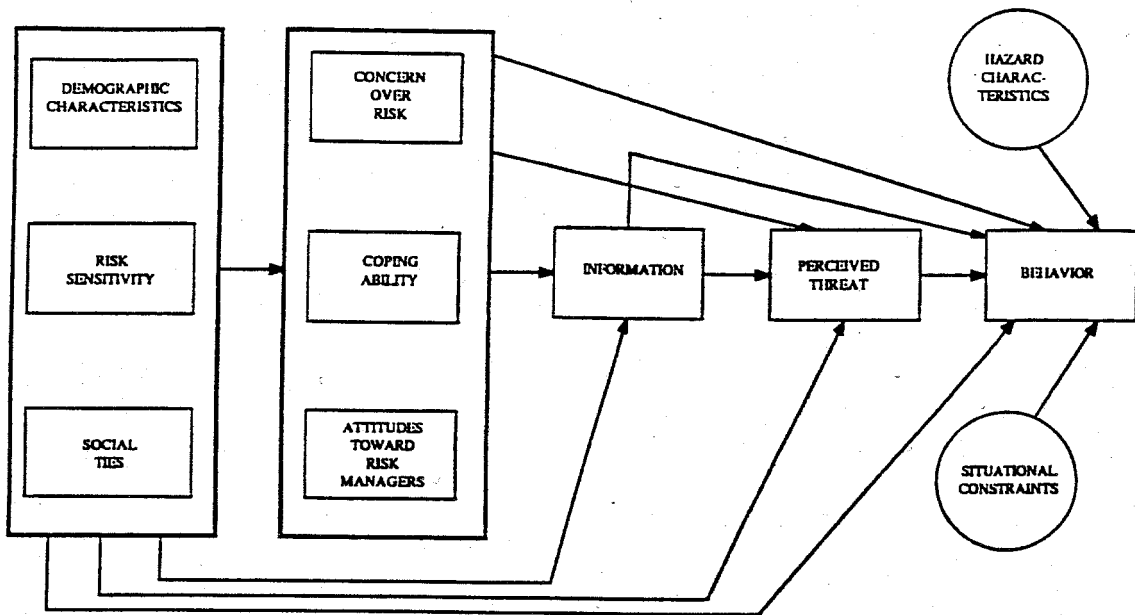


Figure 1. A general model of evacuation behavior. From Sorensen, Vogt and Mileti, 1987.

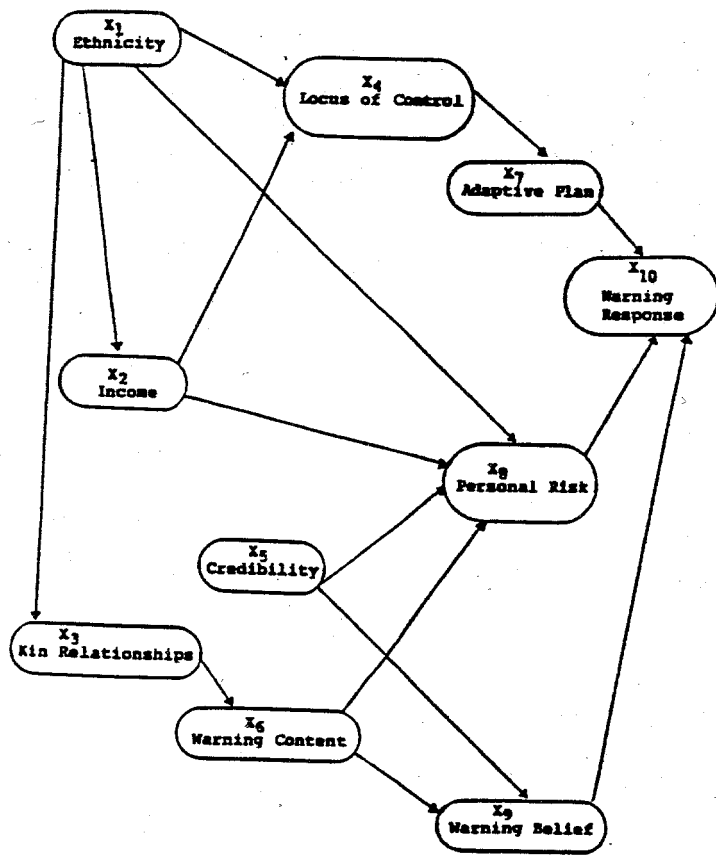


Figure 2. Model of evacuation decision-making. From Perry and Mushkatel, 1984.

and commitment to preparedness, disaster experience), the social characteristics and past experiences of the groups receiving the evacuation message, and the immediate context in which the message is received and evaluated--whether the members of the household are able to account for one another and evacuate together, whether it is possible to confirm the evacuation warning through personal contacts, whether it is practically possible to evacuate, and so on.

Based on his assessment of research on the evacuation process, Quarantelli (1984a) makes the following recommendations: (1) that evacuation is an important policy matter that deserves serious consideration by emergency managers; (2) that planning should visualize evacuation as a process consisting of different stages and various contingencies, rather than a simple linear process; evacuation consists of a number of subtasks that need to be considered in detail; and (3) that planning should take into account all the behaviors that are involved in the evacuation process--including the warning itself, the withdrawal phase, emergency sheltering, and the return phase.

It has been repeatedly observed that even under obviously hazardous conditions, and even when they are ordered to do so, people generally are very reluctant to leave their homes (Quarantelli, 1984a; 1990). However, a growing body of evidence suggests that with careful attention to all phases of the warning/evacuation process it is possible to carry out very successful evacuations, even of large numbers of people. For

example, last year in the U. S. officials made an intensive effort to warn the public in the region of Florida that Hurricane Andrew was expected to strike, and 700,000 people heeded the warning and withdrew from the area. As a result few lives were lost, even though the storm (the costliest disaster in U. S. history) devastated the areas it hit.

ORGANIZED SOCIAL BEHAVIOR DURING THE EMERGENCY PERIOD

Behavior of Populations in Disaster-Stricken Areas

Numerous reports in the literature aim at dispelling so-called "disaster myths"--erroneous ideas about how people respond in emergency situations (for discussions, see Quarantelli and Dynes, 1972; Wenger, Dynes, Sebok and Neff, 1985; Wenger, James, and Faupel, 1985). Such myths include the idea that panic flight is common before, during, or immediately after disaster impact; that after impact residents of disaster stricken areas are dazed, shocked, helpless, and unable to assist one another; that crime and other forms of anti-social behavior increase markedly after disaster impact¹; and that persons who have been assigned official disaster response tasks will abandon their posts and think only of caring for their loved ones, leaving the stricken community without sufficient assistance. If used as a basis for emergency

¹ Studies on disasters in the U. S. and a number of other countries suggest that the looting of disaster-stricken areas is extremely rare--although looting is invariably mentioned in mass media stories on disasters. This research finding seems quite robust. However, the frequency of looting and other crime may vary cross-culturally and across different types of disaster situations. More research is needed to identify factors that affect rates of looting and other anti-social behavior following disasters.

preparedness and disaster response, these kinds of ideas can result in misallocation of resources and failure to address the real problems a disaster may present.

In contrast with these generally negative images of disaster behavior, empirical research suggests that human behavior in emergency situations is generally adaptive and that considerable continuity exists between pre- and post-disaster behavior patterns. Research shows that, rather than being dazed and in shock, residents of disaster-stricken areas have been found to be extremely proactive and willing to assist one another. **Pro-social behavior**, rather than anti-social behavior, is the norm. To the greatest extent possible, people respond immediately to the demands of an emergency situation, providing assistance to one another and supporting those who attempt to manage the emergency. The most tasks--initial search and rescue and life-saving measures--typically are performed by community residents themselves. People behave very altruistically, often risking their lives to provide assistance to fellow victims. (For recent evidence on this pattern in various cultural settings, see Wyllie and Filson 1989, on the 1988 Armenian earthquake; Dynes, Quarantelli, and Wenger, 1990, on the 1985 Mexico City earthquake; Tierney, 1991, on the 1989 Loma Prieta earthquake in California; and Aguirre, 1993, on the 1992 Guadalajara, Mexico, gas explosion.)

In this same vein, **volunteer activity** increases at the time of disaster impact and remains widespread during the emergency period. For example, in a survey conducted on a random sample of nearly

3,000 Mexico City residents following the 1985 earthquake, 9.8% of all those surveyed reported engaging in some sort of volunteer action during the three week period after the earthquake. Extrapolated to the entire population of the city, this translates to at least 2,000,000 persons (Dynes, Quarantelli, and Wenger, 1990). Following the 1989 Loma Prieta earthquake in California, a survey conducted by O'Brien and Miletic (1993) found that a large majority of the residents of the two hardest-hit areas participated in some type of emergency response activity following the earthquake. Such activities included engaging in search and rescue activities, providing food and water, helping with clean-up and debris removal, and providing shelter to displaced earthquake victims.

Community residents engaging in response-related activities in what Barton (1969) terms the "mass assault" phase following disaster impact do not do so as individuals; rather, they rapidly organize themselves into groups. These emergent groups (to be discussed in more detail below), which are often based on pre-disaster social ties (friendship networks, extended families, neighborhood organizations), are an extremely important aspect of the overall disaster response. Disaster planners should anticipate the emergence of new groups performing disaster-related tasks and develop ways of incorporating them into the overall response.

During the immediate post-impact period, community solidarity is typically heightened. Conflicts still exist and problems invariably occur during the response period, but norms emerge that

encourage cooperation and mutual aid. As communities become more solidaristic, however, they may also become more intolerant of outsiders--including outside providers of assistance (Dynes, 1970; Drabek, 1986; 1993).

Convergence, or the movement of people and resources into the stricken area following disaster impact, was one of the first patterns systematically documented by disaster researchers (Fritz and Mathewson, 1957). Convergence of people and resources occurs for a variety of reasons: the natural tendency to want to help disaster victims; media attention; and curiosity and the desire for excitement. Convergence can occasion problems, particularly when the people who converge and the materials and supplies that are sent aren't needed or can't be used--as is often the case (Dynes, 1970). Numerous reports highlight the problems that disaster responders encounter in dealing with the convergence of unwanted and unneeded resources. Those attempting to provide aid may be completely unaware of what the real needs are. One recent report, for example, indicated that only 30% of the drugs sent to Armenia after the 1988 earthquake were immediately useful; the remainder were too poorly labeled to be of use, not suitable, or expired or frozen when they arrived (International Federation of Red Cross and Red Crescent Societies, 1993). Carter (1991: 117) gives other examples:

In one recorded case, a large supply of yellow bikinis were sent to refugees trying to subsist in semi-arctic conditions. In another case, supplies of high-heeled shoes were sent to victims who were never likely to wear them. In a third case, a well-meaning overseas community collected a huge amount of fruit and had it flown by

chartered aircraft to a neighboring country. On arrival, the fruit had to be destroyed because of the danger of introducing fruit-fly and thus risking the future of indigenous crops.

In short, research suggests that planners need to pay close attention to how the inevitable influx of people and goods into a disaster area will be managed and that they should be very cautious about issuing blanket requests for resources; the response could overwhelm them.

Organizational Responses

A key feature of disasters is that they create very high demands for a range of activities (e.g., life-saving, medical care, debris removal)--demands that exceed the normal response capacity of the community or society. Under such high demand levels, organizations, groups, and individuals must adapt. For organizations involved in disaster, adaptation involves undergoing changes in structure and functioning that enable them to perform disaster-related tasks more effectively.

One typology of organizational adaptation to stress that has been used extensively (see Dynes, 1970; Brouillette and Quarantelli, 1971; Stallings, 1978) classifies responding organizations along two dimensions--tasks and structure--and according to whether or not either dimension undergoes change during the emergency period. This classification yields four types of organized response to disaster (see Figure 3 below). Established, or Type I organizations perform the same tasks for which they are responsible during non-disaster times, with basically the same organizational structure. Relatively

specialized and highly structured, these organizations do not attempt to incorporate new members or perform new tasks; they merely step up their operations to meet increased demands.

Type II, or expanding, organizations tend to be small or relatively inactive during non-disaster times, but they increase in size during the emergency, and they also become involved in activities different from their everyday tasks. Such organizations can experience considerable difficulty adapting, because their structure changes at the same time they are required to engage in new and sometimes complex tasks².

Type III, or extending, organizations retain their predisaster structure but engage in disaster-related tasks that are new. What changes for these organizations is what they are doing in the emergency situation, not their membership or authority structure. A business that offers to perform some emergency task is an example of a Type III organization.

Type IV, or emergent groups, were mentioned briefly above. Emergent groups typically consist of residents of the stricken area and are informal and relatively undifferentiated structurally--at least initially. Since these groups were not part of the pre-disaster community setting, they may lack linkages to official disaster response networks.

² In the U. S., Red Cross operations in disaster situations fall into this category. Although the Red Cross has a Federal mandate to provide emergency shelter and other services to disaster victims, it must perform these tasks using volunteers. Taking on complex tasks while incorporating large numbers of new staff members is often difficult for the agency, particularly in very large disaster events.

		Tasks	
		Routine	Nonroutine
Organizational Structure	Same as Predisaster	Type I Established	Type III Extending
	New	Type II Expanding	Type IV Emergent

Figure 3. Forms of organizational adaptation in disasters. Based on illustration in Dynes, 1970.

The presence of so many new organizational forms makes overall coordination difficult during the emergency period. It can also create the impression that the response is "chaotic," or that organization is absent. However, such changes are adaptive and are inevitable in disaster situations; the larger the disaster, the more these patterns will be observed. The difficulty arises when emergency planners fail to anticipate these changes in organizational structure and functioning (including the emergence of new groups), fail to build flexibility into their plans, and expect all activities in the response period to be pre-planned and highly-structured. If a situation could be handled through routine organizational operations and standard procedures, and if all its details could be planned out beforehand, it would not be a disaster.

Generally speaking, the larger the event, the more the response is likely to include organizations from outside the

stricken area, such as regional and central government agencies, outside non-governmental organizations, and international aid providers. Besides adding further to problems of coordination, such situations can be accompanied by considerable political friction. Although the politics of disaster assistance and international aid are outside the scope of this paper, they do warrant at least a brief mention here because they are an important part of the context in which preparedness and response agencies must operate. In addition to aiding victims, clearing debris, and dealing with other aspects of the physical disaster agent, emergency managers and officials in disaster-stricken areas frequently find that they must become experts at handling bureaucratic and political disasters as well.

CONCLUDING COMMENTS

Disaster preparedness and response are extremely large areas to review in a single paper. What this paper has attempted to do is to introduce readers to some major preparedness and response-related topics that have been considered in the social science literature. For those wishing to obtain more detailed information on subjects such as warning, evacuation, and the overall management of disasters, the list of references appended to this paper should provide a starting-point for in-depth inquiry.

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