Introduction

This element in the Tricenter Project is based on the assumption that seismic safety advocates have a better chance of realizing their objectives—persuading the public that enhanced safety measures are needed, turning apathy and even outright opposition into support for earthquake safety, and building a constituency that will support loss-reduction measures—if they convey information in ways that are consistent with sound risk communication principles. While risk communication alone is not sufficient to bring about change in individual, group, and organizational behavior, effective risk communication is an essential element in that process. Beyond communicating risk, however, advocates must also build constituencies that support seismic safety and take other steps to realize their objectives in public policy arenas. Strategies for building that support are discussed at length in other papers in this volume. This paper provides guidance that will enable advocates to craft effective risk communication messages and campaigns, deal with issues that are unique to earthquake risk communication, and avoid mistakes that can undermine efforts to enhance seismic safety.

Risk Communication Research and the Earthquake Threat

Background: Taking Advantage of a Large Body of Knowledge

The literature on risk communication is large and diverse. Various disciplines, including psychology, cognitive science, communication and mass media studies, sociology, management science, decision sciences, and various health-related disciplines, have made contributions to the body of work that currently exists on risk communication. Studies vary along many dimensions, including:

- The types of risks that are focused on, which span a vast panoply of health, safety, and environmental risks—including natural and technological hazards
- Salient characteristics associated with risks, including their frequency and severity, uncertainty with respect to the risks themselves and to outcomes resulting from their occurrence, and other attributes of risks (e.g., familiar, exotic, dreaded or deadly)
- Risk communication time frames, which range from very short-term (e.g., warnings that some disaster will strike within minutes or hours) to long-term (e.g., risk communications focusing on the long-term health risks associated with smoking or poor diet)
• Elements in the risk communication process that are considered (e.g., source, message, channel, and receiver characteristics and combinations of those elements)
• Models used to describe and explain the risk communication process
• Factors associated with risk communication successes and failures
• Dependent variables and outcomes of interest, which range from risk perceptions and changes in those perceptions to specific actions that can be taken in response to risk communication messages, such as self-protective and risk-management activities

Within this very large literature, there are a variety of publications that attempt to distill general lessons learned from risk communication research and practice. Some of these publications focus on natural hazards. Examples of relevant work include: National Research Council, 1989; Handmer and Rowsell, 1990; Kasperson and Stallen, 1991; Sublet, Covello, and Tinker, 1996; Lundgren and McMakin, 1998; and Morgan, 2002. While the literature on risk communication involving natural hazards includes studies on hazards of all types, a significant proportion of that work addresses earthquakes (see, for example, Mileti, Fitzpatrick, and Farhar, 1990; Mileti and Fitzpatrick, 1993; Mileti, Darlington, Fitzpatrick, and O’Brien, 1993; Blanchard-Boehm, 1998). Guidance can thus be drawn from a wide variety of sources, including the large literature on shorter-term disaster warnings (see Lindell and Perry, 1992), which also has potential relevance for earthquake risk communication.

The Challenge of Communicating About Earthquake Risks

Efforts to design effective risk communication messages and campaigns can draw upon general lessons from the broader risk communication literature, as well as portions of that literature that focus specifically on natural and technological hazards. However, in drawing upon those lessons, advocates must also take into account what is distinctive about the U. S. earthquake threat and the public response to that threat—factors that make devising risk communication strategies and stimulating action particularly challenging. In particular, the tasks advocates face are difficult because:

• Hazard contexts vary nationwide
• Risk communication contexts also vary in a variety of ways, e.g., situations in which considerable effort has already been invested in communicating earthquake risk versus those in which little has been done, and situations in which significant earthquakes have recently occurred versus those in which it is not possible to “capitalize” on recent events in risk communication efforts
• While not rare when considered on a national scale, earthquakes range from infrequent to very rare for individual communities, and highly damaging earthquakes remain very rare
• Regions, communities, groups, and individuals vary with respect to their earthquake experience
• All earthquake forecasts and loss projections involve significant uncertainties, and those uncertainties also vary on a regional basis
• Earthquakes are seen as a serious threat in only a few U.S. communities
• Public perceptions and knowledge of the earthquake threat vary on a community
  and regional basis
• Public perceptions and knowledge of the earthquake threat also vary as a function
  of such factors as socioeconomic status, ethnicity, and gender
• Even in areas where awareness is high, that awareness only rarely leads to action
• Views concerning the earthquake are colored by a variety of myths and subject to
  the same biases as those that accompany other hazard-related risk perceptions
• In general, the public is not well-informed, either with respect to the earthquake
  hazard or with respect to current and achievable levels of seismic safety—for
  example, how much safety current codes offer, what additional levels of safety
  can be achieved through stricter codes, and what benefits can be achieved through
  seismic retrofitting
• In many communities, lawmakers and other public officials—that is, those this
  project targets as potential advocates—may be no better informed than the general
  public on issues of seismic safety
• Earthquakes tend to be low on political agendas, except during periods
  immediately following significant disaster events
• Since the events of September 11, 2001, earthquakes and other natural hazards
  must increasingly compete with homeland-security-related threats for public
  attention and dollars

These aspects of the earthquake threat have several implications for how advocates
should approach the challenge of communicating earthquake risks. One major set of
concerns centers on ways of effectively targeting audiences. In many parts of the U.S.
and in many segments of the public, the earthquake threat is not salient enough to
generate either true concern or action. Thus, one overriding challenge is to provide
information in ways that motivate people to take the threat seriously. Because many
audiences are likely to be confused about the earthquake hazard, even in high-risk areas,
risk communication messages must be informative, rich in educational content, and
designed in ways that enhance learning and the retention of relatively complex
information. Along these same lines, strategies must be customized in ways that address
variations in hazard context and in earthquake experience. They must also be designed
to take into account sociodemographic factors, such as community and regional
variations in public perceptions and knowledge of earthquake threats, that influence the
risk communication process.

A second set of challenges center on the nature of the earthquake hazard itself. For risk
communication purposes, earthquakes can be classified as “low probability/high
consequence” events, and risk communication strategies should be designed accordingly.
Additionally, risk communication strategies must address and surmount problems
associated with the communication of uncertainties. Finally, the approaches adopted for
communicating earthquake risk and mobilizing public support strategies must be
designed to overcome apathy and anticipate and neutralize organized opposition. The
remainder of this section of the paper discusses these general considerations and suggests
appropriate risk communication strategies.
Earthquake Risk Communication as Process

One major barrier to effective risk communication lies in the fact that scientists and engineers developed much of the knowledge that exists on the earthquake threat, and, as a result, available information on earthquakes and their impacts is often geared towards these professional groups. Geologists, seismologists, structural engineers, and other professionals conduct research and develop findings in order to communicate with one another, but generally not with community residents, public officials, or community groups. Their work is mainly carried out to advance professional knowledge and improve engineering practice rather than to motivate public concern or reshape public policy. There is thus a disconnect between existing scientific information on risks and the information needs of the public and stakeholder groups. All public risk communication efforts must identify ways of translating data that were originally developed for communication within the scientific community into information the public and decision makers can understand and use. Fortunately, the literature contains a considerable amount of sound guidance on how that can be done. What follows are some practical pointers that are based on that literature.

Addressing All Components of the Process

There are many models of the risk communication process, virtually all of which have their basis in Lasswell’s (1948) original characterization of communications as involving six elements: source, channel, message, receiver, effect, and feedback. As summarized by Tierney, Lindell, and Perry (2001: 84-85), the process can be thought of as encompassing the following steps or stages:

1. Information about an actual or potential disaster can come from physical cues or from social sources such as authorities, news media, and informal groups. The information can be transmitted face-to-face or through different technological channels (print or electronic) to different demographic segments of the community, producing a range of psychological and behavioral effects…the effects on the recipient take place in a sequence of stages, including exposure to the information, attention to it, comprehension of its meaning, and acceptance of its accuracy and relevance for the receiver.

Once received, the information produces both cognitive and affective responses among information recipients. Ideally, those information recipients then take some action, which in turn produces feedback and possible subsequent behavioral adjustment.

From the perspective of the individual who is the intended recipient of risk information, the risk communication process involves a series of stages, described by different researchers as hearing the information, understanding it, and perceiving its relevance (Nigg, 1982); attention, comprehension, acceptance, retention, and action (Lindell and Perry, 1992); and hearing, understanding, believing, and personalizing the risk (Mileti and Fitzpatrick, 1993). Nathe, et al. (1999) characterize the public education process for
enhancing seismic safety as seeking to provide answers to the following questions for message recipients:

- What is an earthquake?
- What are the likely damages and losses from an earthquake event?
- Am I likely to suffer personal losses in my home or office?
- Can I do anything to reduce my vulnerability to seismic events?
- What will it cost to reduce my losses? How complicated is it? Has anybody I know done it? And when shall I begin?

Risk communication campaigns that are not able to provide answers for those questions are unlikely to succeed in gaining attention and motivating action. Effective efforts are those that help message recipients move through the entire process, from understanding the hazard to taking action to reduce their risks.

In developing and carrying out their risk communication strategies, advocates must think in terms of the entire risk communication process, taking into account all elements that are necessary for effective risk communication. Working through the stages of the general model of communications outlined above, ensuring that risk communication efforts have an impact involves selecting the best **sources** for the release of information; taking information **channels** into account, crafting appropriate **messages**, visuals, and other media for communicating risk; having an understanding of which message **recipients** are being targeted and what the needs and capabilities of those target audiences are; and specifying what **effects or actions** the message is intended to produce (for example, stimulating preparedness). The following sections provide further guidance with respect to the first four components of the risk communication process: (1) sources; (2) channels; (3) messages; and (4) recipients.

**Information Sources**

People receive information on hazards of all kinds from a wide range of sources, including informal sources such as friends, family members, co-workers, and neighbors; mass media outlets; new communications media, such as the Internet; the scientific community; government sources; private-sector sources, including corporations and advertising; and their own personal experiences. At any given time, individuals and groups may be actively involved in seeking out hazard-related information, or they may merely passively receive that information in the course of their everyday activities. Information obtained from the media and other “impersonal” sources is confirmed, reinforced, or revised through informal contacts and conversations. The reverse is also true: when people obtain information through their informal ties, they may seek verification or additional information through formal channels. These various formal and informal sources may convey erroneous as well as accurate information, and the information obtained may be consistent or inconsistent. Various information sources may contradict one another, and information that is disseminated through formal channels may be further distorted—or further clarified—through informal communications networks.
There is, in other words, considerable amount of complexity and “noise” in the entire process of disseminating information on hazards. This is not something that earthquake safety advocates can change. The challenge for those involved in the risk communication process is to cut through the noise with strong “signals” for message recipients. With respect to message sources, this involves first understanding what sources people typically use to obtain their information on earthquake hazards, and then using those sources and making sure that the information that is disseminated is clear, consistent, and credible. It also involves being ready to use information sources effectively when situations and events develop that stimulate information-seeking among members of the public, such as the occurrence of small earthquakes, or damaging earthquakes in other countries.

Seismic safety advocates must always be concerned with maintaining and enhancing source credibility. They face two key challenges with respect to the information sources they use in risk communication campaigns. The first is to ensure the credibility and legitimacy of the organizations that are providing seismic hazard information. The second is to identify spokespersons that audiences perceive as trustworthy. The discussions that follow provide advice on how advocates can surmount these challenges.

Factors Influencing the Credibility of Sources and Spokespersons

People are bombarded daily with information of all types from a wide range of sources. One major challenge they face in dealing with excessive amounts of information is to decide which sources are credible and trustworthy and which should be ignored. Obviously, people listen to, value, and in general are more likely to act on information they receive from sources that they trust as reliable. Conversely, these individuals tend to discount information that comes from untrustworthy sources. Even complete and accurate information will be rejected if the information source is not considered credible. Risk communication thus involves two interrelated challenges: determining which sources people consider credible, and using those sources effectively in seismic safety campaigns; and taking steps to ensure that the agencies, organizations, and individuals involved in communicating about seismic hazard maintain high levels of credibility. In a related vein, advocates should guard against doing things that are likely to damage their credibility.

What makes an information source credible? Put another way, what are the factors that damage the credibility of sources? In a publication on risk communication, the National Research Council (1989) discussed several factors that stand in the way of effective risk communication due to their impact on source credibility: (1) taking positions that appear to audiences as unjustified, in light of what people consider to be reasonable; (2) gaining a reputation for deceit, misrepresentation, or lack of full disclosure of information; (3) making statements and taking actions that contradict previous positions; (4) communicating risks in ways that appear to be self-serving; and (5) putting out messages that contradict information provided by other sources. This last point is especially problematic; in many cases risk communication efforts are accompanied by seemingly
contradictory messages from various sources. Nevertheless, the challenge for seismic safety advocates is to try to see to it that the various sources that are engaged in disseminating seismic hazard information are consistent with one another.

The National Research Council report also identified other factors that affect source credibility. The perceived competence of those providing risk information is one such factor. Credible sources are those that can legitimately claim specialized knowledge concerning the topics about which they are communicating. Following this advice, information sources used by seismic safety advocates—both specific individuals and organizations and agencies—should be those that are seen by audiences as having special expertise and competence with respect to earthquake hazards. This would include earth scientists, agencies such as the US Geological Survey, and other recognized authorities. At the same time, since it cannot be automatically assumed that all recipients of risk messages understand what different scientific specialties and government agencies do, risk communicators should find ways of conferring legitimacy on the information sources they use—for example, by providing more information about sources and about the credentials of spokespersons.

Various publications have focused on factors that may enhance source credibility and trustworthiness. According to a recent publication from the California Governor’s Office of Emergency Services (2001) entitled Risk Communication Guide for State and Local Authorities, agencies can be expected to be seen as trustworthy if they portray a sense of competence; appear to genuinely care about the things their audiences care about; encourage meaningful public involvement in discussions on risk; appear to be honorable and honest; and are able to deal effectively with public outrage and other emotions that members of the public may express with respect to hazards. Along similar lines, Renn and Levine (1991) identified five characteristics of information sources that enhance their trustworthiness and credibility: competence; objectivity; fairness; consistency; and the ability to transmit a sense of goodwill. Others point to the importance of similar attributes, such as perceived knowledge and expertise, perceived openness and honesty, and perceived caring and concern (Peters, Covello, and McCallum, 1997). The California OES Risk Communication Guide (2001) offers the following advice for advocates wishing to maintain and enhance their credibility:

Be forthcoming with information and involve the community from the outset…Focus on building trust as well as generating good technical information…Provide information that meets people’s needs…Get the facts straight and avoid mixed messages…Only make promises you are sure you can keep…Follow through (p. 25).

Turning more specifically to attributes and behaviors that make individuals more credible as spokespersons, Renn and Levine (1991) argue that several factors are associated with being a good risk communications spokesperson: the ability to admit uncertainty; the public perception that the spokespersons are competent, expert, honest, altruistic, and objective; the physical attractiveness and overall appearance of the individual; and the person’s ability to respond to the emotions of audience members. They also note that
message recipients assign more credibility to people who are similar to them—something advocates should keep in mind in selecting spokespersons to communicate with diverse groups within the population. On the negative side, individuals are seen in a negative light if they appear arrogant and indifferent, if they are seen by target audiences as outsiders, or if they come across as too technical.

In their handbook on risk communication, Lundgren and McMakin (1998) cite a number of different factors that may affect the credibility of spokespersons. Spokespersons must be acceptable to the audience, which, in turn, affects how well they are able to respond to audience concerns. Spokespersons must also have a good track record of working with the target audience—whether that audience consists of community residents, particular groups, or decision makers—and must be able to convey information in a manner that the audience can understand. For example, in dealing with the public, spokespersons must often communicate in languages other than English and be able to clearly present scientific data and information in ways that the public can understand.

Another notable finding from research in risk communication is that it appears to be easier for a source to lose credibility than to gain it. Slovic (1993) has referred to this phenomenon as the “asymmetry principle;” essentially, people more readily perceive negative events—such as accidents and failures—than positive ones. Negative events, such as communications gaffes and messages that are seen as deceptive, also appear to have a more significant impact on attitudes than positive ones. Additionally, risk communication research has found that people tend to view sources of bad news as more credible than sources of good news. As a result, advocates should be aware that the mishandling of situations in which information about earthquake risks is communicated might result in damaging relationships of credibility and trust that may have taken years to develop. For example, care should be taken to avoid situations in which sources could be perceived as withholding vital information from audiences, or, on the other hand, releasing erroneous or contradictory information. Similarly, advocates should control any tendency they may have to release inconclusive information too rapidly, in case that information might later prove to be inaccurate. Sources should also be as honest as possible about the information they release—for example, by stating explicitly that they do not have enough information to reach definitive conclusions, or that the knowledge conveyed is the best they currently have.

Research on source credibility and trustworthiness contains a number of general lessons for seismic safety advocates. One important lesson is that, while technical expertise and knowledge clearly help a source present itself as trustworthy, factors such as perceived honesty, consistency, genuine concern for the needs of audiences, and disinterestedness also play an important role in establishing credibility. Long-term involvement with the community and an understanding of community needs also help establish the perception of credibility and trust.

Consistency is important, with respect to both information sources and spokespersons. Just as it does in interpersonal relationships, consistency plays an important role in building trust in institutions. The creation of a consistent and trustworthy image for
seismic hazard information sources can be seen as parallel to the “branding” efforts of private-sector organizations. Indeed, much like corporate advertising strategies, seismic hazard information sources must be aware of their brand image, and, therefore, should seek to imbue their messages with an image of accuracy, high quality, reliability, familiarity, and concern.

There are several examples of organizations and information sources that are widely viewed as credible sources for risk communication. For example, the U.S. Geological Survey and the California Geological Survey are typically viewed as the “sources of record” for valid information on the earthquake threat. In terms of spokespersons for seismic risk, Lucy Jones and Kate Hutton are seen in Southern California as highly credible and trustworthy sources for earthquake hazard information. The decision to designate specific spokespersons to appear frequently on the media, rather than continuing to introduce new faces, was a good one, because the public likes to feel that it “knows” both organizational information providers and specific spokespersons. A longstanding and solid track record also helps institutionalize source credibility; for example, the National Hurricane Center is widely recognized as the definitive source for accurate and credible hurricane forecasts and warnings.

**Intergroup Differences and Information Sources**

Although there has not been much research on the extent to which various segments of the U.S. public rely on different sources for information on earthquakes and other hazards, the existing research does suggest that risk communication campaigns should take intergroup differences into account. Members of different minority groups do not necessarily turn to the same kinds of sources for information on hazards as do members of the Caucasian majority, nor do they find the same sources credible and trustworthy (Turner, Nigg, and Heller Paz, 1986; Lindell and Perry, 1992). For example, in a study on the warning responses of African-Americans, Mexican-Americans, and Caucasians, Perry and Lindell (1991) found that white respondents were more likely to identify public authorities, such as police and fire departments, as well as mass media as credible sources of hazard information. African-Americans also considered public authorities credible, but they were more likely than whites to rely on social network ties—such as family and friendship relationships—for hazards information. Mexican-Americans placed even more trust in those kinds of informal networks for information.

The important point to note here is that subgroups within the population vary with respect to the conduits they rely on for information, including information on hazards. Information sources that are used by “majority” community residents are not the same as those used by racial and cultural minorities. Moreover, as noted earlier, people assign more credibility to information sources that they see as similar to themselves. Therefore, seismic safety advocates need to closely study their own communities to identify where different groups routinely turn for hazard-related information; what institutions, organizations, leaders, and other information sources they consider most credible and trustworthy; and which leaders they trust. Rather than assuming that all members of the public will find particular institutions and spokespersons equally credible, advocates
should seek out organizations and individuals that different groups within the population already consider credible and engage these groups and individuals in seismic risk communication efforts. To obtain this kind of information, it will be necessary for advocates to contact and work closely with community groups and leaders that represent various community constituencies. At the same time, they should actively work to familiarize less-well-informed groups within the population with proven sources of valid information and to make that information available in a form that is readily understandable.

**Communication Channels**

Communication channels consist of the various means through which hazard-related information is disseminated. Channels include both interpersonal communication networks and mass media sources. Focusing on the variety of ways information can be conveyed to the public and groups within the population, California Governor’s Office of Emergency Services report on risk communication (2001) discusses a wide variety of “vehicles” that can be used in risk communication activities. These different vehicles employ both person-to-person and mass media information dissemination. Person-to-person communication channels include public hearings, conferences, workshops, courses, and door-to-door canvassing. Communication vehicles that employ the mass media include news conferences, talk shows, public service announcements, press briefings, feature articles, and newspaper advertisements. Complementing and supplementing formal risk communication efforts are the informal interpersonal channels that people routinely employ in the workplace, neighborhoods, and among family members.

As a general rule, experts on risk communication stress the importance of using multiple channels for information dissemination, rather than relying on one or two sources (Nathe, et al, 1999). A well-designed risk communication campaign is one that employs both person-to-person and mass media communication strategies. Ideally, campaigns should be designed and timed so that both types of channels are addressed simultaneously and various vehicles of communication are used within each. At the same time, as discussed in the following section on messages and message content, care needs to be taken to ensure that the messages that are conveyed through various channels are consistent and mutually reinforcing.

**Socio-Economic Factors Affecting the Use of Different Information Sources**

Some mass media are almost universally used in U. S. society, but there is also quite strong evidence for differential media use among different age, ethnic and racial, and income groups. Television is the most commonly used mass medium in the U.S., with 94% of the population reporting television use. Prime-time television and cable television reach slightly smaller audiences (82% and 73%, respectively). Eighty-four percent of the population reports listening to the radio, 79% read newspapers, and about 52% of the population report using the Internet. While television, prime-time television programs, and cable use do not vary much across ethnic groups in the U.S., variations are
evident among these groups in radio listening, newspaper reading, and Internet use. For example, while 67% of Asian-Americans use Internet information sources, only 41% of Spanish-speaking Americans report Internet usage.

Radio use, newspaper reading, and Internet use are directly related to both education and income. That is, the higher the income and educational level, the greater the reported use of these media. These differences are particularly evident with respect to the Internet. In the case of income, for example, only 18% of those with household incomes of less than $10,000 use the Internet, while 74% of those with household incomes of $50,000 or more report Internet usage. Around 16% of those who never graduated from high school use the web, while that percentage exceeds 76% for college graduates. Age is also associated with differential media use; younger populations are more likely to utilize radio and Internet information sources. While ninety percent of the 18-24-year-old age group listen to radio, 61% of those over 65 do so. There is also a strong inverse relationship between age and Internet use. While 60-64% of the population between 18 and 54 reports using the Internet, those percentages drop to 49% for those 55 to 64 and 15% for those over 65.

Patterns of media penetration and differential media use are important considerations for those who are designing risk communication campaigns. As a general rule, overall coverage of the population is greatest for television and lowest for the Internet. Newspaper-based seismic educational campaigns will fail to reach one out of every five US residents (and 40% of non-high-school graduates), simply because many people don’t read newspapers. Similarly, owing to the persistence of the “digital divide,” campaigns based solely or primarily on Internet dissemination of information will miss large segments of the population. (Statistics taken from Congressional Information Service, Inc. 2003a; 2003b).

**Strengths and Weaknesses of Different Media**

Advocates must also keep in mind that not all media sources do an equally good job of communicating complex scientific information. Among mass media sources, television can provide dramatic images that attract viewers’ attention, and it offers the potential for providing informative visual material, such as hazard maps, in an easily understandable manner. However, television is also an ephemeral information source; people watch, and under ideal circumstances they assimilate and retain all or some of the information provided. However, unless they tape the program or segment, they generally have no way of saving or referring back to the information later. Additionally, with the exception of documentaries, television coverage tends to be brief and lacking in detail. Radio lacks the visual drama of television. In addition, much like television news reports, most radio news consists of very brief segments, rather than in-depth feature coverage. Like television, radio is also ephemeral. The kinds of radio stories that provide in-depth, useful information on hazards are likely to be aired on public radio, a “prestige” medium whose use varies with education, income, and ethnicity. Regarding the strengths and weaknesses of different mass media, Gutteling and Wiegman (1996: 177) note that:
Audiovisual media will probably be most effective with simple messages. Written materials should be preferred for complex issues. The reasoning behind this notion is relatively straightforward. A written message can be processed more easily, repeatedly, and at the receiver’s own pace, which may be necessary to understand complex information. Television provides the receiver with only one opportunity to process the information. With complex information, this is most likely not enough for adequate processing.

What this means is that because of the ephemeral nature of TV and radio, information—including information on hazards—needs to be disseminated repeatedly and consistently over time in order to have an impact. It also means that, given the complex nature of earthquake hazards and earthquake safety-related issues, print media are more likely than electronic media to influence audience perceptions and behaviors.

As the above passage suggests, newspapers are generally capable of providing more detailed content than either television or radio. Newspaper stories on risk can also be accompanied by eye-catching graphics that convey needed information. As a medium, the newspaper also has the advantage of being storable—provided readers can be encouraged to save relevant newspaper stories.

In virtually the only systematic study that has attempted to assess the impact of a specific seismic risk communication strategy, Mileti, et al. (1993) observed many potential benefits to distributing risk information through newspapers. In this study, for example, Mileti and his colleagues evaluated a 23 page brochure inserted in San Francisco area newspapers on September 9, 1990. The insert contained detailed information on the likelihood of future earthquakes, potential ground shaking intensity maps, advice for residents on how to mitigate hazards and prepare for earthquakes, and suggestions on how residents can learn more about seismic risk and earthquake preparedness. In subsequent surveys and interviews with business representatives, Mileti and his colleagues found that about half of the residents surveyed had seen the insert, and that almost everyone who had seen it recalled reading it. Many found that the insert had provided new information, most found the information useful, and they were able to recall specific information that had been contained in the brochure.

The newspaper insert was also found to have had a measurable impact on willingness to prepare for future earthquakes. The researchers concluded that this positive effect had to do not only with the information that was provided, but also with the fact that the brochure stimulated additional information seeking and interaction among members of the target audience. When people received consistent information from a range of sources, they were more likely to act.

At the same time, as noted earlier, newspapers tend to be read by better-educated, higher-income members of the population. Since so many members of the public either do not read newspapers or are poor readers, it is not clear whether printed materials will reach less-well-off and less-well-educated segments of the population. To make sure that messages reach those audiences, materials should be distributed through print media that
are routinely used by different groups, and in languages spoken and read by those audiences. The Bay Area newspaper insert, for example, was distributed in English, Spanish, Chinese, Braille, and recordings for the blind.

Much faith is being placed in the Internet as a source of information on hazards, both during non-disaster times and in the context of disaster events. For example, the U.S. Geological Survey has recently developed an Internet-based product called *ShakeMap* that is capable of providing information on earthquake epicenters and shaking intensities in near-real time. Many in the general public have responded to Internet-based questionnaires that request information on their own experiences during earthquakes. The Internet would seem to make an ideal risk communication tool owing to its ability to provide large amounts of information, including maps, graphics, and real time information, as well as its ability to store information that can be retrieved as needed.

However, while the Internet clearly has enormous potential as a medium, its drawbacks must also be recognized. One such drawback is the “digital divide” revealed in the media usage statistics cited above. Although the situation is changing rapidly, as noted earlier, Internet use is currently highly structured by age, income, educational level, and ethnicity. Another drawback is the problem of sheer information overload, coupled with potential problems of source credibility and inconsistency. Indeed, with its immense complexity and staggering amount of content, the Internet is a repository for truth and myth, science, pseudo-science, and superstition, current and accurate as well as out-of-date information.

**Avoiding Overreliance on Mass Media**

One of the most durable findings in mass communications research, first articulated by Paul Lazarsfeld and his colleagues (1948), centers on the importance of the “two-step flow” of communications—that is, the relationship between information obtained through formal channels, such as the media, official sources, and opinion leaders, and informal channels, such as family, friendship, and other social networks. As indicated earlier, people receive information from formal sources and opinion leaders and process that information through their own interpersonal communications networks. Conversely, communications within social networks may give rise to information-seeking from official sources. Opinion-formation and decision-making take place as people receive information from a variety of sources, interpret and compare that information, and seek additional information to address doubts and inconsistencies.

Research also suggests that media campaigns alone are insufficient to motivate behavior change, including the adoption of self-protective behaviors. In a review of research on the role of media in promoting positive health-related behaviors, Redman, Spencer, and Sanson-Fisher (1990) concluded that, when used alone, the media do a very poor job of influencing behavior change. More success is achieved when mass media campaigns are used in conjunction with community-oriented programs promoting the same behaviors—for example, presenting media messages encouraging people not to smoke, and at the same time providing a hotline through which people can access information on local
programs devoted to smoking cessation. These authors concluded that, at least in the case of the studies they reviewed, “[w]hile the mass media may not be effective in directly altering behavior, an alternative view of their role is that they can supply motivation or awareness of a health problem which can later be built on by other intervention strategies” (1990: 95).

These findings suggest that the most effective communications strategies are those that use mass media to disseminate information but that also recognize that message recipients will turn to other informal information sources for confirmation of what they hear from the media. To be effective, media campaigns must be supplemented with community programs that provide additional information, such as school- or neighborhood-based programs. One important lesson from research is that media dissemination constitutes only one phase of a process that also seeks to employ the organizations and social networks with which community residents are involved as risk communication channels. This is especially important for campaigns that actively seek behavior change among information recipients. The general rule is that while media-focused risk communication strategies are a necessary component in any seismic safety campaign, in and of themselves they will never be sufficient to influence target audiences.

It should also be kept in mind that in addition to serving as channels for communicating information to various audiences, the mass media also perform an important agenda-setting function with respect to public policy issues—including issues related to seismic safety. That is, through their reporting, the mass media have a tremendous ability to increase or decrease the salience of policy issues both within the public and among influential groups (Shaw and McCombs, 1977).

**Messages: The Importance of Content and Consistency**

Risk communication activities have different objectives. In some cases, risk communication efforts seek to inform audiences about a particular risk in order to influence risk decisions. In others, the goal is to influence message recipients to undertake some specific action with respect to the risk—for example, to evacuate in the face of an immediate threat, purchase insurance, or retrofit a home (Covello, et al., 1987; Morgan and Lave, 1990). Some risk communication efforts center on trying to make a particular risk more salient to audiences and to make them more concerned. Other risk communication efforts may try to calm audiences down and address their concerns in order to limit unnecessary or unrealistic fears about a particular threat. The last-mentioned type of risk communication challenge is probably best illustrated by the case of the 1990 Iben Browning earthquake “prediction.” The Browning prediction, which forecasted a large-scale seismic event in the Central U.S. in December 1990, gained salience with many audiences, including mass media outlets. Most likely, the public response to this prediction would have been more measured and skeptical had the scientific community been quicker to inform the public of its lack of scientific validity.

This discussion will center on seismic hazard risk communication strategies and messages that seek to both inform the public about earthquake hazards and encourage
self-protective behavior. A key challenge here is to combine accurate and understandable information about the earthquake threat with concrete guidance on what people can do to protect themselves against the hazard. This is no small undertaking, since it involves both being able to effectively communicate about the hazard itself and being able to provide information on a range of adjustments message that recipients might adopt.

As indicated earlier, the difficulties associated with communicating earthquake risk are further complicated by the fact that virtually everything related to the hazard—including the effectiveness of various protective measures—is accompanied by uncertainty. Thus, in addition to providing information that is reliable, valid, and current, messages must be formulated in ways that help audiences appreciate the uncertainties involved in communications regarding the earthquake hazard, yet at the same time not be so confused by them that they decide against taking any action.

**Characteristics of Effective Risk Communication Messages**

Many people assume that failure to prepare for earthquakes and other disasters is a consequence of conscious individual decision-making. People are seen as not sufficiently interested in engaging in self-protective measures or as preferring to take risks and then wait for government assistance in the event a disaster should occur. It is clear that many risky behaviors are the consequence of intentional individual and group choices. Yet at the same time, in the case of natural hazards it is equally probable, if not more likely, that inaction is the result of failure to understand hazards and personalize risks, coupled with a lack of knowledge about what to do to reduce risks or an inability to carry out those measures. For example, Lave and Lave (1991), who studied why people do so little to protect themselves from floods and why so few insure their properties against floods, found that only a relatively small percentage of people actually understand flood hazards. The researchers also found that many people find flood maps and other governmental publications on flood hazards difficult to understand. The study concluded in part that FEMA and other responsible authorities should strive to improve their flood-related risk communication activities by addressing the questions and concerns of at-risk populations in a way that they can understand.

As with flood hazards, the challenge associated with communicating about earthquake hazards is to develop messages that help audiences understand the hazard, understand the extent to which they are personally at risk, know what that information means in terms of potential losses, know what they can do to reduce their risks, and also have adequate information about where they can go for more information on both the hazard and appropriate loss-reduction measures. It is the responsibility of seismic safety advocates to ensure that the information they provide addresses these needs.

The research literature contains a great deal of advice on how to craft effective risk communication messages, including both messages used during “normal,” non-disaster times and those used to issue warnings in the context of specific threats. Based on a systematic review of numerous studies, Mileti and Fitzpatrick (1994) offer the following guidance with respect to the content of risk communication messages:
• Consistency in message content is extremely important. Inconsistencies lead to misunderstanding and inaction. The information provided should be consistent across time, as well as across different message sources and channels.

• The information that is provided should be accurate, timely, and complete. In situations in which incomplete or contradictory information may have been provided, those discrepancies should be explained. Complete accuracy throughout documents and messages is key. Indeed, even small or seemingly unimportant inaccuracies may call into doubt the reliability of the entire message.

• The language used in risk communication messages should be clear, simple, and easy to understand. In other words, technical jargon and unfamiliar terminology should be avoided to the greatest extent possible.

• Messages should convey a sense of confidence in the information that is being provided. Confidence and a sense of certainty should be maintained even in situations involving probabilities and ambiguous information. Message recipients should not be left with doubts about whether to take the information seriously. The importance of certainty and confidence extends both to the information conveyed and to the way in which it is conveyed—including the behavior of official spokespersons.

• Messages should be released as frequently as possible. Frequency influences both attentiveness to and belief in the information that is being communicated.

• Messages should contain information about the anticipated event, its likelihood, and its probable effects in as much detail as possible. It is not sufficient to merely provide general information on when and where earthquakes may occur. Detailed information should be provided on the earthquake and on various types of seismic effects, such as fault rupture, ground shaking, liquefaction, and damage to the built environment.

• Message content should include information on the location of relevant risks and hazards. Risk information that is geographically specific encourages message recipients to personalize these risks.

• Messages should also contain specific guidance on what people should do with respect to the hazard and when they should take those actions. Along those same lines, the message should inform audiences about where they can go for additional information and assistance with carrying out recommended measures.

Looking further into the implications of this advice, it is clear that maps, charts, photographs, film images, and other visual materials are important to the communication of seismic risk information. Visuals can provide needed information on the effects of
earthquakes, including information on the location of specific impacts that can help people better understand and personalize risk. At the same time, visual materials must be clear and easy to understand, and there must be consistency between risk communication texts and the visual information that accompanies them. The previously discussed earthquake hazard insert in Bay Area newspapers, described by Nathe et al. (1999) as the “gold standard” for risk communication, contained all the requisite elements for effective risk communication, including clear and concise text, easy-to-understand maps and information on earthquake probabilities, advice on what readers could do to protect themselves, and guidance on where to go for additional information.

Message Recipients

Effective risk communication and public education campaigns are those that can reach, can be easily understood, and can be acted on by their target audiences. Again, accomplishing these goals presents a significant challenge, particularly in a diverse society. This section contains a series of brief discussions on things that advocates should take into account in developing their risk communications strategies. Those points include understanding how message recipients deal with risk-related information, particularly probabilistic information; developing strategies for communicating both with key actors and opinion leaders and with the public; and understanding audience diversity.

Recognizing Audience Diversity

In his paper “Thinking About Audiences,” Peter May established a typology for classifying advocacy groups. These groups include governmental decision makers at the authoritative policy, managerial, and policy influence levels; private-sector decision makers at both authoritative and policy-influencing levels; professional influence sources, including consulting engineers, planners, insurers, and other types of advisors who can play an advocacy role in seismic safety; and external sources of influence, consisting of those groups that have a stake or interest in seismic safety issues. This list is already quite broad, but it could be broadened further to include nonprofit organizations with significant hazard-related advocacy responsibilities, such as the Red Cross. Professional influence sources also include university-based researchers with relevant expertise.

Using this framework, May identified approximately forty different audiences or potential advocacy groups, along with their information needs, functions, and the roles they play in the policy adoption and implementation process. It is neither feasible nor necessary to develop specialized risk communication messages for each of these groups. Rather, the goal should be to design risk communication strategies that are consistent with their main functional roles—for example, guidelines that would enable those whose role it is to influence policy to be more influential and persuasive with target audiences, or that would enable decision makers to make appropriate decisions more easily. In other words, risk communication strategies should take into account both the needs and normal activities of different groups. Additionally, informational materials should be designed to be consistent with the kinds of data and information those groups commonly use and prefer in their professional roles. For example, organizational and community decision
makers and technical experts differ in terms of the kinds of written materials they generally use and find informative. Experts may find complex discussions of probabilities extremely interesting and useful, while the same information will likely be seen as too complicated and overly vague by decision makers. Information on risk should be packaged in ways that make that information accessible and immediately usable by different audiences.

**Individual and Group Differences in Risk Perception**

It would seem reasonable to assume that when members of the public receive clear, concise, and accurate scientific information on some hazard, they will perceive and process that information in much the same way and reach similar conclusions concerning the threat. However, decades of research indicate that is not the case. Instead, presented with the same information, people typically respond in very different ways.

Receptivity to and processing of risk information are related to a wide range of factors, including: sociodemographic factors, such as race, social class, gender, and education; personality characteristics, such as the tendency to feel fatalistic or, on the other hand, to have a greater sense of personal control; experience with the hazard in question; attitudes concerning information sources, including views on the credibility and trustworthiness of scientific experts; attitudes towards recommended loss-reduction activities—for example, how easy or difficult those actions may be; the ways in which risk information is contextualized or “framed” by those providing risk information; perceptions of what others are doing with respect to the hazard; and general worldviews held by audience members. The brief discussions that follow are not comprehensive, but rather are meant to illustrate a few ways in which different segments of the public differ in their views with respect to hazards.

Regarding racial factors in risk perception, in her study of racial groups and environmental hazards, Vaughan (1995) found that African-Americans tend to be more distrustful of official information sources than the Caucasian population. African-Americans were also found to perceive and “frame” toxic hazards differently than the white majority. While official sources may communicate information about toxic threats in ways that emphasize scientific probabilities or use the language of cost-benefit analysis in discussions on toxic remediation, African-Americans may frame those same hazards in terms of justice and fairness—viewing themselves as disproportionately exposed to toxic hazards.

Many other studies have pointed to racial/ethnic, gender, and household-related differences in risk perception and behavior. Women generally perceive risks differently from men and are generally more risk-averse (Cutter, et al., 1992). According to a body of literature cited by Fothergill (1998), gender influences a range of hazard-related perceptions and behavior, including exposure to hazards, risk perception, preparedness and response behaviors, vulnerability to the physical and psychosocial impacts of disasters, and participation in response and recovery activities. In a study on technological and health risks, for example, researchers found that risk perceptions
differed between Caucasian males and females, as well as from those of non-white males and females. Caucasian males were significantly less likely than members of other groups to perceive a range of different hazards as risky. This pattern, known as the “white male effect,” appears to be related to their higher trust in societal institutions and their greater tendency to see individuals as responsible for making their own choices about the risks they face (Flynn, Slovic, and Mertz, 1994. For further information on ethnic diversity and risk perception, see Vaughan and Nordenstam (1991)). The presence of school-age children in the home is another factor that influences both knowledge concerning hazards and the adoption of hazard adjustments.

Given the literature on differing perceptions of risk among social groups, how should seismic safety advocates proceed? On the one hand, since risk perceptions and actions with respect to hazards are related to factors beyond their control, such as gender, ethnicity, socioeconomic status, and individual beliefs, advocates could conclude that there is little they can do to affect attitudes and behavior among some segments of the population. On the other hand, however, a better strategy would be to acknowledge individual and group differences and address them to the greatest extent possible. For example, anti-smoking campaigns have successfully utilized school-based risk communication outreach to influence the attitudes and behavior of students as well as their parents. Similarly, children-centered earthquake education campaigns appear to be having some success. Some research suggests that providing information that makes people feel more confident that they have the resources necessary to manage the earthquake threat encourages the adoption of self-protective behavior (Mulilis and Duval, 1995). Risk communication messages can be developed that convey that type of information. Along those same lines, Vaughan (1995) noted that one major strategy for communicating risks and bringing about behavioral changes among low-income and minority populations—groups that typically feel little sense of control over their own lives—is to engage their participation in risk-reduction activities and increase their sense of empowerment. Similarly, once barriers associated with education and scientific knowledge are recognized, they can be addressed through the development of simple and clear message content and graphics that communicate hazard information in ways that are easy for those with limited language skills to understand.

**Concluding Comments: Putting the Pieces Together**

Advice abounds on how to communicate with the public and stakeholders about seismic hazards. Based on a review of seismic hazard risk communication studies, Nathe (2000), for example, highlights the following six “immutable laws of public education programs”: (1) programs must explain complicated phenomena in non-technical terms; (2) messages must come from a variety of credible sources; (3) disseminated messages must be consistent, regardless of which media are used; (4) while television and radio messages are effective, printed messages are the most effective manner to disseminate risk-related information; (5) the information provided must enable people to understand what they can do before, during, and after earthquakes; and (6) information is most likely to be believed and accepted if individuals have the opportunity to discuss these messages with their peers.
In another recent document on public hazards education, Mileti (2003) also provides guidance on how to craft successful educational campaigns. Among the points he makes are that: people factors always must be taken into account in any communications strategy; effective hazard education must be seen as ongoing, rather than as a one-time effort; and campaigns work best when people come to believe that taking action was their own idea. Like Nathe, Mileti has developed his own list of what he terms “laws” of effective public hazard education, many of which have already been touched upon earlier. In addition to discussing concrete steps advocates should take, however, Mileti also makes a more general point that advocates need to keep in mind, which is that the goal of hazards communication campaigns should be to create in the minds of audiences a sense of uncertainty, a willingness to question, and an interest in learning more about their environment and their own levels of safety. In other words, educational advocacy efforts must seek to overcome people’s tendency to take their own safety for granted, and to encourage them to talk with others about the earthquake threat and seek out additional information. To the extent advocates can succeed in breaking through that reluctance to face potentially unsettling information, they will have taken the first step toward motivating change.

Timing is clearly a factor in bringing about behavior change. When are people most likely to be receptive to seismic risk communication campaigns? Clearly earthquakes are “windows of opportunity” that can stimulate behavioral change. This includes both earthquakes taking place in a community and distant events that can be made relevant to local audiences. For example, the 1985 Mexico City earthquake proved to be a “teachable moment” for some communities in Southern California. Shaken from their tendency to feel hazards won’t affect them, people are more receptive to information and more willing to act when they see the death and destruction earthquakes can produce. However, the time when an earthquake strikes is no time to begin designing educational campaigns. As Mileti (2003: 6) cautions:

…while people are more apt to alter behaviors after a disaster strikes, change after a disaster is most likely when public educators have already worked to make sure the problem is recognized, the solution is known, and some advocates are already in place. Do not wait for the window to open; build a sustained advocacy program beforehand. Not working constantly may result in waiting forever. (Emphasis added.)

As this quote suggests, communicating about earthquake risks, and seismic safety advocacy more generally, are activities that must be sustained over time if they are to be effective. The advocacy success stories outlined in this volume point clearly to the role of persistence in making change happen. In educating the public, stakeholder groups, and decision makers, advocates must think in terms of long-term strategic planning involving informational products and educational activities that reinforce and build upon one another. This requires in-depth knowledge of the earthquake hazard, media savvy, an understanding of the needs of audiences, resources that are adequate to the task, and above all an ongoing
commitment to raising awareness and stimulating public action. More strategies for building public support for earthquake safety initiatives are discussed in other chapters in this volume, such as “Mobilizing Support for Seismic Loss Reduction.”

References


Brookfield, VT: Gower Technical.


