ANNOTATED BIBLIOGRAPHY
FOR PUBLIC RISK COMMUNICATION
ON WARNINGS FOR PUBLIC PROTECTIVE ACTIONS RESPONSE
AND PUBLIC EDUCATION*
(Revision 4)

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Aguirre, B. 1991. "Evacuation in Cancun During Hurricane Gilbert." *International Journal of Mass Emergencies and Disasters* 9 (1):31-45.

Abstract

This paper describes the evacuation of the population of Cancun, Mexico during Hurricane Gilbert, and identifies some of the correlates of their evacuation behavior. The information was collected during a post-disaster visit conducted one week after impact (September 13, 1988) and as part of a survey a year later of a random sample of 431 persons 18 years and older who resided in Cancun at the time of the disaster. One-fourth of the respondents evacuated. The majority of the evacuees found shelter in the homes of friends, neighbors, and relatives and were gone from their homes a week or less. Socio-demographic variables such as the number of persons in the household, gender, age, and marital status were not very useful predictors of evacuation behavior. Lower socioeconomic status (SES) and higher numbers of family contacts did not increase the probability of evacuation. The findings underscore the importance of calculations of risk for understanding evacuation behavior. The environmental context and physical characteristics of residences are significant variables impacting on the perceptions of risk and on subsequent evacuation behavior.

Causal Findings

A person is more likely to respond to a warning message if they have a subscription to cable television. The greater the fear in looting a person has, the less likely they are to respond to a warning message. A person with a low socio-economic status and/or low quality housing is more likely to respond to a warning message.

Aguirre, Benigno E. 1994. "Planning, Warning, Evacuation and Search and Rescue: A Review of the Social Science Research Literature." Hazard Reduction and Recovery Center, College of Architecture, Texas A&M University, College Station, TX.

Abstract

The focus of this review is on planning, warnings, evacuations, and search and rescue activities that are designed to minimize the deleterious effects of disasters on populations. The review discusses the points of consensus among specialists in these disaster-related activities, and it illustrates them with the authors' research in Puerto Rico and Mexico. The review discusses present-day lack of interest in planning for disasters and the determinants of public response to warnings. A third section presents the prevailing definition of evacuation, types of evacuation, and a list of its determinants, as well as the two major extant conceptual frameworks of evacuation. The fourth and final section of this review presents what is known about search and rescue activities in disaster, to include the importance of volunteers and emergent group activities, the importance of the timing of rescue, and the policy implications of these patterns.

Aguirre, B.E. 2000. "Social Science and Severe Weather Warnings." Pp. 98-108 in *Storms Volume I*. London, UK: Routledge.

Abstract

Although storms are a constant to life on earth, their impacts on society and the environment are not always welcome. As a result, societies seek to reduce their vulnerability to storms, although sometimes these responses can exacerbate vulnerability. This book includes papers from academics from around the world that discuss storm science and social vulnerability, tropical cyclones, extra-tropical cyclones, mesoscale convective systems, and other storms. Detailed accounts of storms in the U.S., Canada, China, Cuba, Australia, India, Russia, Vietnam, Brazil, and Mexico are included.

Aguirre, Benigno E., Walter A. Anderson, Sam Balandran, Brian E. Peters, and H. Max White. 1991. *Saragosa, Texas, Tornado, May 22, 1987: An Evaluation of the Warning System.* Washington, D.C.: National Academy Press.

Abstract

This study examines the effects of the tornado that struck Saragosa, Texas, in 1987, killing 30 people, injuring 121, and destroying public buildings and many homes. Despite a severe thunderstorm watch and tornado warning issued for the area by the National Weather Service and carried by area radio and television stations, many residents were unaware of the danger. Some were watching cable TV, particularly a Spanish-speaking channel that did not carry the warnings. The report discusses the tornado warning systems, together with an evaluation of the warning process and its effects on the residents of Saragosa. Observations and recommendations offered by the survey team included 1) the tornado warning lead time was in excess of 20 minutes--significantly better than could be expected with the technology being used; 2) many people in Saragosa were aware of basic tornado safety rules, and many individuals took proper protective actions; and 3) multiethnic/multilingual warning procedures need to be developed. Eyewitness accounts of the tornado are included as an appendix, as is an analysis of warning responses to the Palestine, Texas tornado of November 15, 1987.

Causal Findings

The public is less likely to hear and understand a warning if it is issued in a language other than their own. The public is more likely to hear a warning if they have a strong social network. If the public receives no communication from officials, they are less likely to hear a warning message. If sirens are not heard, the public is less likely to hear a warning message. The closer a person is to a disaster/hazards area, they more likely they are to understand a warning message. A person is less likely to respond to warning messages if environmental cues are lacking and/or if they are not geographically proximate to the disaster.

Aguirre, Benigno E., R. Saenz, J. Edmiston, N. Yang, E. Agramonte, and D. L. Stuart. 1993. "The Human Ecology of Tornadoes." *Demography* 30 (4):623-633.

Abstract

This paper offers an empirical test of the impact of human ecological patterns and other known correlates on tornado occurrence. It uses the National Severe Storms Forecast Center's information on tornadoes from 1950 through 1990 and employs ecological data from the U.S. Bureau of the Census and the Environmental Protection Agency. The results show that metropolitan and other urban counties have higher odds of tornado occurrence than rural counties, and that the probability of occurrence of tornadoes increases with increases in the number of previous tornadoes. The paper assesses the meaning of this finding for demographers, atmospheric scientists, engineers, and disaster managers.

Aguirre, B. E., Dennis Wenger, and Gabriela Vigo. 1998. "A Test of the Emergent Norm Theory of Collective Behavior." *Sociological Forum* 13 (2): 301-320.

Abstract

The paper uses the timing of evacuation behavior of occupants of the World Trade Center at the time of the explosion of February 26, 1993, to test predictions from Emergent Norm Theory. It uses ordinary least squares multiple regression analysis to examine data from a survey done in the first week in May 1993 of 415 people who worked at the World Trade Center. The theory's predictions regarding the additive effects of size of group and preexisting social relationships on the timing of evacuation are supported. However, the findings document important and unexpected interaction effects of these two variables on the effects of perceived threat, resources, and cooperativeness on the timing of evacuation. The results augment the theory by showing the continued importance of enduring social relationships as determinants of collective behavior from institutionalized behavior but also specify the dynamics attending the occurrence of collective behavior.

Causal Findings

Having a strong social network increases the likelihood of a person responding to a warning message. Being in a large group at the time of a warning message decreases the likelihood of a person responding to a warning message. If a person believes a warning message, they are more likely to respond to the message. If injuries are present, a person is more likely to respond to a warning message. If a person is older, and/or female, they are more likely to respond to a warning message. Having contact with rescue workers decreases a persons' likelihood of responding to a warning message. There is no relationship between how geographically a person is and their likelihood of responding to a warning message.

Anderson, Jon W. 1968. "Cultural Adaptation to Threatened Disasters." *Human Organization* 27:298-307.

Abstract

Presents the hypothesis, illustrated by seven studies of individual disasters, that reactions to a disaster are extensions of normal frames of reference, in both "disaster cultures" and in situations in which the normal frames of reference may be inappropriate.

Causal Findings

The more habituation of a disaster/hazard a person experiences, the less likely they are to respond to a warning message.

Anderson, L., J. Keaton, T. Saarinen, and W. Wells II. 1984. *The Utah Landslides, Debris Flows and Floods of May and June 1983*. Washington DC: National Academy Press.

Abstract

During the Spring of 1983, flooding in Salt Lake City and the massive Thistle Landslide received much publicity from the national press and media. These two events, however, were by no means the only natural disasters to strike Utah during that abnormally wet year. For example, 92 landslides occurred along just a 15-mile stretch of the densely populated Wasatch Front and another large landslide dammed the Twelve Mile River east of Gunnison. When this naturally created dam failed, a 30-foot-high flash flood surged down the canyon. Prepared by a four-member multidisciplinary reconnaissance team, this report contends that the long duration of the emergency period presents unique opportunities for disaster research, particularly in the areas of geotechnical engineering, emergency planning, and the social sciences. An additional plus for researchers is the fact that a FEMA disaster team had been established and at work for nearly a month before the major landslides and floods took place. Public response to the Thistle Landslide is noted and successful community response to flooding in Salt Lake City is chronicled. The geological characteristics of Utah make the state a unique area for landslide-related research.

Causal Findings

Having a strong social network increases the likelihood of a person responding to a warning message.

Anderson, William A. 1969. "Disaster Warning and Communication Processes in Two Communities." *Journal of Communication* 19 (2):92-104.

Abstract

This paper is based on a study of disaster warning in the communities of Crescent City, California and Hilo, Hawaii, both of which have had a history of tsunami threats and warnings. Disaster warning is viewed in the paper as a process consisting of a number of interrelated activities and procedures in which a variety of organizations and individuals become involved.

The study indicates that local officials such as those in Crescent City and Hilo are responsible for evacuating incoming information concerning potentially disruptive environmental changes and for determining if a public warning is to be issued. Among the problems that local officials may face while attempting to meet such responsibilities is the lack of adequate information on which to base critical decisions and the difficulty of maintaining public willingness to comply with requests for evacuation when there have been repeated alerts not followed by the disaster.

Although both the communities in the study have undergone major tsunami disasters, the data show that this has been followed by significant change and improvement in warning procedures chiefly in Hilo. For example, evacuation areas have been predetermined in Hilo and a variety of mechanisms for transmitting tsunami warning signals and information to the public have been devised. These changes came about largely because local officials in Hilo received considerable feedback from scientific experts and others regarding the kinds of improvements needed in the community's warning system. Such a feedback process did not develop in Crescent City following the major tsunami disaster in that community and thus less change occurred in its warning procedures.

Causal Findings

A person is more likely to respond to a warning message if they have recently experienced a hazard/disaster. A person who has had previous experiences with a disaster is more likely to hear a warning message.

Arlikatti, Sudha, Michael K Lindell, Carla S Prater, and Yang Zhang. 2006. "Risk Area Accuracy and Hurricane Evacuation Expectations of Coastal Residents." *Environment and Behavior* 38 (2):226-47.

Abstract

This study examined the accuracy with which Texas coastal residents were able to locate their residences on hurricane risk area maps provided to them. Overall, only 36% of the respondents correctly identified their risk areas and another 28% were off by one risk area. Risk area accuracy shows minimal correlations with respondents' demographic characteristics but is negatively correlated with the respondent's previous hurricane exposure and evacuation experience. Ultimately, risk area accuracy appears to have little significance because it is uncorrelated with evacuation expectations. Instead, the latter were related to respondents' previous hazard experience and expected evacuation context.

Causal Findings

Risk area accuracy is minimally correlated with people's demographic characteristics but is negatively correlated with people's previous hurricane exposure. Risk area accuracy is uncorrelated with evacuation expectations. Evacuation expectations are related to age, length of coastal residence, people's previous hazard experience and expected evacuation context.

Atwood, L. Erwin and Ann Marie Major. 1998. "Exploring the "Cry Wolf" Hypothesis."
International Journal of Mass Emergencies and Disasters 16:279-302.

Abstract

The "cry wolf" hypothesis argues that individuals who have experienced predictions of disasters that do not materialize will discount the validity of subsequent disaster warnings. This belief in the false alarm effect is widely mentioned in the disaster literature, and anecdotal material appears to support the validity of the hypothesis. This study of a false earthquake warning supports experimental findings indicating that cancellation of a disaster warning leads to a false alarm effect. Following cancellation of the threat by the nonappearance of the predicted earthquake, 46.7 percent of the panel respondents indicated that the y would pay less attention whereas only 16.7 percent said that they would pay more attention to a future earthquake prediction. The panel data also suggest that the mass media were substantial contributors to the observed false alarm effect, while at the same time the media escaped blame for their contributions to the problem.

Causal Findings

If a person has had experiences with the cancellation of warnings, they are less likely to believe and respond to warning messages.

Averill, Jason D., Dennis S. Mileti, Richard D. Peacock, Erica D. Kuligowski, Norman Groner, Guylene Proulx, Paul A. Reneke, Harold E. Nelson. 2005. Appendix C: Causal Modelling. "Predicting Evacuation Delay in the World Trade Center," Pp. 217-228. *Occupant Behavior, Egress, and Emergency Communications: Federal Building and Fire Safety Investigation of the World Trade Center Disaster*. NIST NCSTAR 1-7. Washington, D.C.: U.S. Department of Commerce, National Institute of Standards and Technology.

Abstract

This research was based on representative samples of occupants (of approximately 400 respondents in each sample) in Towers 1 and 2 of the World Trade Center on September 11, 2001 just prior to collapse. Respondents were interviewed over the telephone using a CATI. The ultimate dependent variable in the study was time delay in the initiation of beginning evacuation out of the towers. A range of independent variables from the evacuation literatures in both the general evacuation and fire evacuation research literatures were assessed for their impacts on evacuation time delay. The variables with statistically impacts in predicting evacuation time delay were causally modeled. Explained variance approximated 50 percent in the dependent variable in both of the towers.

Causal Findings

Tower One: Environmental cues (information from the physical environment that something was terribly wrong) and floor (increased distance to safety) caused people to set out to find additional information, most likely information abut what was going on and what they should do. Next the act of seeking additional information to make sense out of the situation led people to take actions to prepare to evacuate. Taking actions to prepare to evacuate delayed the initiation of actually evacuating. Environmental cues and floor also had direct impacts on evacuation delay as follows. Both factors increased the odds of seeking information and both factors increased the chances that people took pre-evacuation actions prior to evacuation. Environmental cues increased delay while floor decreased delay.

Tower Two: The findings for respondents in Tower Two were the same as for Tower One described above with one difference. This was that perceived risk had a role in predicting evacuation delay as follows. Environmental cues, floor, and perceived risk caused people to set out to find additional information which, in turn increased evacuation delay.

Baker, E.J. 1979. "Predicting Response to Hurricane Warnings: A Reanalysis of Data from Four Studies." *Mass Emergencies* 4 (1):9-24.

Abstract

The author reviewed four sample survey studies, considered to provide the basis for most of what is known about human response to hurricane warnings and their analysis was extended with respect to a dependent variable of whether or not the survey respondent evacuated his or her home in response to the hurricane warning. The goal of the review was to identify useful variables, out of 75 that had been tested which predict evacuation behavior. The criteria for a predictor to be considered successful was three-fold. It had to show statistical significance, strong association, and replicability.

The four studies under review failed to identify powerful predictors, which the author speculates may be a measurement issue. The most reassuring conclusion event, however, is that the most risky areas have, in fact, been the most extensively evacuated.

Causal Findings

The public is more likely to hear a warning message via the television. The more frequently a sender relays warning information, the more likely the public is to believe the warning information. There is no relationship between age and a persons' likelihood of responding to a warning message. The less experience a person has with a disaster/hazard, the more likely they are to respond to a warning message. The more freedom a person has to leave their place of employment, the more likely they are to respond to a warning message. Being in geographical proximity to the disaster/hazard increases the likelihood of a person responding to a warning message. If a person has had experience with hazards before, they are more likely to respond to warning messages. Having membership in social networks increases the likelihood of a person responding to a warning message. The greater the perception of loss/risk, the more likely a person is to respond to a warning message. Having resources increases the likelihood of a person responding to a warning message. Observing social cues increases the likelihood of a person responding to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. Hearing, understanding, and believing a warning message increases the likelihood of responding to it. The personalization of a warning message increases the likelihood of responding to it.

Baker, Earl J. 1991. "Hurricane Evacuation Behavior." *International Journal of Mass Emergencies and Disasters.* 9 (2):287-310.

Abstract

Researchers have conducted sample surveys following at least twelve hurricanes from 1961 through 1989 in almost every state from Texas through Massachusetts. The resulting database is larger than that for any other hazard, and many generalizations are feasible concerning factors accounting for variation in response to hurricane threats.

Risk area and actions by public officials are the most important variables affecting public response. When public officials are aggressive in issuing evacuation notices and disseminate the messages effectively, over 90 percent of the residents of high-risk barrier islands and open coasts evacuate. People hearing, or believing they hear, official evacuation advisories or orders are more than twice as likely to leave in most locations. A greater percentage of mobile home dwellers evacuate than occupants of other housing, especially in moderate-risk and low-risk areas. General knowledge about hurricanes and hurricane safety is weakly related or unrelated to evacuation, but belief that one's own home is subject to flooding is strongly associated with whether the occupant leaves. Length of residence in hurricane prone areas and hurricane experience are not good predictors of response. The great majority of people who evacuate unnecessarily in one hurricane will still leave in future threats

Baker, Earl J. 1995. "Public Response to Hurricane Probability Forecasts." *Professional Geographer* 47 (2):137-147.

Abstract

Interviewers presented 400 residents of Pinellas County, Florida, with sets of hypothetical hurricane threats to assess the effect of hurricane probability forecasts and other risk indicators on public response to the threats. Evacuation notices from local officials were more important than other threat variables, and use the probability information reasonably. Evacuation behavior in actual hurricane threats is consistent with the survey findings.

Causal Findings

The public is more likely to believe a warning message if the sender includes probability information in the warning. If the probability of the event happening is high or low, there is no relationship between the probability and the public's likelihood of responding to a warning message. If there is medium probability of the event happening, the public is more likely to respond to a warning message. The more risk information the public has, the less likely it is to respond to warning messages. The greater the severity of the threat, the more likely the public is to respond to a warning message.

Baker, E. J. 2000. "Hurricane Evacuation in the United States." Pp. 306-319 in *Storms Volume I*. London: Routledge.

Abstract

Although storms are a constant to life on earth, their impacts on society and the environment are not always welcome. As a result, societies seek to reduce their vulnerability to storms, although sometimes these responses can exacerbate vulnerability. This book includes papers from academics from around the world that discuss storm science and social vulnerability, tropical cyclones, extra-tropical cyclones, mesoscale convective systems, and other storms. Detailed accounts of storms in the U.S., Canada, China, Cuba, Australia, India, Russia, Vietnam, Brazil, and Mexico are included.

Baker, J. 1984. "Public Response to Hurricane Probability Forecasts." National Weather Service, Washington DC.

Abstract

In the spring of 1983, an experiment was conducted to measure the effect that hurricane probability forecasts would have on public response. One group of respondents in Pinellas County, Florida, was presented with 16 hypothetical hurricane threat situations described in terms of storm severity, storm location, National Hurricane Center "alert" (watch, warning, neither), and local officials' statements regarding evacuation. Another group of residents was presented with exactly the same 16 threat situations, plus the probability that the storm would affect their area and the probabilities of its affecting other coastal locations. People in both groups were asked whether they would evacuate in each of the 16 situations. The 16 threats were constructed such that the variables involved were statistically independent of one another. Overall, probabilities were found to have little, if any, effect on public response one way or the other.

Causal Findings

If warning information comes from an official source, the public is more likely to respond to the warning message.

Baker, Jay. 1986. "Hurricane Elena: Preparedness and Response in Florida." *Florida Policy Review* Winter:17-23.

Abstract

The author described the hurricane warning process in general, the threat information available to public officials during Hurricane Elena, the actions taken by officials, and public response to those actions. The author evaluated and critiqued the adequacy of prior hurricane preparedness activities and the appropriateness of official actions taken during Hurricane Elena. Criticisms of the decision making process by local and state authorities is offered with the caveat that the author found that Hurricane Elena posed a highly unusual challenge to for Florida's emergency management community and that they performed well considering the challenges.

Causal Findings

If warning information comes from an official source, the public is more likely to respond to the warning message.

Baker, Jay. 1987. "Warning and Evacuation in Hurricanes Elena and Kate." Department of Geography, Florida State University, Tallahassee, FL.

Abstract

In Pinellas County, Florida 405 residents were interviewed to document their response in Hurricane Elena. The area had not experienced a major hurricane since 1921, and few studies of response in south Florida had been completed. Public response to Elena in Pinellas County, however, was excellent in high-risk areas. More people evacuated from low-risk areas than officials had anticipated, leading to overcrowding in some shelters. compared to most evacuations, very few people evacuated out of the county due to the late hour, the necessity of traveling over water, the perceived urgency of the evacuation, and the availability of safe refuge locally. Other than that, evacuation patterns were consistent with those normally observed in hurricanes.

In Bay County, Florida 100 people were interviewed in both Panama City and Panama City Beach. The population was told to evacuate twice in Elena and again in Kate during 1985, and there was concern about complacency and the "cry-wolf syndrome." Response was good in all three threats, and there was no evidence of deterioration in response over the three evacuations, particularly in the more hazardous beach area.

Causal Findings

If warning information comes from an official source, the public is more likely to respond to the warning message. The older a person is, the less likely they are to respond to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Balluz, L., L. Schieve, T. Holmes, S. Kiezak, J. Malilay. 2000. "Predictors for People's Response to a Tornado Warning: Arkansas, 1 March 1997." *Disasters* 24 (1):71-77.

Abstract

On 1 March 1997, powerful tornadoes touched in Arkansas (USA) on a Saturday afternoon. Twenty-six fatalities and 400 non-fatal injuries were reported. We performed a population-based cross-sectional study to determine factors associated with appropriate responses to tornado warnings.

Of 146 survey participants, 140 (96%) knew the difference between "tornado watch" and "tornado warning" and were aware of when the warning was announced. Of those 140 participants, 64 (45.7%) responded to the warning by seeking shelter, and 58 (90.6%) of those 64 acted within five minutes of hearing the warning. Four factors were positively associated with those seeking shelter: having graduated from high school (OR=4.2, 95% CI=1.1-15.5); having a basement in one's home (OR=3.8, 95% exact CI=1.1-17.1); hearing a siren (OR=4.4, 95% CI=1.3-18.9); and having prepared a household plan of response when tornadoes occur (OR=2.6, 95%, CI=1.1-6.3).

On the basis of these findings, we recommend: first, that people who live in tornado-prone areas have a personal plan of action to help them respond immediately to warnings; second, public-health education officials in areas with frequent tornadic activity should do more to educate the public about what they can do to protect themselves from a tornado; and third, that emergency-management officials planning protection measures for vulnerable communities should consider that most people have limited time (our study documented five minutes) in which to respond to a tornado warning. Thus shelters in tornado-prone areas should be quickly accessible by residents.

Causal Findings

The public is more likely to respond to a warning message if they hear sirens. Being a high school graduate increases the likelihood of a person responding to a warning message. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages. Having resources increases the likelihood of a person responding to a warning message.

Baron, Roy C., Ruth A. Etzel, Lee M. Sanderson. 1988. "Surveillance for Adverse Health Effects Following a Chemical Release in West Virginia." *Disasters* 12:356-365.

Abstract

On 11 August 1985, a large inadvertent release occurred from a chemical manufacturing plant in Institute, West Virginia. The emission was related to overheating of a storage tank that contained chemicals for the production of aldicarb, a cholinesterase inhibiting pesticide. As a result of this emission, 136 persons were treated in five local emergency rooms, 29 of which were hospitalized for one or more days, mostly for observation. No fatalities resulted. Interviews with treated persons and non-treated community residents confirmed that the health effects were transient and compatible with exposure to irritating vapors rather than with exposure to methyl isocyanate (a chemical used in the process) or to aldicarb. Only 5% of the community residents surveyed were adequately warned of the emission by the plant siren. Because persons in the nearby community are potentially vulnerable to chemical injury, we recommend the development of an improved warning system, a formal evacuation procedure, and other measure to limit exposure of persons in this area in the event of a future release.

Causal Findings

The public is more likely to respond to warning messages if the warning messages are delivered over multiple channels. The more environmental cues the public observes, the more likely they are to respond to warning messages.

Bateman, Julie M. and Bob Edwards. 2002. "Gender and Evacuation: A Closer Look at Why Women are More Likely to Evacuate for Hurricanes." *Natural Hazards Review* 3:107-117.

Abstract

Studies of hurricane evacuation have often noted that women are more likely than men to evacuate, yet few examined those differences and tried to explain them. This paper undertakes a series of bivariate and multivariate analyses to examine the relationship between evacuation and gendered variations in socioeconomic status, care-giving roles in the household, evacuation incentives, exposure to risks, and perception of risk. A series of hypotheses are developed and tested in order to help explain why women are more likely than men to evacuate. The data used come from a cross-sectional survey of 1,050 coastal North Carolina households affected by Hurricane Bonnie, which made landfall near Wilmington, N. C., on August 25, 1998. Results from a series of bivariate and multivariate logistic regression analyses indicate that women are more likely to evacuate than men because of socially constructed gender differences in care-giving roles, access to evacuation incentives, exposure to risk, and perceived risk. We find, in part, that women are more likely to evacuate because, compared to men, they live at greater exposure to risk and have a heightened perception of risk. Yet, those men who are at greater risk and do perceive heightened risk, are more likely to evacuate than women with comparable risk exposure and perception. Future studies of disaster response should distinguish clearly between the intention to evacuate and the capacity to do so.

Causal Findings

There is no relationship between age and/or education and a persons' likelihood of responding to a warning message. Women are more likely than men to respond to warning messages. The more care-giving responsibilities a person has, the more likely they are to respond to a warning message. There is no relationship between a persons' education and/or full-time work status and their likelihood for responding to a warning message. Being in geographical proximity to the disaster/hazard increases the likelihood of a person responding to a warning message. An increased exposure to risk and/or an increased perception of risk and loss increases the likelihood of a person responding to a warning message. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages. Living in a mobile home increases the likelihood of a person responding to a warning message. A person is more likely to respond to a warning message if there are medical needs of someone in their household. There is no relationship between race/ethnicity and/or socio-economic status and the likelihood of responding to a warning message. Being a woman on a fixed income increases the likelihood of a person responding to a warning message. Observing social cues increases the likelihood of a person responding to a warning message.

Bates, Frederick L. and et.al. 1963. "The Social and Psychological Consequences of a National Disaster." Washington, D.C.: National Research Council, National Academy of Sciences.

Abstract

A field study conducted over a period of 4 1/2 years from the date of the hurricane, with emphasis on long-term social change. Topics covered include: 1) warning, impact, and rescue, 2) rehabilitation and recovery, 3) role stresses associated with rehabilitation, 4) mental health effects of Hurricane Audrey, 5) social change in response to Hurricane Audrey, 6) civil defense in Hurricanes Audrey and Carla, and 7) conclusions and recommendations for further research.

Causal Findings

The personalization of a warning message increases the likelihood of responding to it.

Berger, George F. 1994. "Flood Warnings." *Urban Land* 53 (3):11.

Abstract

The author discusses the potential problems and necessary procedures for building residences in a floodplain, including an individuals liability for causing damages to neighboring residences or buildings by diverting flood water from ones home to another.

Berry, Linda. 1999a. "Cyclone Rona: Evacuation of Caravonica and Lake Placid Report." Australia: Centre for Disaster Studies, James Cook University.

Abstract

The aim of this study was to analyze the Caravonica and Lake Placid community response to the evacuation advice messages issued on February 12, 1999. Information relating to how they both received and responded to these warnings was acquired through 183 questionnaires and interviews.

Causal Findings

Including local information and/or televised maps in a warning message to the public assists the public in understanding the warning message.

Berry, Linda. 1999b. "Cyclone Rona: Mossman/Port Douglas Warnings Report." Centre for Disaster Studies, James Cook University, Australia.

Abstract

The aim of this study was to analyze the Mossman/Port Douglas community response to the Tropical Cyclone Rona evacuation advice messages issued on February 11, 1999. Information relating to how they both received and responded to these warnings was acquired through 100 questionnaires and interviews.

Causal Findings

Having confirmation of the disaster/hazard increases the likelihood of a person responding to it. The public is more likely to respond to a warning message if it comes from an official source.

Blanchard-Boehm, R. Denise. 1998. "Understanding Public Response to Increased Risk from Natural Hazards: Application of the Hazards Risk Communication Framework." *International Journal of Mass Emergencies and Disasters* 16 (3):247-278.

Abstract

This paper applies the risk communication framework and its principles to a case study where probabilities were increased in 1990 of future earthquakes in the San Francisco Bay area. Following the scientific community's announcement, a low-key warning was issued to approximately two million residents through a large-scale information campaign. This study demonstrates that the risk communication model is an invaluable tool for helping us to understand the behavior of individuals who must learn of and act upon warning information that could save their lives and property. Further, researchers are urged to find ways to adapt this risk communication model to other types of natural and human-made hazards.

Causal Findingss

The public is more likely to hear a warning about a disaster agent with which they are familiar. The greater the perceived vulnerability the public feels towards a disaster, the more likely they are to hear the warning message. If a person has had prior experience with a disaster, the more likely they are to hear the warning message. The older a person is, the more likely they are to understand a warning message. The greater the belief in science as a predictor of hazards/disasters, the more likely a person is to understand a warning message. The closer to a disaster/hazards area a person is, the more likely they are to understand a warning message. The longer a person has been a resident of a community, the more likely they are to understand a warning message.

Botterill, Linda and Nicole Mazur. 2004. "Risk and Risk Perception: A Literature Review." Barton, AU: Rural Industries Research and Development Corporation.

Abstract

This report investigates the literature on risk and risk perception across a range of disciplines in order to provide a better understanding of the diverse theoretical approaches to risk and risk perception and the available work on farmers' perceptions of risk; contribute to improved policy outcomes in areas involving risk management, such as drought and import risk analysis; and support the improvement of the communication of policy decisions. Some of the topics covered in this report include measuring risk; values and "non-rational" factors in risk perception; and differences between expert and lay person perceptions. The understanding provided in this report of how stakeholders and the broader community perceive risk should assist policy makers in developing better policy and more effective means for communicating government policies and programs in areas involving risk management.

Bourque, L B, L G Reeder, A Cherlin, B H Raven, and D M Walton. 1971. "The Unpredictable Disaster in a Metropolis: Public Response to the Los Angeles Earthquake of February, 1971 ". University of California, Los Angeles: Prepared for the Defense Civil Preparedness Agency, Washington, D.C., 20301, UCLA Survey Research Center.

Abstract

Los Angeles County residents were interviewed in the homes after the San Fernando earthquake of February 9, 1971. The 687 respondents were asked what they did at the time of the earthquake, where they got information about the earthquake, which organizations and agencies worked on earthquake problems, their opinions of public officials, whether they evacuated, what losses they and others experienced, what preparations they had made, and how likely they thought a future earthquake was. In addition 100 persons in Sylmar near where two hospitals collapsed were interviewed in the summer of 1971, and 50 people who lived under the Van Norman dam were interviewed in February 1971.

A compulsory evacuation was ordered for the 50,000 persons who lived under the Van Norman dam and for 30,000 persons in a nearby area because of a gas leak. The Van Norman evacuation order lasted from midmorning on February 9th until 4:00 PM on February 12.

Causal Findings

Sixty-one people or 7.8% evacuated with 30 evacuating in response to the Van Norman evacuation order. Reasons given for the remaining evacuations included structural damage (N = 16), lack of water (N = 20), gas leaks (N = 19), and lack of electricity (N = 18). In Sylmar 34 of 100 persons evacuated with most evacuating because of utility outages, and younger persons being most likely to evacuate. While 90% of residents knew about the evacuation order by 11:00 AM, 8 of 50 never left, saying that their homes were too far from the dam or that if the dam had not broken at the time of the quake itself it would not break later.

Evacuation increases with proximity to a possible threat, official instructions, structural damage and loss of utilities.

Bourque, L B, and L A Russell. 1994. Experiences During and Responses to the Loma Prieta Earthquake. Sacramento, CA: Governor's Office of Emergency Services.

Abstract

Following the Loma Prieta earthquake 656 residents of Santa Cruz, Santa Clara, San Francisco, Alameda and San Mateo counties were interviewed by telephone in 1990. Respondents were selected using random digit dialing and the northeast edge of the San Francisco peninsula, Oakland, and the Boulder Creek-Santa Cruz-Watsonville area were oversampled. Respondents experiences in and responses to the earthquake were examined including loss of utilities, reported damage to property and personal possessions, physical injuries to respondents and others, use of the media, decisions to evacuate, contact with officials and agencies after the earthquake, psychological distress, earthquake preparedness, knowledge about what to do during an earthquake, and hearing and responding to earthquake predictions.

Causal Findings

Persons who were at work or school, and those who felt poorly prepared for the earthquake were least likely to be exposed to electronic media after the earthquake and, thus, missed post-impact warnings and information that might have been transmitted by electronic media. Exposure to electronic media was not associated with age, gender, ethnicity/race, education, income, prior earthquake experience, presence of others, level of fear, damage to home, proximity of home or respondent to the epicenter, psychological distress, tendency to evacuate, or physical shaking.

Decisions to evacuate varied with proximity to the epicenter, damage to homes, loss of utilities and in response to advise by officials. Two different groups of evacuees are identified. The first group evacuates because of earthquake-induced events such as structural damage, absence of utilities and the advice of officials. The second group evacuates because of psychological distress.

Knowledge of the prediction that another large earthquake would occur was greater among Latinos, those with more education, and those who had experienced damage in the Loma Prieta earthquake. Thirty-seven percent said they took action to protect self and family as a result of the prediction. Married persons between 31 and 59 who lived outside the high impact areas but who evacuated and said they were afraid during the earthquake were most likely to take action in response to the prediction.

Bowonder, B., Jeanne X. Kasperson, and Roger E. Kasperson. 1985. "Avoiding future Bhopals."
Environment 27 (7):6-13; 31-37.

Abstract

The acute human and environmental consequences of the Bhopal accident are not well defined even now, and the longer-term effects can only be speculated on. Evidence is accumulating of continuing physiological effects on survivors; reports of mental trauma and other psychiatric disturbances persist, but there is no program for monitoring or treating mental health problems; there is special concern over damage to the health of women in their childbearing years; the social disruption and economic losses--both immediate and in the future--can not be estimated accurately or, therefore, anticipated. The authors describe the technical problems that led to the accident and then discuss a number of basic issues in industrial hazards management and disaster prevention that are highlighted by the Bhopal incident: choice of technology (low vs. high-risk processes), the desirability of setting and land use controls, the stringency of risk management practices, the need for emergency preparedness measures, and institutional considerations such as political systems, international regulations, and cultural assumptions.

Brennan, Patricia. 1998. "Bushfire Threat: Response in a Small Community." Melbourne, Australia: Center for Environmental Safety and Risk Engineering, Victoria University of Technology.

Abstract

This report describes response to a threat from fire in the small township of Macedon, Vitorica in February 1998. This fire started on the outskirts of the town and encroached on some properties but was brought under control without damage to houses. Shortly after the fire, residents were interviewed about their responses during the incident. The fifty-seven households contacted represent approximately twelve percent of households in the township. Sixty percent of the sample population did not evacuate, 17% evacuated and some members (typically one adult and young children) were evacuated from 23% of households. Resident movement contributed considerably to traffic increase. There are marked differences in situation awareness and approach to threat. Less than half of the households reported having planned prior to the incident either to stay through a fire front or to evacuate. They activated plans on hearing of the fire. They contrast with the majority whose decision to stay appears to be conditional: many would have been likely to leave if conditions had changed for the worse. Their time for starting evacuation is dependent on an uncertain mix of their perception of the degree of threat at any one moment and on information and advice from emergency personnel.

Breznitz, Shlomo. 1984. *Cry Wolf: The Psychology of False Alarms*. Hillsdale, NJ: Lawrence Erlbaum Associates Publishers.

Abstract

The psychological effects of false alarms have been widely recognized. False alarms play a major role in a warning system, yet they have not been studied systemically. The author posits that false alarms are on the increase and that their psychological impacts may be the most vulnerable link of many warning systems. The author examines this phenomenon through an experimental program that attempted to provide a systematic analysis. Different types of dangers are reviewed and the effect of false alarms on behavior is examined through an experiment with a control group and an experimental group.

Causal Findings

If a person has had personal experience with a hazard/disaster in the past, they are less likely to believe and respond to a warning message.

Browning, Larry D. and Judy C. Shetler. 1992. "Communication in Crisis, Communication in Recovery: A Postmodern Commentary on the Exxon Valdez Disaster." *International Journal of Mass Emergencies and Disasters* 10 (3):477-498.

Abstract

This article is an application of the postmodern characteristics of simultaneity, chaos, unintended consequences, and multiple realities to the Exxon Valdez disaster. After postmodernity is applied to the Exxon Valdez case-study, the changes in contingency planning, prevention, and response that have occurred since 1989, and their implications for the Pacific Rim, are reviewed. The theme of the paper is the use of differences for problem solving in emergencies.

Bucher, Hans-Jeurgen. 2002. "Crisis Communication and the Internet: Risk and Trust in a Global Media." *First Monday* 1-10.

Abstract

Risk is one of the main features of modern societies. With the rise of the Internet, the risk associated with information has increased to an extent: free accessibility, interactivity, and connectivity of personal, economic, political, and media communication have all led to myriad sources of information and a lessening of control over the information market. Using the Internet, the events of September 11 are profiled as an example of crisis communication on the global level.

Burby, R.J. and F. Wagner. 1996. "Protecting Tourists from Death and Injury in Coastal Storms." *Disasters* 20 (1):49-60.

Abstract

Hurricanes, typhoons, tsunamis, and other storms force thousands to flee coastal regions every year. In many cases, resort areas have been severely damaged and tourists place in jeopardy. This article examines ways tourist business can and already have protected holiday-makers from coastal storm hazards through emergency evacuation and other measures. Using data from a sample of large and small hotels in New Orleans, Louisiana, we find considerable variation in protective behavior. To explain this variation, we look at how perceptions and preparedness differ by both managerial and organizational characteristics. We then suggest a variety of measures that can be taken by hotels in coastal resort areas to reduce risk.

Causal Findings

An increased exposure to risk and/or an increased perception of risk and loss increases the likelihood of a person responding to a warning message. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages. Having membership in social networks increases the likelihood of a person responding to a warning message. If a person works for a large organization, they are more likely to respond to a warning message. If a person works for a small organization, they are less likely to respond to a warning message.

Burkhart, Ford N. 1991. *Media, Emergency Warnings, and Citizen Response*. Boulder, CO: Westview Press.

Abstract

The author suggests that three types of warning channels--mass media, public officials, and social networks--play different roles in a community's response to the threat of disaster. The study examines how the source of warnings affects behavior in both a natural and a technological emergency. Also explored are the factors associated with the credibility of warning sources. The media--particularly television--and social networks are primary channels for preparedness information, yet citizens prefer to turn to public officials when searching for details concerning community emergency plans. The author discusses the roles of officials, the mass media, and social networks in the preparedness and response phases of disaster management and identifies potential partnership roles between disaster managers and the media. Findings from the study include: 1) citizens tend to use social networks to relay and receive warnings in a chemical emergency; 2) citizens make use of the mass media when attempting to manage information about hazards with long lead-times; 3) emergency managers should avoid generic approaches to using the media--different hazard agents and different disaster settings require custom-made warnings from the media; and 4) as confirmation sources, the media played a less important role than did social networks or officials.

Burton, I. 1981. "The Mississauga Evacuation: Final Report." Toronto, ON: Institute of Environmental Studies, University of Toronto.

Abstract

The train derailment of November 10, 1979, in Mississauga led to fires and explosions in derailed propane tank cars, the leakage of chlorine from another tank car, the evacuation of the city's entire populace, and the closing of the city for nearly a week. Utilizing previous experience in the field of disaster research, a team of researchers from the Emergency and Risk Research Group made first-hand observations at the disaster Command Post and the International Evacuation Center while the evacuation was in progress. Within one week of their return home, 1,000 evacuated households received a specially designed questionnaire on their perceptions of the emergency and their part in it. Research topics accorded major attention during the project included public response to the evacuation, social impacts of the event, economic costs of the disaster, the ability to cope with disaster risk, and organizational response to the emergency. Many findings resulted from the study including 1) secondary schools, community colleges, and recreation centers are most likely to contain the necessary facilities for emergency shelters; 2) an "evacuation alert" stage prior to an actual evacuation may expedite the process; and 3) evacuees should be involved as much as possible in running the evacuation center. Also, problems arise if the chronically ill are separated from their doctors and their medical records.

Carter, Michael T. 1980. "Community Warning Systems: The Interface Between the Broadcast Media, Emergency Service Agencies and the National Weather Service." Pp. 214-228 in *Disasters and the Mass Media*. Washington, D.C.: Committee on Disasters and Mass Media, National Academy of Sciences.

Abstract

This paper focuses on the role the media plays in disseminating severe or hazardous weather warnings to local communities. An examination is made of 1) the existence, and 2) the utilization under threatening weather conditions of communication linkages in 20 communities exposed to hurricane, tornado, or flash flood hazard. Four categories of communication systems are investigated for their effectiveness in providing warning linkages to commercial broadcast facilities, the source from which most of the public receives its severe weather information. In order of their reliability, the categories are: 1) two-way systems, 2) directed one-way systems, 3) radio monitor systems only, and 4) no reliable method of communication. Findings indicate that the very general statements issued by the weather service do not provide sufficient detail to convince all individuals that a serious situation exists in their locale. Receiving adequate information during a developing threat appears to be a serious stumbling block in motivating appropriate warning response. Significant improvements are needed to expedite the transfer of emergency information from local emergency service agencies to the commercial broadcast media for public dissemination.

Causal Findings

The public is more likely to hear a warning from the mass media. When the media reports on the hazard/disaster with adequate information, the public is more likely to understand the warning message. The more specific the warning message, the more likely the public is to respond to it.

Carter, Michael T., Stephanie Kendall, and John P. Clark. 1983. "Household Response to Warnings." *International Journal of Mass Emergencies and Disasters* 9 (1):94-104.

Abstract

By use of a two-stage decision-model, the effect of family structure on household response to natural hazard warnings is examined for a sample of 429 Mobile, Alabama residents interviewed after Hurricane Frederic in 1979. The basic hypothesis that is examined is that the manner in which residents decide to evacuate differs depending on the structural characteristics of the household. Results show that the complete nuclear family-father, mother, and children-appears to respond much more like relatively isolated groups, relying on their own interpretation of warning information, in contrast to what may be labeled as incomplete nuclear families- married couples without children and single residents living alone- who rely on their prior perceptions of risk and their social contacts with other significant persons.

Causal Findings

People with children are more likely to respond to disaster warning messages, than people without children.

Chan, Ngai Weng. 1997. "Warnings in the Context of Flood Hazard Management in Malaysia." Pp. 115-131 in *Flood Warning: Issues and Practice in Total System Design*, edited by J. Handmer. Middlesex, UK: Flood Hazard Research Centre, Middlesex University.

Abstract

As a developing country, Malaysia's flood mitigation policy can be viewed as commendable. As a country that is annually affected by flooding, there is no lack of measures and strategies to reduce flood damages in Malaysia. While the many strategies employed have been responsible for reducing some of the impacts of flooding, they have been far from successful in the overall management of floods. Flood forecasting and warning systems have also not developed as quickly as expected. Modern information technology is applied weakly and unevenly. Flood hazard management must be viewed in the context of the country's rapid development. Malaysia is a newly industrializing nation in which the pace of social, economic, and political change is fast, as is the pace of physical and environmental change.

Chertkoff, Jerome and Russell H. Kushigian. 1999. *Don't Panic: The Psychology of Emergency Egress and Ingress*. Westport, CT.: Praeger Publishers.

Abstract

This book serves to provide the reader with an overview of some of the most widely cited cases of disastrous emergency egress and ingress. It is compares cases of good versus bad emergency escape in order to determine the differences between rapid, efficient escape and slow, inefficient escape. The authors provide practical recommendations for achieving good emergency egress and ingress.

Chiu, A. and et.al. 1983. "Hurricane Iwa, Hawaii, November 23, 1982." Washington, D.C.: National Academy of Sciences.

Abstract

Although Hurricane Iwa was the most costly storm ever to strike Hawaii, the report notes that Iwa was not a strong hurricane nor did it produce winds in excess of many of the Islands' previous records. The report indicates that nearly everything that could have gone wrong went wrong. Attention is given to the meteorological and hydrological aspects of the storm, but most of the publication is devoted to an examination of damage to buildings, lifelines, and other structures, and to the disaster response/recovery endeavors. Other features of the report include an overview of Hawaii's hurricane preparedness measures, an examination of the pre-warning and immediate post-warning phases, and a list of pertinent references to hurricane hazard in Hawaii. Among the report's numerous conclusions, it is suggested that 1) a weather radar station should be established in Hawaii; 2) structural wind load provisions currently in effect may not be adequate; 3) hurricane-resistant buildings should be identified for use as storm shelters; 4) an investigation should be made into the design of wood power poles to determine the cause of their numerous failures; and 5) FEMA should investigate and encourage the development of improved or new methods for relieving the disproportionate burdens borne by poor and uninsured or under-insured populations after disasters.

Causal Findings

The more consistent a warning message is, the more likely the public is to respond to it. The more time there is to impact of a disaster, the less likely a person is to respond.

Christensen, Larry and Carlton E. Ruch. 1980. "The Effect of Social Influence on Response to Hurricane Warnings." *Disasters* 4 (2):205-210.

Abstract

Two experiments were conducted to examine the hypothesis that a social influence effect exists and impacts a person's response to warnings of an impending hurricane. The first experiment investigated the influence of strangers' responses on one's own response . The second experiment, the influence of a spouse or friend's response on one's own response was investigated.

The two experiments suggest that advisories issued by authority figures such as the National Weather Service produce a significant impact on individuals in terms of generating a more extreme response. The surprising component identified by these two studies is that neither the actions of strangers nor the actions of a friend or spouse had any impact on an individuals' response.

Causal Findings

Observing social cues increases the likelihood of a person responding to a warning message.

Clifford, R.A. 1956. "The Rio Grande Flood: A Comparative Study of Border Communities." Washington, D.C.: National Research Council, National Academy of Sciences.

Abstract

A comparative field study of the response of two adjacent communities, one Mexican and the other American, to a severe flood. The communities differed in the efficiency of formal and informal organizations and the political structure in warning, evacuation and relief efforts; response of the townsfolk to evacuation; citizens' and officials' evaluation of relief efforts; patterns of helping behavior; and response to "outside" organizations. These differences are evaluated in terms of the political organization, social structure and cultural values of each community.

Causal Findings

If a person is with their peers, they are less likely to believe and respond to a warning message. Having membership in social networks increases the likelihood of a person responding to a warning message. The more consistency with which a warning message is delivered, the more likely the receiver is to believe it. Receiving a warning message through a personal channel, increases the likelihood of a person believing the message.

Coile, Russell C. 1997. "The Role of Amateur Radio in Providing Emergency Electronic Communication for Disaster Management." *Disaster Prevention and Management* 6 (3):176-185.

Abstract

In the USA, the Federal Emergency Management Agency (FEMA) provides support to State and local governments in fulfillment of their responsibilities for preparedness, response, recovery, and mitigation of disasters. One method FEMA ha used to support State and local emergency communication functions was to sign and implement a Memorandum of Understanding with the American Radio Relay League (ARRL) for amateur radio operators to provide electronic communications for State and local governments in disasters. The Federal Communications Commission (FCC) has licensed more than 600,000 amateur radio operators in the USA. The national organization of amateur radio operators called the American Radio Relay League (ARRL) was formed in 1914. More than 80,000 of these amateurs have registered their availability for emergency communications in disasters in ARRL's Amateur Radio Emergency Service (ARES). Amateur radio operators have been providing communications in natural disaster such as floods, hurricanes, and earthquakes since 1910. Since amateur radio operation was prohibited during the years of both World Wars I and II, FEMA has sponsored a new branch of the amateur service called Radio Amateur Civil Emergency Service (RACES). RACES operators are authorized to operate if the President invokes his War Emergency Powers while all other amateur operation would be silenced. Examines the role of amateur radio in providing emergency electronic communications for disaster management and explores future contributions.

Cola, Raoul M. 1996. "Responses of Pampanga Households to Lahar Warnings: Lessons from Two Villages in the Pasig-Potrero River Watershed." Pp. 141-149 in *Fire and Mud: Eruptions and Lahars of Mount Pinatubo, Philippines*, edited by C. G. Newhall and R. S. Punongbayan. Seattle, WA: University of Washington Press.

Abstract

Barangays Parulog and San Antonio, Bacolor, were hit by lahars in 1991 and by flooding in 1992. 119 of 143 respondent families received lahar warnings, and, of those, all but eight evacuated at least temporarily, at least once. However, false alarms and sometimes inadequate evacuation facilities raised skepticism in 1991, and a generally improving outlook in 1992 brought many evacuated families back to their homes.

Warnings could be improved by the addition of village-level, house-by-house hazard maps, vesting of sole warning responsibility in Barangay Disaster Brigades, identification and use of proven warning strategies, and recognition that warnings will only be heeded if adequate transportation, shelter, and livelihood can be provided to those who evacuate.

Causal Findings

If the public hears a warning through multiple channels, from an official source, and/or the warning involves a short range, they are more likely to respond to the warning. If the public has received false alarms in the past from a sender, they are less likely to believe and respond to subsequent warnings from that sender. If a person has a comfortable shelter to which they can retreat, they are more likely to respond to warning messages. The more vulnerable a person feels, the morel likely they are to respond to a warning message. The more specific a warning message is, the more likely the receiver is to confirm the warning.

Coleman, Cynthia-Lou. 1993. "The Influence of Mass Media and Interpersonal Communication on Societal and Personal Risk Judgments." *Communication Research* 20 (4):611-628.

Abstract

The study described in this article examines the influences of mass media, interpersonal channels, and self-efficacy on risk judgment, using data from a sample of New York State residents. Risk judgment is conceptualized on two distinct domains: personal-level risk judgment and social-level risk judgment. The health and risk communication literature suggests that mass media channels are more likely to influence social-level risk judgment, and the current study bears out this hypothesis. But, unlike typical findings, personal-level risk was found to be influenced, to some degree, by mass media channels. The health risks examined include heart disease, AIDS, smoking, and hazards from drinking water, household radon, chemicals on food, household chemicals, and low-level radioactive waste.

Causal Findings

Mass-media channels are more likely to influence social-level risk judgment. Personal-level risk is also influenced, to some degree, by mass media channels. Interpersonal channels account for a portion of the variance on social-level risk judgment, as does self-efficacy.

Committee on Socioeconomic Effects of Earthquake Predictions. 1978. "A Program of Studies on the Socioeconomic Effects of Earthquake Prediction." Washington, D.C.: National Research Council, National Academy of Sciences.

Abstract

Geological technology presumably will reach a point in the foreseeable future at which scientifically credible earthquake predictions can be made. The purpose of this report by the committee on Socioeconomic Effects of Earthquake Predictions is to point out the possible consequences arising from viable predictions and to suggest the research necessary to anticipate and deal with them. The report discusses earthquake prediction in terms of individual, household, and social group response; economic consequences; government responsibilities; and legal problems. It outlines a strategy for future socioeconomic research and assigns priorities for research in monitoring, theory building, and policy analysis. Approximately 150 references are cited in the bibliography.

Causal Findings

The more credible the source of warning information, the more likely the public is to believe it and respond to the warning.

Cutter, Susan L. 1987. "Airborne Toxic Releases: Are Communities Prepared?" *Environment* 29 (6):12-17.

Abstract

This article examines the current status of contingency planning for technological accidents involving airborne releases of non-radioactive toxic substances in the United States. The purpose is to demonstrate the lack of preparedness of some communities and to highlight the obstacles they face in trying to plan effectively for these accidents. Four actual airborne toxic releases are described in the article in terms of how local residents and emergency management personnel handled them. The article also suggests some ways in which communities can improve contingency planning for such accidents in their own areas.

Causal Findings

The more credible the source of a warning message, the more likely the public is to respond to a warning message. The more environmental cues the public observes, the more likely they are to respond to warning messages. The more hazards knowledge a person has, the more likely they are to respond to a warning message. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages. Observing social cues increases the likelihood of a person responding to a warning message. A person is more likely to respond to a warning message if they receive that message from a face-to-face channel. If a family is together in the same place at the same time, they are more likely to respond to a warning message. The more time there is to impact of a disaster, the less likely a person is to respond.

Cutter, Susan L. 1991. "Fleeing from Harm: International Trends in Evacuations from Chemical Accidents." *International Journal of Mass Emergencies and Disasters* 9 (2):267-285.

Abstract

This paper surveys the historical context of chemical hazards through an examination of the international pattern of airborne releases from 1900-1989. Changes in the frequency of incidents and the prevalence of evacuations during this time period are examined. A total of 333 accidents were found, mostly originating form stationary facilities such as chemical plants or industrial sites. Nearly one-third of the incidents involved an acutely toxic chemical release. There was a significant increase in the frequency of incidents over time, with a record number of incidents occurring in the 1980-89 period. Earlier decades were characterized by ammunition and natural gas explosions resulting in numerous fatalities and injuries but very few evacuations. Later decades (1960s onward) show more acutely toxic releases, fewer fatalities, more injuries, and more evacuation events with larger numbers of evacuees. The majority of evacuation events, however, involved between 1,000-6,000 evacuees. The historical context of chemical hazards is important and more instructive than simple case studies in furthering our understanding of chemical hazards and evacuation responses.

Cutter, Susan and Kent Barnes. 1982. "Evacuation Behavior and Three Mile Island." *Disasters* 6 (2):116-124.

Abstract

The responses of the residents to the nuclear power plant accident at Three Mile Island, Pennsylvania illustrate the factors influencing pre-impact coping responses of populations exposed to technological hazards. Confusion and ambiguous information influenced both the decision to evacuate and to remain in place. Proximity to the facility, stage in life cycle and the actions of friends and neighbors influenced the decision to evacuate.

Causal Findings

The older a person is, the more likely they are to respond to a warning message. Observing social cues increases the likelihood of a person responding to a warning message. A person is more likely to respond to a warning message if their livelihood will be unaffected by their response.

Danielson, Jeris A. 2000. "Investigation into Major Evacuations." Lakewood, CO: Danielson and Associates, Inc.

Abstract

The objective of this investigation was to research documented experience on major evacuations of people that have been conducted in the United States primarily from flood events. Concentration was focused on urban and rural/suburban areas which were similar to the areas which make up the Hawkesbury-Nepean Valley with the intention of identifying lessons learned which will assist the State Emergency Service in its process of refining the flood emergency plans for the flood affected areas of the valley.

Local, State, and Federal officials were interviewed to ascertain information on the following topics: description of the arrangements used by the emergency management agency(s) in charge of evacuation; effectiveness and success in the evacuation; effectiveness of the different warning methods and any problems encountered; means of evacuation and the effectiveness of different modes of transport; problems in the community not responding to the warning and proceeding to evacuate in a timely manner; response by institutions required to evacuate their occupants; response by businesses and industry in the area requiring evacuation; problems encountered with the issue of the road evacuation network in accommodating large numbers of evacuees in private cars including traffic management issues; lessons to be learned from the successes and failures experienced by other major evacuations.

Danzig, Elliot R., Paul W. Thayer, and Lila R. Galater. 1958. "The Effects of a Threatening Rumor on a Disaster-Stricken Community." Washington, D.C.: Disaster Research Group, National Academy of Sciences.

Abstract

A study of the behavior of the population in a flood stricken community in response to a rumor that the dam had broken. First, a descriptive account of the rumor communication network and communication of denial was prepared from interviews of officials. Second, a random sample of city residents and a saturation sample from the previously flooded area were interviewed. Data is presented on variables related and not related to flight behavior, respondents reactions to rumor and denials, confirmation behavior, flight behavior, credibility of sources, etc.

Causal Findings

If confirmation of the disaster/hazard happens, people are more likely to believe and respond to a warning message. The greater a person perceives their personal risk in a disaster, the more likely they are to confirm the warning message they receive about that disaster.

Davis, L. E., T. LaTourrette, D. Mosher, L. Davis, and D. Howell. 2003. "Individual Preparedness and Response to Chemical, Radiological, Nuclear, and Biological Terrorist Attacks." Santa Monica, CA: RAND Corporation.

Abstract

This report defines a strategy that individuals could adopt to prepare for, and respond to, terrorist attacks involving chemical, radiological, nuclear, and biological weapons. The strategy outlines the context in which individuals will be acting, what their overarching goals should be, and why these responses are appropriate and others are not for each of the four types of terrorist attacks. The strategy goes on to list the priorities individuals should have in responding. The strategy concludes by defining the preparatory steps that individuals should take to be able to respond in these recommended ways. This report includes an Appendix which provides a review of the literature on risk perception and risk communication.

De Kay, Michael and Gary H. McClelland. 1991. "Setting Decision Thresholds for Dam Failure Warning: A Practical Theory-Based Approach." Boulder, CO: Center for Research on Judgment and Policy, University of Colorado.

Abstract

This paper presents a theory-driven approach (along with suggested practical applications) for determining optimal thresholds for the issuance of dam failure warnings. Drawing from examples of Bureau of Reclamation dams equipped with early warning systems, the study first describes the problems facing a decision maker who must decide, on the basis of limited and imperfect information, whether to issue a dam failure warning and evacuate the threatened populace. Factors introduced into the risk analysis include the value of life, the risk associated with potential loss of life, and the real or imagined effects of false alerts. Among the study's results is the suggestion that a dam failure warning should be issued when the probability that a dam will fail as the result of overtopping exceeds a very low value--between one in 100 and one in 10,000. These probabilities are very low because the benefits of an early warning (including the value of the lives saved) far outweigh the economic costs associated with a false alert.

De Marchi, Bruna A. 1990. "Assessing People's Information Needs about Major Accident Hazards: Improving Knowledge for a Better Response." Pp.389-400 in *Communicating with the Public about Major Accident Hazards*, edited by H. B. F. Gow and H. Otway. New York, NY: Elsevier Applied Science.

Abstract

Upon the transposition of the so-called EEC Sevesco Directive into national legislations of the member states, all European citizens liable to be affected by a major accident have acquired the right to be informed about safety measures and how to behave in the event of an accident. Formal incorporation of the Directive, however, is not equivalent to full implementation. This paper suggests that, besides formally transposing the Directive into national legislations, member states are called to pay attention to social-psychological dynamics entailed in communication processes, in order to consolidate and confirm democratic principles. Prerequisites and outcomes of effective communication are proposed and a definition of information needs is suggested. Eventually a new model for assessing such needs is outlined.

De Marchi, Bruna A. and E. Rota. 1990. "Risk Information Needs of Communities Near Seveso Sites: A Pilot Study." Gorizia, Italy: Institute of International Sociology.

Abstract

100 interviews were conducted at two communities near two Sevesco sites in Italy. The interviews were conducted to help understand what information needs the public has, including the amount of information and its level of detail, in the case of an industrial hazard. The study identified how people thought of risk. It found that people store, give and utilize information about risk in ways that are highly diversified. Moreover, it found that the preferred messenger of risk-related information is the plant manager. The researchers provide some preliminary guidelines for communicating risk.

Causal Findings

The more specific a warning message is, the more likely the receiver will believe and respond to it. The more vulnerable the public feels towards a hazard/disaster, the more likely they are to believe a warning message and respond to it.

Dearing, James W. and Jeff Kazmierczak. 1991. "Making Iconoclasts Credible: The Iben Browning Earthquake Prediction." Presented at the *Research Conference on Public and Media Response to Earthquake Forecasts*. Southern Illinois University-Edwardsville: Michigan State University.

Abstract

The present investigation concerns mass media communication about risk. Mass media portrayals of scientific issues, and in particular, iconoclastic science, are discussed. A model of how analysis as opposed to objectivity in writing a story might play a beneficial role in journalists' coverage of iconoclastic science is presented. In gathering preliminary data with which to test this model of science journalism, a content analysis of hw the U.S. mass media portrayed the 1991 earthquake prediction by Dr. Iben Browning was conducted. Results suggest that journalists wrote stories that readers may have interpreted as advocating a belief in Browning's prediction. Specifically, news stories were found to be subjective and supportive of Iben Browning or his theory. Relevant experts who were used as quoted sources in news articles were subjective than objective, and more critical than supportive about Browning and his theory.

Demerath, Nicholas J. 1957. "Some General Propositions: An Interpretive Summary." *Human Organization* 16 (2):28-29.

Abstract

The author asks the question, "What propositions about human social behavior in disasters may be inferred from the case-based papers preceding (this chapter)?" He organizes and conceptualizes the propositions with reference to: a) the force as a factor in behavior, b) initial perception and behavior, c) organizational adjustment, and d) solidarity, conflict and tension release. These propositions were developed from analyzing either case studies of single disasters or case studies involving certain patterns of behavior that are inferred from numerous instances of disaster.

Causal Findings

The more consistent the sender is about the warning information they are relaying, the more likely the public is to believe the warning. If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe a warning message. Having membership in a majority group makes a person less likely to understand a warning message. The personalization of a warning message increases the likelihood of responding to it. The more habituation of a disaster/hazard a person experiences, the less likely they are to respond to a warning message.

Demerath, Nicholas J. and Anthony F. C. Wallace. 1957. "Human Adaptation to Disaster."
Human Organization 16:1-2.

Abstract

The essay serves as an introduction to a special issue dedicated to examining human adaptations to disasters. The authors posit that the systems of human behavior are highly unstable compounds, tenuously structured and forever needing revitalization. They suggest that a prime contribution of disaster research may be to correct mechanistic fallacies and to enlarge the social scientists' awareness of the precariousness and flux to be observed even in the most stable of socio-cultural systems.

Diggory, James C. 1956. "Some Consequences of Proximity to a Disease Threat." *Sociometry* 19:47-53.

Abstract

A study was conducted to examine the effects of proximity to a mobile threat, a rabies outbreak. 300 interviews were conducted among residents of Pennsylvania, near the break out.

The author found that the greater the proximity of the threat, the greater the number of sources from which people derived information about it, the greater the importance of word of mouth communication as a first source and otherwise, the less the tendency to over-estimate the seriousness of the threat, the greater the amount of anxiety, and the greater the number of changes in behavior. The less the proximity, the greater is the correlation of number of sources of information with behavior changes, anxiety, and accuracy of information. In the areas remote from the threat, those who overestimate the general danger to humans also overestimated its proximity.

Causal Findings

The closer a person is to a hazard/disaster area, the more likely they are to believe and understand a warning message. People who are in close proximity to the impact point of a disaster are more likely to hear a warning message.

DiGiovanni, Clete, Barbara Reynolds, Robert Harwell, and Elliot B. Stonecipher. 2002. "A Prospective Study of the Reactions of Residents of an American Community to a Bioterrorist Attack." Bethesda, MD: Defense Threat Reduction Agency.

Abstract

The purpose of this study was two-fold: to gauge how residents of an American community might behave should their community be attacked with a biological agent by terrorists, and to identify their information requirements and sources as an attack unfolds. The study employed the model of a table-top exercise (involving a hypothetical biological outbreak) that was used with 153 adult members of four groups comprised of community members. The community members were medical first-responders, their spouses or significant others, local print and television news media, and the general population.

The study found that although frightened, the residents did not panic. The majority of medical staff indicated a willingness to respond to work in the midst of the crisis. Only a minority of persons in each study group indicated a desire to take drugs that were uncalled for, and only about half of the participants said they would seek the vaccine for the hypothetical biological outbreak. Most reported a desire to obey quarantine orders. It was also found that significant segments of all groups, at times, reacted to events, made decisions, and took actions that could have evolved into trouble.

Causal Findings

People were less likely to understand a warning message if it only came from a single source. People were more likely to respond to a warning message if there was a high degree of certainty with which the message was delivered. If a warning message included risk information, people were more likely to respond to it. People are more likely to respond to a warning message if it includes informative guidance and/or if there is a lack of response alternatives. A warning message is more likely to be personalized if it is received via multiple channels. If a person receives confirmation of a warning message, they are more likely to respond to it. A person is more likely to believe a warning message if they receive it through a local channel. A person is less likely to understand a warning message if it contains too much information.

Dillman, Don A., Michael L. Schwalbe, and Jr. James F. Short. 1980. "Communication Behavior and Social Impacts Following the May 18, 1980 Eruption of Mount St. Helens," Pp. 173-179 in *Mt. St. Helens: Three Years Later*, edited by S. A. C. Keller. Pullman, WA: Washington State University.

Abstract

The May 18, 1980 explosion of Mt. St. Helens provided a rare opportunity to study the rapid diffusion of important information through the population in a single day. To do so, telephone interviews were conducted with 1023 out of 1494 residents of eastern Washington, whose names were drawn systemically from a telephone directory.

Residents of the area viewed the eruption as a major event, rather than as a disaster. There appeared to be no wide spread panic, instead, respondents were more concerned with letting loved ones know they were "ok." Radio was considered more useful than television in being kept apprised of the situation. Few respondents reported major disruptions in their lives due to the eruption. The eruption of Mt. St. Helens appears to have reaffirmed the effectiveness of interpersonal communication as a vehicle for diffusing information across a large population.

Causal Findings

If the public hears a warning via the radio, they are more likely to respond to the warning. If the public receive a warning from a media source, they are more likely to confirm that warning.

Dooley, D., R. Catalano, S. Mishra, and S. Serxner. 2006. "Earthquake Preparedness: Predictors in a Community Survey." *Journal of Applied Social Psychology* 22 (6): 451-470.

Abstract

We measured the relationship between earthquake concern and preparation in a community with high seismic risk. Five samples of approximately 800 people were interviewed by telephone about their earthquake concern, but this study focuses on the last two samples in which respondents reported their preparatory behaviors. The findings were consistent in showing greater likelihood of concern for those who had experienced an earthquake, were female, younger, and non-Anglo and a greater likelihood of preparation for those who had more concern, were married, and had lived longer at their present address. In a nonrecursive causal model, no evidence was found for a reciprocal effect of preparation on concern. These results were discussed in terms of health belief models including the self-efficacy and "stages of change" perspectives. Implications were drawn for interventions to increase preparation in ready-to-change groups and compensate for the resistance of those less willing or able to prepare.

Causal Findings

People who have experienced an earthquake, are female, younger, and non-Anglo are more likely to be concerned about seismic risk. People who are more concerned about seismic risk, are married, and have lived longer at their present address are more likely to prepare for an earthquake.

Dow, Kirstin and Susan L. Cutter. 1998. "Crying Wolf: Repeat Responses to Hurricane Evacuation Orders." *Coastal Management* 26 (4):237-252.

Abstract

In 1996, two hurricanes---Hurricane Bertha and Hurricane Fran---threatened the coast of South Carolina, but eventually veered north and struck North Carolina instead. In response to both of the threats, the governor of South Carolina issued evacuation orders for the state's entire coast. The "near miss" or "false alarm" characteristics of the storms prompted this study to see whether any light could be shed on whether repeated false alarms reduce the credibility of warning information. Three specific research questions are examined: Were there differences in evacuation responses of residents for the two storms? Was there an action or a specific piece of information that convinced people to evacuate and did this vary between the events? What was the major source of "reliable" information influencing the decisions to evacuate and did this differ in the two hurricanes? The behavior of residents of two South Carolina communities is investigated---Hilton Head and Myrtle Beach, the latter significantly closer to the storms' landfalls. Among the study's numerous findings are: 1) the perceived most reliable source of information was generally the media, particularly the Weather Channel. Despite their importance to the emergency management community, the governor's orders were not evaluated as the most reliable information source; 2) in response to the hypothetical question, "If another hurricane approached the coast, would you evacuate?", the majority (48%) answered "It depends," 21% answered "No," and the remaining 31% replied that they would evacuate; 3) residents in many instances sought confirmatory data (wind speed, path, storm category) before making an evacuation decision; and 4) emergency management officials are having a weakened impact on decision-making as individuals rely more and more on their understanding of the hurricane threat and their ability to collect and evaluate relevant information.

Causal Findings

If a person receives a warning message from friends and/or family, they are more likely to respond to a warning message. The public is more likely to respond to warning messages it receives from a mass media source and/or an official source. There is no relationship between a person having had experience with hazards before, and their likelihood to respond to warning messages.

Drabek, Thomas E. 1968. "Disaster in Aisle 13." College of Administrative Science, Columbus, OH: Ohio State University.

Abstract

A case study of the coliseum explosion at the Indiana State Fairgrounds on October 31, 1963. 12 emergency organizations which appeared to be the most involved in the disaster response were selected for the study which was comprised of interviews, and content analysis of newspapers, fire and police department logs, public relations brochures, etc. The study explored the organizational environment, mobilization, communication, coordination, control, and pre-planning of this disaster response.

Causal Findings

The more specific a warning message is, the more likely the receiver will believe and understand it.

Drabek, Thomas E. 1969. "Social Processes in Disaster: Family Evacuation." *Social Problems* 16:336-349.

Abstract

Describes four types of evacuation patterns found in an interview study of response to an evacuation warning prior to a major flood. The types of evacuation patterns were interrelated with source of warning and types of confirmation behavior.

Causal Findings

The more frequently a sender relays warning information, the more likely the public is to believe it and respond to the warning information. If the source of the warning is an official source, the receiver is more likely to believe the warning and respond to it. The more specific a warning message is, the more likely the receiver will believe and respond to it. Women are more likely than men to believe a warning message and respond to it. The more cues the public receives of the impending hazard/disaster, the more likely they are to believe and respond to warning messages. If confirmation of the disaster/hazard happens, people are more likely to believe and respond to a warning message. People are more likely to confirm a warning message if that message has been received from a media source. If a person hears a warning message, the more likely they are to confirm the message. The more frequently a warning message is delivered, the more likely the public is to respond to it.

Drabek, Thomas E. 1992. "Variations in Disaster Evacuation Behavior: Public Responses Versus Private Sector Executive Decision-making Processes." *Disasters* 16 (2):104-118.

Abstract

Data obtained from 65 executives working for tourism firms in three sample communities permitted comparison with the public warning response literature regarding three topics: disaster evacuation planning, initial warning responses, and disaster evacuation behavior. Disaster evacuation planning was reported by nearly all of these business executives, although it was highly variable in content, completeness, and formality. Managerial responses to post-disaster warnings paralleled the type of complex social processes that have been documented within the public response literature, except that warning sources and confirmation behavior were significantly affected by contact with authorities. Five key areas of difference were discovered in disaster evacuation behavior pertaining to: influence of planning, firm versus family priorities, shelter selection, looting concerns, and media contacts.

Drabek Thomas E. 1994a. "Disaster Evacuation and the Tourist Industry." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

This monograph reveals major problems and questions for the tourist industry. While there is some good news, in that many of the largest firms have quality plans in place, the overall portrait is that "the tourist industry is a ticking time bomb; it represents a vulnerability of enormous catastrophic potential." The research had six objectives: 1) assess the extent of disaster evacuation planning by business executives; 2) identify factors that constrain the variation in this planning; 3) describe the sequence of information and behavior that culminate in actual evacuation decisions; 4) identify factors that constrain the variation in those decisions; 5) describe established and emergency organizational policies designed to guide employee behavior regarding evacuation-related advisories for both staff and clients; and 6) formulate relevant policy recommendations for local emergency managers and business executives. The author asserts that, "often evacuation occurs incrementally, rather than through the implementation of a single decision." The monograph presents a predictor of this behavior called the Evacuation Behavior Index and a model that specifies that the social factors constraining evacuation decisions.

Causal Findings

The public is more likely to believe and respond to a warning that comes from a government source, an official source, and/or the mass media. If confirmation of the disaster/hazard happens, people are more likely to believe and respond to a warning message. There is no relationship between how specific and/or consistent a warning message is and the likelihood that the public will to respond to it. Women are more likely than men to respond to warning messages. If a person has had experience with hazards before, they are less likely to respond to warning messages. An increased exposure to risk and/or an increased perception of risk and loss increases the likelihood of a person responding to a warning message. Having a strong social network increases the likelihood of a person responding to a warning message. The more prepared the public is for response, the more likely they are to respond to a warning message. Believing a warning message increases the likelihood of responding to it. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it. Personalization of a warning message is greater when there is confirmation of the message.

Drabek, Thomas E. 1994b. "Risk Perceptions of Tourist Business Managers." *Environmental Professional* 16:327-341.

Abstract

At times, business executives responsible for tourist businesses must temporarily shut down operations because of disaster events. What is their perception of such risks? When required, how well prepared are they to evacuate their business facility? In-depth face-to-face interviews with 185 executives in 9 tourist communities indicated the following relationships among risk perceptions, social characteristics, and extent of disaster evacuation planning: 1) managers who perceive higher levels of risk are more likely to engage in disaster evacuation planning, although organizational characteristics better predict the extent of such planning than does risk perception or any other individual quality; 2) although the relationships are weak, risk perception is positively associated with certain managerial characteristics; and 3) the risk perceptions of individual managers also covary with certain characteristics of their firms such as mission, size, complexity, and type of sponsorship (i.e., whether the firm is independently owned or part of a national chain). The most parsimonious multivariate model, which accounted for nearly one third of the variance in risk perception is comprised of six variables: whether or not the firm has been evacuated previously, the degree to which the community in which the firm is located reflected a disaster subculture, the frequency with which the managers attended professional meetings, whether or not the manager had formal disaster training, and index of disaster evacuation planning activities, and organizational mission.

Causal Findings

If a person works for a large organization, they are more likely to respond to a warning message. If a person works for an organization that provides lodging, they are more likely to respond to a warning message.

Drabek, Thomas E. 1995. "Disaster Responses Within the Tourist Industry." *International Journal of Mass Emergencies and Disasters* 13:7-23.

Abstracts

Reflecting a series of converging international trends, the tourist industry represents a vulnerability of catastrophic potential. Interview and questionnaire data obtained from 185 owners or managers in nine USA communities, provide answers to five questions: 1) what is the extent of disaster evacuation planning? 2)What factors account for the variations in this planning? 3) What behavioral patterns occur during actual evacuations? 4)What factors account for these pattern variations? and 5) What are the policy implications of these behavioral assessments? While many larger firms managed by more professional staff have completed extensive disaster evacuation planning, the overall record is very spotty. Hence, major initiatives both within the industry, and by emergency managers at all levels of government, are needed to reduce this rapidly expanding vulnerability.

Drabek, Thomas E. 1996. *Disaster Evacuation Behavior: Tourists and Other Transients.* Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

The author, a sociologist, previously had examined disaster planning (and the lack of it) among hoteliers and others whose livelihood centers on tourism. Even before that study was completed, he had begun to look at the behavior of tourists themselves when disasters struck. This latter study was expanded to include other transient individuals--business travelers, migrant workers, and homeless persons. This monograph addresses the basic question: When people are away from home and are impacted by disaster, how do they respond? Through interviews with over 800 individuals who were affected by one of three hurricanes and two earthquakes, this comparative study provides two important answers to this question: 1) policies and procedures for the timely evacuation of tourists and other transients are spotty at best and frequently leave victims critical of those they feel are responsible for their safety, and 2) investments in community disaster planning through public/private partnerships can reduce a community's vulnerability to catastrophe--a vulnerability that otherwise worsens daily. The monograph covers the five objectives of his research: 1) to describe the behavior that culminates in evacuation from disaster sites by persons who are away from their residences--for example, tourists, business travelers, migratory workers, or people in the process of relocation; 2) to describe the range of variation in this behavior among different types of evacuees, events, disaster phases, and locations; 3) to identify factors that affect variation in these behavioral sequences; 4) to document perceptions of disaster victims regarding evacuation policies and procedures implemented by private firm executives and government representatives; and 5) to formulate policy recommendations for local emergency managers and business executives. The monograph concludes by constructing a set of prediction models to answer the question: Who leaves first?, and then presents an "Action Agenda" for both disaster managers and tourist industry personnel.

Drabek, Thomas E. 1999a. "Disaster-Induced Employee Evacuation." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

This book asks the fundamental question: When people are at work and they learn that disaster is imminent, what are their responses? To find answers, the author interviewed 406 employees of 118 businesses and 23 emergency managers following seven disasters involving hurricanes or floods. He documented employee information sources, judgments, and actions, and, in so doing, discovered that many businesses were ill-prepared to provide the guidance their employees expected or needed. Thus, many employees experienced stress because of inadequate managerial leadership and acute tension because of conflicting demands between work and family. Collectively, findings suggest that business owners must make significant investments in disaster preparedness or risk significant costs in both material losses and employee morale and effectiveness. Numerous dimensions of employee evacuation behavior are examined and a survey is conducted on the effects of that behavior on various event characteristics, organizational size, and organizational mission. In addition, models are developed to explain and predict evacuation behavior and risk perception. Finally, specific policy gaps are identified that must be addressed to improve business and employee response to impending disaster and suggestions are offered for future research that would both clarify and improve that process. An "Action Agenda" concludes the volume in which a call is put forth for employee initiatives to improve business preparedness, employer audits of current practices and resources, and promotion of disaster planning throughout the business community by local emergency managers.

Drabek, Thomas E. 1999b. "Understanding Disaster Warning Responses." *The Social Science Journal* 36(3):515-523.

Abstract

When threatened with some type of disaster, how do people respond? What are the social factors that constrain their responses? Receiver characteristics, message characteristics, and social contexts are explained and related to variations in disaster warning responses. Finally, two components of a vision for the future are described: (1) disaster event taxonomies, and (2) implemented social policies.

Drabek Thomas E. 2000. "Pattern Differences in Disaster-Induced Employee Evacuations."
International Journal of Mass Emergencies and Disasters 18:289-315.

Abstract

When people are at work and they learn that disaster is imminent, what are their responses? To what degree are there pattern differences in their response profiles because of event variations or structural features of the business firm for which they work? Interviews with employees (n=406) of 118 businesses impacted by one of seven different recent disasters provide the first answers to these questions. While there were many interdependencies among three areas of constraints, analyses documented that many, but not all, aspects of employee evacuation behavior were patterned significantly by (1) length of forewarning; (2) organizational size; and (3) organizational mission.

Drabek, Thomas E. 2001. "Disaster Warning and Evacuation Responses by Private Business Employees." *Disasters* 25 (1):76-94.

Abstract

When people are advised that their place of employment is threatened with disaster, how do they respond? Interviews with employees (n=406) of 118 businesses affected by one of seven recent disasters provide the first answers to this question. Multivariate analysis document the key variable that best predict variation are: 1) emergent perceptions of risk; 2) time of evacuation from work; 3) time of evacuation from home; 4) multiple evacuations; 5) tension between work and family commitments. When warned of impending disaster, most employees initially responded with denial. Gradually, however, emergent perceptions of risk intensified especially among those who resided in a mobile home or apartment. Highest levels of work and family tensions during these evacuations were reported by racial minority employees who had children living at home. Policy implications for these and other findings are discussed as to pin-point changes business managers should make that will enable them to provide the leadership and compassion expected by employees.

Causal Findings

If the sender issues an order for mandatory evacuation, the receiver is more likely to believe the warning and respond to it. The more vulnerable a persons' housing, the more likely they are to believe and respond to a warning message. The more lacking a community is in disaster planning, the more likely that community is to believe and respond to a warning message. The longer the public perceives the duration of a disaster event, the more likely the public will believe and respond to a warning message. Persons who work in formalized firms are more likely to believe and respond to warning messages.

Drabek, Thomas E. and Keith Boggs. 1968. "Families in Disaster: Reactions and Relatives."
Journal of Marriage and the Family 30:443-451.

Abstract

In response to a massive flood which struck the metropolitan area of Denver, Colorado, June 16, 1965, approximately 3700 families were evacuated from their homes. Interview with a random sample of 278 of these families indicated that the initial reason to warning was marked disbelief regardless of warning source. Families evacuated as unites, and data indicated a strong tendency for them to take refuge in homes of relatives rather than in official centers. This tendency was significantly affected by social class. Data further suggested that interaction between relatives during the warning period increased the likelihood that relative homes would be selected as evacuation points.

Causal Findings

The more frequently a sender relays warning information, the more likely the public is to believe the warning information. If the source of the warning is an official source, the receiver is more likely to believe the warning. If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe and understand a warning message. If confirmation of the disaster/hazard happens, people are more likely to believe a warning message. Membership in a minority group decreases the likelihood that a person will respond to a warning message.

Drabek, Thomas and John S. Stephenson III. 1971. "When Disaster Strikes." *Journal of Applied Social Psychology* 1 (2):187-203.

Abstract

Warning responses are described on the basis of interviews with 278 randomly selected families who were evacuated from their homes prior to a flood in Denver, Colorado, on June 16, 1965. Response patterns are analyzed in detail fro families who were geographically separated at the time initial warnings were received. Numerous implications for community disaster planning are explicated.

Causal Findings

If the public hears a warning via the radio, they are more likely to positively respond to the warning. When a family is united in the same location at the same time, that family is more likely to believe, confirm, and/or respond to a warning message. If confirmation of the disaster/hazard happens, people are more likely to believe and respond to a warning message.

Duval, T. Shelley and John-Paul Mulilis. 1999. "A Person-Relative-to-Event (PrE) Approach to Negative Threat Appeals and Earthquake Preparedness: A Field Study." *Journal of Applied Psychology* 29 (3):495-516.

Abstract

The person-relative-to-event (PrE) model of fear-arousing or negative threat appeals predicts that increasing levels of threat when resources are appraised as sufficient relative to the magnitude of the threat when resources are appraised as sufficient relative to the magnitude of the threat will increase problem-focused coping. Conversely, increasing levels of threat when resources are appraised as insufficient relative to threat magnitude will decrease problem-focused coping. These hypotheses were tested in the context of a field study in which homeowners living in a local city were the participants. Results generally supported the PrE model in that preparedness increased over a 1-month period as level of appraised threat increased, but only for those who also appraised resources as sufficient relative to threat. The possibility that perceived difficulty of preparation for a threatening event should be added to the PrE model as an essential component is discussed.

Causal Findings

There is no relationship between a persons' gender and their likelihood for responding to a warning message. The greater the threat of the impending disaster/hazard, the more likely a person is to respond to a warning message. A person is less likely to respond to a warning message, if they perceive their resources to be insufficient. There is no relationship between having moderate resources and responding to a warning message. Having resources increases the likelihood of a person responding to a warning message.

Dynes, Russell R. and et.al. 1979. "The Accident at Three Mile Island: Report of the Emergency Preparedness and Response Task Force." Washington, D.C.: Executive Office of the President.

Abstract

This report, prepared by the Emergency Preparedness and Response Task Force for submission to the President's Commission on the Accident on Three Mile Island, discusses two distinct phases of the response to the Three Mile Island Accident. These phases included the 1) emergency response, and the 2) crisis response. Factors involved in evaluating the responses included an examination of the promptness of notification, the activation of public warning, the collection of information on threat and impact, and the translation of this information into organizational responsibilities, the establishment of mechanisms of coordination, and the distribution of public information. The Task Force provides recommendations for improving the state and local response capabilities in the event of a radiological emergency.

Causal Findings

The public is more likely to hear a warning message if it is delivered via the radio. The more specific the warning message, the more likely the public is to respond to it. The older a person is, the less likely they are to respond to a warning message. The more freedom a person has to leave their place of employment, the more likely they are to respond to a warning message. Being in geographical proximity to the disaster/hazard increases the likelihood of a person responding to a warning message. The more hazards knowledge a person has, the more likely they are to respond to a warning message. Having membership in social networks increases the likelihood of a person responding to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. The personalization of a warning message increases the likelihood of responding to it.

Dynes, Russell R. and E.L. Quarantelli. 1976. "The Family and Community Context of Individual Reactions to Disaster." Pp. 231-245 in *Emergency and Disaster Management: A Mental Health Sourcebook*, edited by H. Parad, H. L. Resnik, and L. Parad. Bowie, MD: Charles Press.

Abstract

Four behavioral contexts were examined: reaction to warning, reaction to threat, reaction to impact, and coping with loss. In all these situations, the family and community provided mechanisms which tended to reduce the potential consequences of disaster.

Causal Findings

Observing social cues increases the likelihood of a person responding to a warning message. If a family is together in the same place at the same time, they are more likely to respond to a warning message.

Edwards, Margie L. 1993. "Social Location and Self-Protective Behavior: Implications for Earthquake Preparedness." *International Journal of Mass Emergencies and Disasters* 11 (3):293-303.

Abstract

Participation in household preparedness activities is examined in light of the first highly publicized earthquake prediction issues for the Central United States. Drawing on earlier research conducted in California, this paper examines the adoption of self-protective measures in Memphis, Tennessee. Survey data show that while people in this city are generally aware of and concerned about the earthquake hazard in their community, few have adopted the necessary precautions to reduce the negative effects of a damaging earthquake. However, those respondents who were most likely to engage in self-protective behavior are situated in structurally advantageous locations. Thus, future community-wide planning and preparedness efforts must be more attentive to limitations on household resources when advocating individual responsibility for safety.

Causal Findings

Those with access to social resources, higher education, higher incomes, and/or have children are the most likely to respond to a warning message. People who have low incomes, lower education, have no children, and/or who are black, are less likely to respond to warning messages. There is no relationship between age and a persons likelihood for responding to a warning message.

Emergency Management Australia and Australian Bureau of Meteorology. 1998. "Floods: Warnings, Preparedness and Safety." Emergency Management Australia.

Abstract

This brochure serves to educate on the types of flooding in Australia, as well as means to mitigate its effects.

Farley, J. E. 1993. "Public, Media, and Institutional Responses to the Iben Browning Earthquake Prediction." *International Journal of Mass Emergencies and Disasters* 11 (3):271-468.

Abstract

This article serves as an introduction to a special issue of the International Journal of Mass Emergencies and Disasters dedicated to exploring the Iben Browning Earthquake Prediction.

Farley, John E., Hugh D. Barlow, Marvin S. Finkelstein, and Larry Riley. 1993. "Earthquake Hysteria, Before and After: A Survey and Follow-Up on Public Response to the Browning Forecast." *International Journal of Mass Emergencies and Disasters* 11 (3):305-321.

Abstract

Telephone surveys were conducted in the St. Louis metropolitan area, Cape Girardeau, MO, and Sikeston, MO, in October, 1990 and February, 1991, before and after the date on which Iben Browing predicted a damaging New Madrid earthquake would occur. The surveys revealed that a sizeable minority clearly believed Browning's prediction, with a much larger groups ambivalent about it. Those with lover levels of education, women, those whose thinking about the prediction was influenced by a minor earthquake that occurred in September, those closer to the New Madrid Fault, and those who expected a war with Iraq were more likely to believe the prediction. Many planned changed in schedules, and such plans were strongly influenced by the perceived actions of significant others. In contrast, they were not strongly influenced by believing or not believing the prediction. When the date of the predicted quake arrived, far fewer actually changed their schedules than had indicated plans to do so, and schedule changes were largely a product of school or work cancellations. The prediction did contribute to an increase in household preparedness which was sustained two months after its disconfirmation, but the actions most often taken were ones that were easiest to take. People close to the fault reported higher levels of preparedness. Despite the disconfirmation of the prediction, most respondents still viewed a damaging earthquake as likely within the next 10 to 15 years.

Causal Findings

Women are more likely than men to believe a warning message. The actions of a significant other influence whether or not a person believes a warning message. The closer a person is to the hazard/disaster area, the more likely they are to believe and respond to a warning message. If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe and respond to a warning message. The lower the education a person has, the more likely they are to believe a warning message. The higher the education a person has, the more likely they are to respond to a warning message. The more freedom a person has to leave their place of employment, the more likely they are to respond to a warning message. Believing a warning message increases the likelihood of responding to it.

Fischer III, Henry W., George F. Stine, Brenda L. Stoker, Marna L. Trowbridge, and Eric M. Drain. 1995. "Evacuation Behavior: Why Do Some Evacuate While Others Do Not? A Case Study of the Ephrata, Pennsylvania (USA) Evacuation." *Disaster Prevention and Management* 4 (4):30-36.

Abstract

Evacuation is commonly used to mitigate the ill effects of a variety of disaster agents. It is important that authorities gain an accurate understanding of the circumstances under which citizens will evacuate. Tests the efficacy of evacuation message clarity and frequency, authority type, the accuracy of past warnings, and the impact of the presence of children in the home as viable variables in effecting an evacuation response. Finds the evacuation response was more likely to occur if the potential victim was contacted frequently (more than once) by the proper authority (as perceived by the potential victim), if the past warnings were perceived as being accurate, and dependent children were in the home. Interviews respondents from 83 households in Ephrata, Pennsylvania, USA, after a major fire emergency threatened residents of three neighborhoods contiguous to the site.

Fischhoff, Baruch. 2002. "Assessing and Communicating the Risks of Terrorism." In A. Teich, D. Nelson & S. Lita (Eds.) *Science and Technology in a Vulnerable World* (pp.51-64). Washington, D.C.: American Association for the Advancement of Science.

Abstract

This chapter examines the psychology of risk, both for experts and the public; risk analysis and risk communication and how the two must be integrated for either to be effective; special considerations in the domain of terrorism; how these perspectives might be applied to bioterrorism; and areas where we might immediately begin to develop applications and conduct the supporting basic science.

Fischhoff, Baruch. 2005. "Scientifically Sound Pandemic Risk Communication." Prepared for
House Science Committee Briefing, University of California, Los Angeles, December 14, 2005.

Abstract

This is a testimony prepared for a House Science Committee Briefing on "Gaps in the National
Flu Preparedness Plan: Social Science Planning and Response." Fischhoff highlights seven key
results from past social science research on people's responses to risks. These results include that
people want the truth, even if it is worrisome; people can absorb only a limited amount of new
information at a time; people have difficulty understanding some kinds of information; emotions
can cloud people's judgment; even the most experienced communicators cannot accurately
predict how their messages will be interpreted, especially with novel topics and unfamiliar
audiences; people exaggerate their ability to predict other people's behavior; and people
generally make sensible decisions if they are judged in terms of how they see their circumstances
and what their goals are. Fischhoff concludes by suggesting a strategy for designing and
evaluating the content of risk communication.

Fischhoff, Baruch. 2006. "The Psychological Perception of Risk." In David G. Kemlen (Ed.) *The McGraw-Hill Homeland Security Handbook* (p.463-492). New York.

Abstract

This book chapter discusses three tasks that must be accomplished in order for risk communication to be effective: have a credible message, create appropriate communication channels, and deliver decision-relevant information concisely and comprehensibly. Recommendations are made about how each task should be executed. It draws upon extant literature on communication about health, safety and environmental risks, then proceeds to guarded extrapolations to terror risk (i.e., smallpox vaccination, domestic surveillance, decontamination standards).

Fischhoff, Baruch, Roxana M. Gonzalez, Deborah A. Small, and Jennifer S. Lerner. 2003.
"Evaluating the Success of Terror Risk Communications." *Biosecurity and Bioterrorism:
Biodefense Strategy, Practice, and Science* 1(4): 255-258.

Abstract

A survey was conducted to evaluate whether widely reported facts about terrorism risk have been
correctly understood by citizens. A sample of 532 adults from a nationally representative panel
was surveyed via the Internet in 2002. Results indicated that many people held erroneous beliefs
about the nature of biological agents and the effectiveness of certain protective actions in a
terrorism situation. People also expected others to panic or be uncooperative in certain terrorism
situations. The authors suggest that the professional community has failed to develop and
disseminate clear and focused information on terrorism risk and public reactions to crises.

Causal Findings

Beliefs about the nature of biological agents, the effectiveness of protective actions in a terrorism
situation and public reactions to terrorism events are generally not associated with demographic
characteristics.

Fitzpatrick, Colleen and Dennis S. Mileti. 1990. "Perception and Response to Aftershock Warnings During the Emergency Period." Pp. 75-83 in *The Loma Prieta Earthquake: Studies of Short-Term Impacts*, Monograph No. 50, edited by R. Bolin. Boulder, CO: University of Colorado, Institute of Behavioral Science, Natural Hazards Research and Applications Information Center.

Abstract

The focus of this study was to exam the perception and response to earthquake aftershock warnings. The geographical area studied consisted of the San Francisco Bay area and Santa Cruz. A convenience sampling technique was used for selected interviewees, who ranged from private citizens to government and private officials. Television and radio warning announcements were documented. Three categories of interviews were conducted: 1) with the public about perceptions and response, 2) with organizations about perceptions and response, and 3) with informants on how warnings got from organization to organization and to the public.

The researchers found that it was difficult to provide the public with warnings in the midst of an earthquake disaster because the public is focused on the existing disaster and warnings are somewhat lost in a flood of media disaster coverage. Factors that assist the effectiveness of public response to pre-impact warnings may actually serve as constraints to post-impact warnings.

Causal Findings

The public is less likely to hear a warning if they are in the middle of a disaster response. If the public hears a warning about a disaster agent with which they are familiar, they are less likely to positively respond to the warning.

Abstract

A common theme in the literature on evacuation compliance is the result of largely social psychological perceptions of risk formed prior to taking the protective action. From this perspective, evacuation is a function of warning recipients coming to define themselves as in danger and believing that fleeing the immediate environment will reduce that danger. This paper explores the social psychological and social structural processes that result in such perceptions. In particular, attention is given to identifying perceptions that motivate evacuation, factors that direct perceptual outcomes and the ways in which motivation and perception are translated into action.

Flynn, C.B. 1979. "Three Mile Island Telephone Survey: Preliminary Report on Procedures and Findings." Tempe, AZ: Mountain West Research.

Abstract

This report describes the methodology used in, and the results of, a telephone survey conducted in the vicinity of the Three Mile Island nuclear power plant. The survey is part of a study of the socioeconomic impacts of nuclear power plant construction and operation at Three Mile Island, and eleven other nuclear power plant sites. The survey covers the areas of evacuation behavior, information processing, short-term accident effects, continuing effects of the accident, and respondents' evaluation of TMI and nuclear power in general. Approximately 1500 households in the vicinity of the Three Mile Island nuclear power plant participated in the survey, which was conducted in July and August, 1979.

Causal Findings

The public is more likely to believe warning information if the source of warning information is electronic media and/or comes from an official source. The more consistent a warning message is, the more likely the public will respond to it. The public is more likely to respond to warning messages it receives from a mass media source and/or a scientific source. The more specific the warning message, the more likely the public is to respond to it. The older a person is, the less likely they are to respond to a warning message. People with children are more likely to respond to disaster warning messages, than people without children. Women are more likely than men to respond to warning messages and to personalize them. The more environmental cues the public observes, the more likely they are to respond to warning messages. The greater the fear in looting a person has, the less likely they are to respond to a warning message. The more fearful a person is of a forced evacuation, the more likely they are to respond to a warning message. The more freedom a person has to leave their place of employment, the more likely they are to respond to a warning message. Being in geographical proximity to the disaster/hazard increases the likelihood of a person responding to a warning message and personalizing it. The greater the perception of loss/risk, the more likely a person is to respond to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. A person is more likely to respond to a warning message if they feel they have at least some personal efficacy. The personalization of a warning message increases the likelihood of responding to it. The older a person is, the less likely they are to personalize a warning message. The greater the socio-economic status a person has, the more likely they are to personalize a warning message. If a family is together in the same place at the same time, they are more likely to respond to a warning message.

Flynn, C.B. and J.A. Chalmers. 1980. "The Social and Economic Effects of the Accident at Three Mile Island." Washington, D.C.: Nuclear Regulatory Commission.

Abstract

This report covers the social and economic effects of the accident at Three Mile Island during the first 6 months following the accident. A variety of data sources were utilized including published documents and statistics, household surveys, newspaper files, interviews, and other research about the accident. The findings can be grouped into effects on (1) the regional economy, (2) institutions, and (3) individuals. Direct economic effects during the emergency period following the accident were interrupted local production and reduced local income and employment. Losses were conspicuous during the first week of April but subsequently very minor. There is no evidence of any continuing interruption of activity because of the accident. However, there is concern within the business community about the effect of the accident on the continued growth and development of the area. Major institutional effects were a strain on the emergency preparedness network in the area and an increased focus on the issue of the TMI plant by the local populace. Major effects on individuals were the evacuation itself and increased stress during the accident period. For most people, the effects of the accident were short-lived, but for others, the accident has caused a more permanent change in their day-to-day activities.

Causal Findings

The closer a person is to a hazard/disaster area, the more likely they are to believe and respond to a warning message. The more specific the warning message, the more likely the public is to respond to it. Women are more likely than men to respond to warning messages.

Flynn, James, Paul Slovic, and C.K. Mertz. 1993. "The Nevada Initiative: A Risk Communication Fiasco." *Risk Analysis* 13:497-508.

Abstract

The U.S. Congress has designated Yucca Mountain, Nevada as the only potential site to be studied for the nation's first high-level nuclear waste repository. People in Nevada strongly oppose the program, managed by the U.S. Department of Energy. Survey research shows that the public believes there are great risks from a repository program, in contrast to a majority of scientists who feel the risks are acceptably small. Delays in the repository program resulting in part from public opposition in Nevada have concerned the nuclear power industry, which collects the fees for the federal repository program and believes it needs the repository as a final disposal facility for its high-level nuclear wastes. To assist the repository program, the American Nuclear Energy Council (ANEC), an industry group, sponsored a massive advertising campaign in Nevada. The campaign attempted to assure people that the risks of a repository were small and that the repository studies should proceed. The campaign failed because its managers misunderstood the issues underlying the controversy, attempted a covert manipulation of public opinion that was revealed, and most importantly, lacked the public trust that was necessary to communicate credibly about the risks of a nuclear waste facility.

Causal Findings

The public is less likely to believe and respond to a warning that comes from an industry source, but more likely to believe and respond to a warning from a public source.

Foster, Harold D. 1980. *Disaster Planning: The Preservation of Life and Property*. New York, NY: Springer-Verlag.

Abstract

The concepts and mechanisms of comprehensive risk management are overviewed in the hope that more local authorities, institutions, and planners will accept the responsibilities for improving safety standards involving the protection of human lives and property. Most of the examples cited have been taken from the natural hazards and disasters area. Topics discussed include: strategies for achieving safety goals and objectives; the pros and cons of hazard microzonation; acceptable risk and the enforcement of unacceptable risk standards; mapping for single and multiple hazards, and for one or multiple purposes; achieving safety through structural design; techniques for predicting and preventing disasters; modeling and simulation methodology; and implementation of disaster warning systems. Also discussed is disaster preparedness and the recovery/reconstruction process. A safety index based on stress factors and a methodology for deciding the necessity of evacuation are introduced.

Causal Findings

The more certain the sender is about the warning information they are relaying, the more likely the public will believe it and respond to the warning. The greater the consistency in a warning message, the more likely the public is to personalize the message. If a person has had previous hazards experience, they are more likely to believe and/or understand a warning message.

Fothergill, Alice. 1996. "Gender, Risk and Disaster." *International Journal of Mass Emergencies and Disasters* 14 (1): 33-56.

Abstract

Focusing on gender differences, this article synthesizes the literature on gender, risk, and disasters and presents a comprehensive view of what is known in this area. Data are limited, yet by using a nine-stage typology to delineate disaster preparedness, impact, and recovery, noteworthy findings are documented and discussed. The literature reveals a pattern of gender differentiation throughout the disaster process. The differences are largely attributed to childcare responsibilities, poverty, social networks, traditional roles, discrimination, and other issues of gender stratification. The emergent patterns have important implications, and recommendations for future directions are offered.

Causal Findings

Women perceive disaster events or threats as more serious and risky than men, especially if it threatens their family members. There is some indication that women prepare their families and communities for disaster more so than men. Women are more likely to receive risk communication, due to their social networks, and more likely to respond with protective actions, such as evacuation.

Fothergill, Alice , Enrique G.M. Maestas, and JoAnne DeRouen Darlington. 1999. "Race, Ethnicity and Disasters in the United States: A Review of the Literature." *Disasters* 23 (2):156-173.

Abstract

In this paper the authors synthesize past disaster research that addresses issues of race and ethnicity in the United States. Using an eight-stage typology to organize the findings, this literature review presents the results from a wide range of studies. The synthesis shows how various racial and ethnic groups perceive natural hazard risks and respond to warnings, how groups may be differentially affected, both physically and psychologically, and how disaster effects vary by race and ethnicity during the periods of emergency response, recovery and reconstruction. They show that studies have important findings, many illustrating that racial and ethnic communities in the US are more vulnerable to natural disasters, due to factors such as language, housing patterns, building construction, community isolation and cultural insensitivities. By presenting these studies together, it is possible to witness patterns of racial and ethnic inequalities that may be more difficult to see or interpret in individual studies that take place in one specific place in one specific place and time. The authors conclude the review with policy and research recommendations.

Frazier, Kendrick. 1979. Violent Face of Nature: Severe Phenomena and Natural Disasters. New York, NY: William Morrow & Co.

Abstract

The causes and dynamics of nine geophysical and meteorological hazards are explained in the first part of this book, while the ways in which society attempts to cope with the destructive aspects of the phenomena are examined in Part II. The techniques currently being utilized in the prediction and warning for each of the hazards--floods, thunderstorms, tornadoes, lightning, hail, hurricanes, blizzards, earthquakes, and volcanoes--are presented, while hazard modification, disaster preparation, the increasing vulnerability to natural disaster, and response and recovery each merit a chapter of its own. The book is a vivid and well-organized portrayal of the consequences suffered by human populations when nature's most destructive forces are unleashed. Technically accurate from the perspectives of both the physical and sociological sciences, it provides a very readable layman's introduction to natural disasters without restoring to an oversimplification of the subject.

Causal Findings

A person is more likely to respond to a hazards warning if they have hazards experience. The more social cues a person receives, the more likely they are to respond to a hazards warning. If a family is united during the time of a disaster/hazard, they are more likely to respond to a warning message. The closer in proximity to a disasters' impact, the more likely a person is to hear a warning message. A person is more likely to confirm a warning message if it comes from a media source.

Friedsam, H. J. 1961. "Reactions of Older Persons to Disaster-Caused Losses: A Hypothesis of Relative Deprivation." *Gerontologist* 1:34-37.

Abstract

This paper attempts to formulate a broad hypothesis on differential reactions of younger and older persons to disaster-caused deprivation with emphasis on the responses of the latter group. A hypothesis involving the concept of relative deprivation is utilized to help conceptualize the problem of differential reactions of younger and older persons to disaster caused losses. The author reviewed several hundred unstructured interviews taken with adult victims of tornadoes in Arkansas, Massachusetts, Texas, and Louisiana.

The research indicates that older persons tend to react to their experiences with a high sense of deprivation more frequently than do younger persons.

Causal Findings

The older a person is, the less likely they are to believe and respond to a warning message.

Friedsam, H. J. 1962. "Older Persons in Disaster." Pp. 151-184 in *Man and Society in Disaster*, edited by G. W. Baker and D. W. Chapman. New York, NY: Basis Books.

Abstract

Discusses eleven hypotheses concerning the aged in disaster situations, with supporting research evidence. The hypotheses concern warning, evacuation, material loss, casualties, family ties, emotional response, and rehabilitation. The interview files of the Disaster Research Group were the primary source of data.

Causal Findings

The older the person hearing the warning is, the less likely they are to believe the warning respond to it.

Fritz, Charles E. 1957. "Disasters Compared in Six American Communities." *Human Organization* 16:6-9.

Abstract

Reports findings from a National Opinion Research Center disaster study centered around extensive interviews with those involved in six major disasters. Covers the social-psychological effects of disaster, common perceptions in disaster, initial behavior in disaster, leadership in disaster, and scapegoating in disasters.

Causal Findings

The more specific a warning message is, the more likely the receiver will believe and respond to it. The personalization of a warning message increases the likelihood of responding to it. The more consistent a warning message is, the more likely the receiver is to believe it.

Fritz, Charles E. 1961. "Disasters." Pp. 651-694 in *Contemporary Social Problems*, edited by R. K. Merton and R. A. Nisbet. New York, NY: Harcourt.

Abstract

This essay examines the importance of studying disasters and the particular role of the social scientist in doing so. The author reviews the definition of disaster, as well as explores disaster warnings, evacuations, planning, and social adaptations to disasters.

Causal Findings

The more frequently a sender relays warning information, the more likely the public is to believe it and respond to the warning information. If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe and respond to a warning message.

Fritz, Charles E. and Eli Marks. 1954. "The NORC Studies of Human Behavior in Disaster." *Journal of Social Issues* 10 (3):26-41.

Abstract

On the basis of interviews of nearly 1,000 persons in over 70 major disasters, data is presented on percent of respondents reporting various affective reactions during and after impact; percent reporting more lasting effects of various kinds; the relationship of forewarning to prior social interaction, protective action, and levels of loss; percent of affective states according to time period, separation from family, and searching activities; and estimated percentage of traumatic reactions to dead or injured.

Causal Findings

The more frequently a warning message is received, the more likely the public is to respond to it.

Fritz, Charles E. and J.H. Mathewson. 1957. "Convergency Behavior in Disasters." Washington, D.C.: National Research Council, National Academy of Sciences.

Abstract

A study of unofficial convergence behavior in disaster, including personal, material, and informational convergence, using information from many different disaster studies. After a discussion of the nature of convergence and the scope of the problem, types of convergers, and methods and techniques for controlling convergence are discussed.

Causal Findings

The more consistent the sender is about the warning information they are relaying, the more likely the public is to believe the warning. The more frequently a warning message is received, the more likely the public is to respond to it.

Genesco, M. 1990. "Warning and Informing the General Public in the Case of a Major Industrial Accident." Pp. 401-404 in *Communicating with the Public about Major Accident Hazards,* edited by H. B. F. Gow and H. Otway. New York, NY: Elsevier Applied Science.

Abstract

A brief discussion of the need and means of issuing warnings to the public about industrial accidents.

Gladwin, C H, H Gladwin, and W G Peacock. 2001. "Modeling Hurricane Evacuation Decisions with Ethnographic Methods." *International Journal of Mass Emergencies and Disaster* 19:117-43.

Abstract

This paper directly models individual and household hurricane evacuation behavior using ethnographic decision tree analysis. This approach uses a set of iterative processes to inductively derive a general decision model from specific individual decision models. To elicit the model described here, below the authors and several graduate students interviewed Miami residents who had been in South Florida during both Hurricanes Andrew in 1992 and Erin in 1995. The resulting model of hurricane evacuation decision processes was then tested with interview data collected from a separate random sample of 954 South Florida residents drawn from areas that were evacuation zones and areas immediately adjacent to them at the time of Hurricane Andrew. The model captures the complexity and messiness of real-life decision-making by including criteria showing how people are constrained by their perceptions of the hurricane, the safety features of their homes, the time they have available to prepare for the hurricane, their age, and the reactions of other family members who are also deciding whether or not to evacuate. By showing the richness of the decision process as well as its messiness, results taken from this model can better inform emergency managers who need to know how people will react to the approach of a hurricane.

Causal Findings

Evacuation decision making is a complex process influenced by factors including perceptions of the hurricane, the safety features of their homes, the time they have available to prepare for the hurricane, their age, and the reactions of other family members who are also deciding whether or not to evacuate.

Gladwin, Hugh and Walter Gillis Peacock. 1997. "Warning and Evacuation: A Night for Hard Houses." Pp. 52-74 in *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disasters*, edited by W. G. Peacock, B. H. Morrow, and H. Gladwin. New York, NY: Routledge.

Abstract

This chapter focuses on how hundreds of thousands of households in Dade County, Florida reacted to the rapidly developing threat posed by Hurricane Andrew. Issues surrounding three topics were examined: household preparation, evacuation, and the consequences of this experience for future disaster response. The authors examined decision shaping factors for household evacuation. The authors concluded by examining potential consequences of Andrew on future household evacuation decisions.

Glass, Albert J. 1970. "The Psychological Aspects of Emergency Situations." Pp. 62-69 in *Psychological Aspects of Stress*, edited by H. S. Abram. Springfield, IL: Charles C. Thomas.

Abstract

This study approaches the problem of psychological aspects of emergency situations by using a model which considers behavior over time, so that various phases of behavior can be viewed separately. This model considers impact--the time when the emergency happens--as its reference point. Pre-impact phase is present when impact becomes probable. The warning period is the period of imminent danger. The recoil period follows impact and is the phase when the individual grasps the situation around him and proceeds in some organized manner to cope with the environment. The post-impact phase is the period of mourning, repair, and rehabilitation for the individuals involved.

Causal Findings

The more habituation of a disaster/hazard a person experiences, the less likely they are to respond to a warning message.

Golden, Joseph H. and Christopher R. Adams. 2000. "The Tornado Problem: Forecast, Warning, and Response." *National Hazards Review* 1 (2):107-118.

Abstract

Research on tornadoes over the last 20 years has been conducted by a combination of universities, research institutions, federal agencies, and more recently by private meteorological companies. Recent advances in scientific technologies and computers have led to an explosion of knowledge in the last decade. This is evidenced by increased accuracy in the detection and prediction of tornadoes as well as increased warning lead time before tornado formation. Most of the research in this area has focused on the physical sciences and technology portion of the warning process. Far less attention has been spent on the warning communication process, behavioral response, and epidemiology of tornadoes. The translation of improved technologies into better tornado forecasting and warning services must also involve the incorporation of physical and social science. This is necessary to develop improved warning communication and coordination processes that will lead to the further reduction of tornado related injuries and fatalities.

Goldsteen, Raymond and John K. Schoor. 1982. "The Long-Term Impact of a Man-Made Disaster: An Examination of a Small Town in the Aftermath of the Three Mile Island Nuclear Reactor Accident." *Disasters* 6 (1):50-59.

Abstract

This paper is an examination of the long-term impact of the Three Mile Island Nuclear Reactor accident on the small towns of Goldsboro and Newberry Township (combined 1980 population of 10,524). Theses two contiguous communities are the closest population centers to the Three Mile Island plant, and they were in the path of the prevailing winds at 4 AM March 28, 1979, when the accident began.

The study focuses on four main social-psychological outcomes of the accident which were exhibited in the population of our research community: fear, de-moralization, distrust of officials, and attitudes towards nuclear power. These concepts are related to other variables which are commonly the subjects of disaster research, such as evacuation at the time of the accident, future evacuation plans, and future community disaster mitigation plans. The data for this community study were collected using multiple methodological tools. There was a telephone survey of a random sample of residents conducted in October of 1979 (n=409). A sub-sample of 100 were re-interviewed in March of 1980. Another sub-sample of 150 completed written questionnaires in October of 1980. From these three studies, a panel of 72 community residents was used for this paper. Each of these respondents has responded at all three points in time. In addition, face-to-face interviews were done with twenty-six community leaders, and twenty residents were also interviewed in person to validate some of the telephone interview data. Finally, direct observations of the community and an analysis of local newspapers and Nuclear Regulatory Commission documents has been conducted.

Causal Findings

The public is more likely to respond to a warning message if it comes from an official source. The personalization of a warning message increases the likelihood of responding to it.

Goldstein, Arnold P. 1960. "Reactions to Disaster." *Psychiatric Communications* 3(2).

Abstract

The nature of individual and group behavior in response to highly stressful stimuli has been studied by the American Psychiatric Association's Committee on Civil Defense and the Disaster Research Group of the National Academy of Sciences. The author reviews and integrates this material on reactions to the extreme stress of civilian disaster situations. The author considers the threat, impact, and aftermath stages in disaster and provides an exploratory investigation into disaster reactions.

Causal Findings

The more consistent the sender is about the warning information they are relaying, the more likely the public is to believe it and respond to the warning.

Gray, J. 1981. "Characteristic Patterns of and Variations in Community Response to Acute Chemical Emergencies." *Journal of Hazardous Materials* 4:357-365.

Abstract

This paper discusses the distinctive socio-behavioral patterns which emerge in the context of community response to acute chemical emergencies. Impact contingencies and the variations in behavior they occasion are especially noted. The characteristic pattern of behavior of first responders and their initial definitions of threat are also outlined. In addition, there is a discussion of the effects of convergence movement towards the disaster site on the outflow of evacuees.

Causal Findings

A person is more likely to respond to a warning message if they receive that message from a face-to-face channel.

Greene, M., R. Perry, and M. Lindell. 1981. "The March 1980 Eruptions of Mt. St. Helens: Citizens Perceptions of Volcano Threat." *Disasters* 5 (1):49-66.

Abstract

In this study, the authors examined selected aspects of citizens' perceptions of the March 1980 eruptions of Mt. St. Helens, Washington. The analysis focused on three general aspects of the hazard posed by the volcano's resumed activity: 1) citizens' beliefs about volcano-related dangers; 2) sources of information about the hazard, and 3) citizens' evaluations of the personal risks associated with Mt. St. Helens and the appropriate protective measures to mitigate these risks. The analysis suggests that several factors emerge that appear important to understanding perception of the risks associated with volcano eruptions.

Causal Findings

The more specific a warning message is, the more likely the receiver will believe and understand it.

Griffin, Robert J., Sharon Dunwoody, and Fernando Zabala. 1998. "Public Reliance on Risk Communication Channels in the Wake of a Cryptosporidium Outbreak." *Risk Analysis* 18:367-375.

Abstract

In the spring of 1993, about 39% of Milwaukee-area resident suffered through a nationally publicized illness brought about by cryptosporidium, a parasite that had infested the metropolitan drinking water supply. Our study, based on a telephone survey of 610 local adult residents, indicates that worry about becoming ill in the future with cryptosporidiosis relates more strongly and consistently to public reliance on, and use of, media for cryptosporidium information than do a range of risk perception and experience variables. We propose that more studies should take an audience-centered approach to understanding risk communication.

Causal Findings

The public is more likely to hear a warning message through specialized media and/or a personal contact. The greater the perceived vulnerability the public feels towards a disaster, the more likely they are to hear a warning message. If confirmation of the disaster/hazard happens, people are more likely to believe a warning message. Racial minorities are more likely to hear warning messages. The greater a person perceives their hazards risk, the more likely they are to personalize a warning message.

Gruntfest, Eve C. 1977. "What People Did During the Big Thompson Flood" Boulder, CO: Institute of Behavioral Science, University of Colorado.

Abstract

The purpose of this study is to analyze the behavior patterns which were adopted at the time of the flood, and to apply that knowledge to the improvement of warning system design for Front Range communities vulnerable to flash flooding. Comparisons are made between the actions of the survivors and non-survivors and the warned and non-warned populations. Results indicate that climbing the canyon wall was the best action to have adopted, and that doing nothing different or taking no action at all were the worst in terms of survival chances. Those who were driving alone through the canyon ran the highest risk. Recommendations include the installation of signs throughout hazardous canyons containing specific instructions for action in the event of a flash flood warning, and improved public education about flash flood hazard.

Causal Findings

The more frequently a warning message is received, the more likely the public is to respond to it. The older a person is, the less likely they are to respond to a warning message. If a person has had experience with hazards before, they are more likely to respond to warning messages. Having membership in social networks increases the likelihood of a person responding to a warning message. Hearing a warning message increases the likelihood of responding to it. The personalization of a warning message increases the likelihood of responding to it. The more time there is to impact of a disaster, the less likely a person is to respond.

Gruntfest, Eve. 1997. "Warning Dissemination and Response with Short Lead Times." Pp. 191-202 in *Flood Hazard Management: British and International Perspectives*, edited by J. Handmer. Norwich, UK: GEO Books.

Abstract

More public investments aim to improve forecasting capability than to evaluate the impact that predictions have on reducing loss of life or property damages. Warning systems are nonstructural measures which can effectively reduce loss of life and mitigate damages from flooding. This chapter looks at the advantages of systems in the United States, important warning and dissemination characteristics to ensure effective warning efforts. Challenging research questions for continuing investigation are also presented.

Causal Findings

The older a person is, the less likely they are to hear and/or respond to a warning message. The clearer the warning message, the more likely the public is to respond to it. The more credible the source of a warning message, the more likely the public is to respond to a warning message. The more specific the warning message, the more likely the public is to respond to it. If a person has had experience with hazards before, they are more likely to respond to warning messages.

Gruntfest, Eve C. and Carole Huber. 1989. "Status Report on Flood Warning Systems in the United States." *Environmental Management* 13:279-286.

Abstract

In 1987 the authors surveyed 18 community or regional early-warning systems as part of a U.S. Bureau of Reclamation investigation into the utility of such systems for warning people about dam failure floods. Problems identified from the survey included the need for redundancy in all parts of the warning system, the need for backup power supplies to forestall problems created by extended power outages, the lack of consistent maintenance funding, and damage to equipment caused by weather extremes or vandalism. On the positive side, the study revealed a number of pleasant surprises, such as intergovernmental and inter-jurisdictional cooperation often was stimulated during the design and operation of an integrated warning system; most communities that experienced a flood following installation of the warning system expressed satisfaction with its operation; and useful hydrological data was obtained for small watersheds whose drainage is a critical factor in producing localized flooding.

Gruntfest, E. and M. Weber. 1998. "Internet and Emergency Management: Prospects for the Future." *International Journal of Mass Emergencies and Disasters* 16 (1):55-72.

Abstract

This article reports on the growing value of Internet resources for the emergency management profession. The analysis has six components: 1) a brief history of the field prior to the introduction of the Internet; 2) an overview of the changes in emergency management since the introduction of the Internet and a summary of the characteristics of Internet communications; 3) some descriptions of how the Internet is currently used in flood, earthquake, and volcano research; 4) examples of Internet use as a tool for education; 5) federal and state employment of the Internet in emergency management during disasters and for public education and awareness between disasters, and 6) conclusions and suggestions for further research.

Haas, J. Eugene, Harold C. Cochrane, and Donald G. Eddy. 1977. "Consequences of a Cyclone on a Small City." *Ekistics* 44:45-50.

Abstract

The destruction of the small town of Darwin, Australia in 1974 is examined, as is the town decision to evacuate, the consequences of the evacuation maintaining services to the town, and the return and rebuilding of the community.

Causal Findings

If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe and understand a warning message.

Hamada, Roger S. 1994. "Children of Iniki: Effects of Evacuation and Intervention." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

This research addressed three questions: 1) What was the incidence of Post Traumatic Stress Disorder (PTSD) symptoms among elementary aged children on Kauai following Hurricane Iniki and how does it compare to the findings in Lonigan's earlier study? 2) Did incidence of PTSD symptoms differ between children who were evacuated from the island post disaster and non-evacuees? 3) Did the large scale school-wide interventions implemented on Kauai in the weeks following the hurricane mitigate incidence and severity of PTSD symptoms in children who participated in the interventions compared to those who did not?

The sample consisted of 452 children and the Revised Children's Manifest Anxiety Scale (RCMAS) and the Child Reaction Inventory (CRI) measurements were taken, via questionnaires. The results showed no statistically significant difference between evacuees and non-evacuees for rates of PTSD or CRI, nor was there any statistical significance in the differences in PTSD prevalence or CRI score between children who received school-based interventions and those who did not.

Hammer, Barbara and Thomas W. Schmidlin. 2002. "Response to Warnings During the 3 May 1999 Oklahoma City Tornado: Reasons and Relative Injury Rates." *Weather and Forecasting* 17:577-581.

Abstract

Residents of homes that sustained F4 or F5 damage in the deadliest of the 3 May 1999 tornadoes were surveyed to determine their responses to the tornado warning, reasons for their responses, and relative injury rates. There were 190 people in 65 surveyed houses at the time that warnings were issued. Television was the mot commonly cited source of the warning (89%), followed by a telephone call (37%), sirens (37%), and AM/FM radio (25%), and 55% received the warning from more than one source. Nearly one-half (47%) of the residents fled their homes before the tornado struck. Of those who fled, 65% went to a tornado shelter, of whom 70% ran to the shelter (median distance 30 m) and 30% drove to the shelter (median distance 4.8 km). About one-half (53%) of those who fled their homes left in a vehicle. None of those who fled their homes, by foot or by vehicle, were injured. Of those who stayed in the home, 39% sought shelter in a bathroom, 38% in a closet, 9% in a hallway, and 15% in other rooms. Reasons for not leaving included believing the storm would not strike their house, believing it was too late or too dangerous to leave, having no transportation available, or having not alternative shelter available. Thirty percent of those who remained in their homes were injured and 1% killed. The rate of serious injury was not significantly different for those in a closet (14%), hallway (20%), or bathroom (23%). Tornado preparedness and warning programs should recognize that long tornado warning lead times and street-level television coverage allow residents to make reasoned decisions to minimize risk and that those decisions may include driving out of the path of the tornado.

Causal Findings

The public is more likely to hear a warning message via the television. If the sender of a warning relays the information via the telephone, the receiver is more likely to believe the message. The public is more likely to respond to a warning message if it includes informative guidance, and/or they are given a long lead time to respond. The more geographical cues a person receives, the more likely they are to believe a warning message.

Handmer, John W. 1990. "Risk Communication for Flash Floods" presented at *Thirtieth Annual Flood Mitigation Conference*. Wollongong, Australia: Australian National University.

Abstract

Unfortunately, there are few true successes in public information programs for hazards, and warning systems are subject to failure for many reasons: it is easy to become depressed by reading the relevant literature. The people we want to influence need to notice the message, understand it, believe it, decide to act on it, and actually act on it. Furthermore, we generally expect them to compete successfully for attention with the vast array of messages on other topics. However, there are occasions when people actively seek information on floods, and it is important that we are ready to take advantage of this opening.

Handmer, John. 1992. "Can We Have Too Much Warning Time? A Study of Rockhampton, Australia." Pp. 155-159 in *Inspiration: Come to the Headwaters*, vol. Special Publication No. 24, edited by Association of State Flood Plain Managers. Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

This study examined the problem of unofficial, potentially competing forecasts of flooding. It accomplished this through a case study of the 1988 flood in the Australian city of Rockhampton.

The researchers found that as warning times increase, the official flood warning system is increasingly likely to find itself working in tandem with an unofficial system. At its simplest, this could be individuals making their own assessments based on environmental indicators such as heavy rain. However, it is more likely that those at risk will receive warning messages from many different sources. The study showed that unofficial forecasts with a clear local origin supported the bureau's official warnings.

Hansson, Robert O., Dianne Noulles, and Steven J. Bellovich. 1982. "Knowledge, Warning and Stress." *Environment and Behavior* 14 (2):171-185.

Abstract

A field study investigated the role of knowledge, experience, and warning in mediating the stress associated with urban flooding. Among residents of an urban floodplain, knowledge about flooding was associated with less trauma during the last flood and reluctance to support indiscriminate government intervention. Increased prior warning of a flood, however, was related to intensified residual fear and feelings of desperation, to more frequent somatic manifestations of stress, and to greater support for all government intervention programs. Previous flood experience (especially recurring experience) was associated with increased fear, depression, and health-stress outcomes. Commitment to adaptive community intervention programs was related to recency of one's flood experience. Having flood insurance was unrelated to stress measures.

Causal Findings

Having had hazards experience increases the likelihood of a person personalizing a warning message.

Haque, C. Emdad. 1995. "Climatic Hazards Warning Process in Bangladesh: Experience of, and Lessons from, the 1991 April Cyclone." *Environmental Management* 19(5):719-734.

Abstract

Science and technology cannot control entirely the causes of natural hazards. However, by using multifaceted programs to modify the physical and human use systems, the potential losses from disasters can effectively be minimized. Predicting, identifying, monitoring, and forecasting extreme meteorological events are the preliminary actions towards mitigating the cyclone-loss potential of coastal inhabitants, but without the successful dissemination of forecasts and relevant information, and without appropriate responses by the potential victims, the loss potential would probably remain the same.

This study examines the process through which warning of the impending disastrous cyclone of April 1991 was receive by the local communities and disseminated throughout the coastal regions of Bangladesh. It is found that identification of the threatening condition due to atmospheric disturbance, monitoring of the hazard event, and dissemination of the cyclone warning were each very successful. However, due to a number of socioeconomic and cognitive factors, the reactions and responses of coastal inhabitants to the warning were in general passive, resulting in a colossal loss, both at the individual and national level. The study recommends that the hazard mitigation policies should be integrated with national economic development plans and programs. Specifically, it is suggested that, in order to attain its goals, the cyclone warning system should regard the aspects of human response to warning as a constituent part and accommodate human dimensions in its operational design.

Causal Findings

The public is more likely to hear a warning from a local government source and/or a personal contact.   The more disbelief a person has about an impending disaster, the less likely they are to respond to warning messages. The more potentially fatal the disaster/hazard, the more likely the public is to respond to a warning message. The greater the fear in looting a person has, the less likely they are to respond to a warning message.

Heath, Robert L. and Michael Palenchar. 2000. "Community Relations and Risk Communication: A Longitudinal Study of the Impact of Emergency Response Messages." *Journal of Public Relations Research* 12(2): 131-161.

Abstract

This study replicates and extends Heath and Abel's (1996) quasi-longitudinal analysis of the long-term impact of risk communication and emergency response measures. This study confirms and disconfirms some of the 1996 Heath and Abel conclusions. We found that because concern remains high that risk events are likely to occur and harm community safety, citizens are willing to become knowledgeable of emergency response measures. Such knowledge gives citizens a greater sense of control, which may translate into trust for industry and city emergency response experts. Support for the industry is increased by effective improvements in its operations. Long-term, community-relations programs may empower citizens with knowledge of what to do in the event an emergency occurs.

Hiroi, Osamo, Shunji Mikami, and Kakuku Miyata. 1985. "A Study of Mass Media Reporting in Emergencies." *International Journal of Mass Emergencies and Disasters* 3 (1):21-50.

Abstract

This paper examines the operations of mass media in disasters, the content of messages in disaster reporting, and the distortion in reporting warnings and disasters, based on empirical studies in several communities in Japan.

In the warning stage, we found that the broadcast media are the primary source of information in most cases. However, the warnings often did not reach a complete range of audience, nor could it induce an adaptive response among these recipients.

As for the mass media operation during and after the disasters, we found that the difficulties in mobilizing resources, uncertainties in reliable news sources, and malfunctioning communication channels were the main obstacles in reporting damages.

The main characteristics of the content of mass media reporting in disasters are described. Six types of information are found in the disaster reporting of the broadcast media: Information on: 1) advice or directions, 2) disaster agent, 3) safety message, 4) damage, 5) countermeasures, and 6) restoration. The results of the content analysis of the broadcast of two stations on the day of the Nihonkai-Chuubu Earthquake shows that personal messages and damages information were the most heavily broadcast. This did not always match the information needs of the residents.

The media in Japan tend to exaggerate damage in disasters, leading to the distorted images perception of hazards. They also tend not to report sufficiently the news people want to get. The reasons for these inaccurate reportings are: 1) journalist's attitude to news editing and reporting, and 2) distorted images or myths among journalists. The content of newspaper reporting of a false warning was analyzed as a case study.

Causal Findings

If the public hears a warning from the broadcast media, they are more likely to positively respond to the warning.

Hodge, David, Virginia Sharp, and Marion Marts. 1981. "Contemporary Responses to Volcanism: Case Studies From the Cascades and Hawaii." Pp. 221-248 in *Volcanic Activity and Human Ecology*, edited by P. D. Sheets and D. K. Grayson. New York, NY: Academic Press.

Abstract

This volume covers three subjects: 1) an investigation of responses to increased volcanic activity at Mount Baker, 2) a predicted eruption of Mauna Loa, and 3) a scenario study of the impact of a major mudflow from Mount Rainier on the Puyallup River Valley, Washington. Although the probability of volcanic eruptions in the Cascades is probably very low, the threat to life and property is potentially great, particularly in the case of subsequent mudflows. The Mount Baker study includes a hazard perception study and a discussion of economic hardship brought about by closure of a potential high hazard area. The Hawaii study produced evidence of misperception of the hazard potential. Both the Mount Baker and Hawaii experiences suggest that people prefer coping to government intervention, at least to the point of a clear and present danger. In regard to public response to the prediction of low probability, high risk events, it is obvious that further attention needs to be given to the management of hazard prediction.

Causal Findings

The older a person is, the less likely they are to believe a warning message. If a person has had personal experience with a hazard/disaster in the past, they are less likely to believe a warning message. The closer a person is to a disaster/hazards area, the more likely they are to understand a warning message. The longer a person has been a resident of a community, the more likely they are to understand a warning message. Women are more likely to personalize a warning message than are men.

Hodler, Thomas W. 1982. "Resident's Preparedness and Response to the Kalamazoo Tornado." *Disasters* 6 (1):44-49.

Abstract

A survey was conducted of individuals residing directly in the path of the tornado that hit Kalamazoo, Michigan, on 13th May 1980. The residents' tornado preparedness and response were examined in an effort to evaluate the city's emergency warning system. The system was adequate for the people on the east side of the city and lacking for west side residents. Other factors pertaining to the storm event and human response were also evacuated.

Causal Findings

If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe and respond to a warning message. If confirmation of the disaster/hazard happens, people are more likely to believe and respond to a warning message. The personalization of a warning message is greater when the message is understood.

Hoffman, Susanna M. 1998. "Eve and Adam Among the Embers: Gender Patterns after the Oakland Berkeley Firestorm." Pp. 55-61 in *The Gendered Terrain of Disaster: Through Women's Eyes*, edited by E. Enarson and B. H. Morrow. Westport, CT: Greenwood Publishing Group.

Abstract

A personal perspective is shared from a survivor of the Oakland Berkeley Firestorm of 1991.

Hoium, D.K. A.J. Riordan, J. Monahan, K.K. Keeter. 1997. "Severe Thunderstorm and Tornado Warnings at Raleigh, North Carolina." *Bulletin of the American Meteorological Society* 78 (11):2259-2575.

Abstract

The National Weather Service issues public warnings for severe thunderstorms when these storms appear imminent. A study of the warning process was conducted at the National Weather Service Forecast Office at Raleigh, North Carolina, from 1994 through 1996. The purpose of the study was to examine the decision process by documenting the types of information leading to decisions to warn or not to warn and by describing the sequence and timing of events in the development of warnings. It found that the evolution of warnings followed a logical sequence beginning with storm monitoring and proceeding with increasingly focused activity. For simplicity, information input to the process was categorized as one of three types: ground truth, radar reflectivity, or radar velocity.

Reflectivity, velocity, and ground truth were all equally likely to initiate the investigation process. This investigation took an average of 7 min, after which either a decision was made not to warn or new information triggered the warning. Decisions not to issue warnings were based more on ground truth and reflectivity than radar velocity products. Warnings with investigations of more than 2 min were more likely to be triggered by radar reflectivity, than by velocity or ground truth. Warnings with a shorter investigation time, defined here as "immediate trigger warnings," were less frequently based on velocity products and more on ground truth information. Once the decision was made to warn, it took on average 2.1 min to prepare the warning text. In 85% of cases when warnings were issued, at least once contact was made to emergency management officials or storm spotters in the warned county. Reports of severe weather were usually received soon after the warning was transmitted--almost half of these within 30 min after issue. A total of 68% wee received during the severe weather episode, but some of these storm reports later proved false according to Storm Data.

Even though the WSR-88D is a sophisticated tool, ground truth information was found to be a vital part of the warning process. However, the data did not indicated that population density was statistically correlated either with the numbers of warnings issued or the verification rate.

Causal Findings

Houts, Peter S., Michael K. Lindell, Teh Weittu, Paul D. Cleary, George Tokuhata, and Cynthia B. Flynn. 1984. "The Protective Action Decision Model Applied to Evacuation During the Three Mile Island Crisis." *International Journal of Mass Emergencies and Disasters* 2 (1):27-39.

Abstract

Interviews with 1505 persons living within 55 miles of the Three Mile Island nuclear power plant three months after the crisis were analyzed to test whether the protective action decision model could predict evacuation behavior during the crisis period. Results indicate that severity, susceptibility, barrier and cost variables were, as suggested by the model, related to evacuation behavior. In addition, several modifications to the model were suggested by the findings including a need to account for why conflicting information may increase evacuation in nuclear disasters while decreasing evacuation in non-nuclear disasters.

Causal Findings

The more specific the warning message, the more likely the public is to respond to it. People with children are more likely to respond to disaster warning messages, than people without children. The more freedom a person has to leave their place of employment, the more likely they are to respond to a warning message. Being in geographical proximity to the disaster/hazard increases the likelihood of a person responding to a warning message. The greater the perception of loss/risk, the more likely a person is to respond to a warning message. Having resources increases the likelihood of a person responding to a warning message.

Hutton, Janice R. 1976. "The Differential Distribution of Death and Disaster: A Test of Theoretical Propositions." *Mass Emergencies* 1 (4):261-266.

Abstract

A fact that has consistently emerged from disaster statistics is that older persons die in greater numbers than would be expected from their proportion in the affected population. Several propositions relating to the cause of this relationship are tested with interview data from the Rapid City Flood. The data indicate that older persons are as likely to receive warnings as others, and are as likely to leave as others, once a warning has been received. The results suggest that disproportionate death for older persons occurs among the segment of persons who do not receive warning. This suggests that differential strength and health account for the disproportionate number of elderly who die in disasters.

Causal Findings

If a person has had experience with hazards before, they are more likely to respond to warning messages. A person is more likely to respond to a warning message if they have recently experienced a hazard/disaster.

Ikeda, Ken'ichi. 1982. "Warning of Disaster and Evacuation Behavior in a Japanese Chemical Fire." *Journal of Hazardous Materials* 7:51-62.

Abstract

A warehouse fire near the center of Ohbu city precipitated a crisis in which an extremely toxic gas was released and the threat of other dangerous gases being released was deemed possible. Three evacuation warnings eventually were issued that prompted 8000 people to evacuate their homes. Over 700 housewives were surveyed to assess the effects of the warnings upon the threatened populace. Findings showed that 1) less than a tenth of the residents received sufficient warning information to motivate them to evacuate; 2) families tended to evacuate as units with many housewives waiting until their spouses returned from work; 3) there was no evidence of the local police asking residents on a door-to-door basis to evacuate nor did the police play an important role in disseminating the warnings; and 4) in order to avoid assuming municipal responsibility, city officials asked leaders of neighborhood associations to cooperate in spreading the warnings. This reluctance of city officials to directly issue warnings was one of the causes of the ineffectiveness of the warnings.

Causal Findings

The more specific the warning message, the more likely the public is to respond to it. The personalization of a warning message increases the likelihood of responding to it.

Irish, J.L. and B. Falconer. 1979. "Reaction to Flood Warning." Pp. 313-329 in *Natural Hazards in Australia*, edited by R. L. Heathcote and B. G. Thom. Canberra, Australia: Australian Academy of Science.

Abstract

A moderate flood occurred in the lower Logan River in southeast Queensland in February 1976. Flood forecasts were prepared by one of the authors and disseminated by Beaudesert Shire Council to residents likely to be affected. Deficiencies in the forecasting method resulted in an over-prediction of the flood peak at 2.5m, and also a prediction that the peak would occur 11-17 hours before the actual peak.

Warnings and the evacuations were based on the flood forecasts. Interviews were conducted by the second author immediately after the flood to determine the response to the flood warnings and preferences for method of and agency responsible for flood warnings to the public. The effect of the forecasting errors on likely attitudes to future flood forecasts was also explored.

It was noted during the progress of the investigation that, following a flood, persons affected by the flood rationalize their behavior prior to and during the flood. This process occurs quite soon after the flood, and an important implication is that post-flood surveys of social factors should be carried out before the clean-up is completed. Similar behavior has been noted following other floods in the Brisbane area.

Causal Findings

If confirmation of the disaster/hazard happens, people are more likely to believe and respond to a warning message. If a person has had experience with hazards before, they are more likely to respond to warning messages. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it. A person is more likely to confirm a warning message if they have heard it.

Jablonowski, Mark. 1994. "Communicating Risk: Words or Numbers?" *Risk Management* 41 (12):47-50.

Abstract

Given the ubiquity of verbal expressions of probability in risk assessment and management, one might wonder how these words relate to their numerical counterparts. In order to determine this relationship, the author conducted a survey of 16 risk managers and risk management consultants. The results suggest that in some cases words communicate certain events more clearly than numbers, and vice versa.

Janda, Richard J., Arturo S. Daag, Perla J.Delos Reyes, Christopher G. Newhall, Thomas C. Pierson, Raymundo S. Punongbayan, Kelvin S. Rodolfo, Renato U. Solidum, and Jesse V. Umbal. 1996. "Assessment and Response to Lahar Hazard Around Mount Pinatubo, 1991 to 1993." Pp. 107-139 in *Fire and Mud: Eruptions and Lahars of Mount Pinatubo, Philippines*, edited by C. G. Newhall and R. S. Punongbayan. Seattle, WA: University of Washington Press.

Abstract

Lahar hazard at Pinatubo is a function of prodigious sediment yield from Pinatubo's upper and middle slopes and the sediment storage capacity in the adjoining lowlands. Both are diminishing but at mismatched rates. Sediment yields set world records during the first three posteruption years, and yields in the Balin Baquero-Bucao and Marella watersheds may do so for several years more. Optimism that the worst is past, especially for the east side of Pinatubo, should be tempered by three factors. First channels in the middle reaches of alluvial fans are filled, so the threat of lahars to several populated areas remains high. On unconfined alluvial fans of the Pasig-Potrero, Marella-Santo Tomas, and perhaps, the Sacobia Rivers, sediment must continue to spread beyond present river channels, into catch basins, if the overall problem is to diminish. Towns on these fans that are beyond the reach of the most sediment-laden flows could be protected from more dilute hyperconcentrated flows and floods by relatively low rind dikes if flows are allowed to spread onto surrounding agricultural land, but that solution has not, to date, been politically acceptable. Second, unusually heavy rainfall, if sustained for several days or more, would temporarily reverse the declining sediment yield and cause serious overbank lahars. Third, erosion and incorporation of sediment predating the 1991 eruptions into current lahars will add on as-yet-uncertain volume to deposits, and reworking of lahar deposits themselves will move sediment problems downstream and fill some distal reaches of channels that have not heretofore been filled. Throughout the first 3 years of the Pinatubo crisis, assessments and warnings of lahar hazard, followed by mitigating actions, saved many lives and some property. Long range warnings, including hazard maps and briefings, identified communities at high risk and led some residents to move transportable belongings--sometimes even houses--to safe, high ground. Immediate warnings from manned watchpoints, supplemented by rain gauges and flow sensors, alerted remaining people to flee villages when their lives were at risk. Information about the nature and magnitude of lahar hazard was also an important basis for planning projects, both sociopolitical and engineering, to help residents through this difficult time. Despite some successes, not all warnings were perfect or heeded. An early excess of false alarms made residents of some areas doubt all alerts; in other areas, dikes and other sediment-control structures offered a false sense of security that delayed evacuations. Better scientific information and better presentation of that information could have reduced unnecessary losses; in other instances, competing political, economic, and social factors limited the acceptance of scientific information.

Causal Findings

If there are no consequences for not responding to warning messages, the public is less likely to do so.

Jervis, Michael. 1990. "Tsunami Warning!" *Emergency Preparedness Digest* 17:14-16.

Abstract

In this essay, the author discusses the definition and history of tsunamis. He discusses the growth in tsunamis in the Pacific Rim and their potential danger. The author, who is the President of Sierra-Misco Environment, Ltd., discusses the company's recent awarding of a contract to expand the existing tsunami monitoring system with the installation of two new monitoring stations in hopes of detecting tsunamis earlier and evacuating the public in at-risk areas.

Johnson, Branden B., Peter M. Sandman, and Paul Miller. 1992. "Testing the Role of Technical Information in Public Risk Perception." *RISK: Issues in Health & Safety* 3: 341-364.

Abstract

Through experiments with simulated news stories about hazardous materials release, this study finds that providing technical detail about health effects may be less useful than keeping citizens current on the agency's strategies for dealing with problems and other behaviors by officials.

Causal Findings

The hypothesis that providing technical detail to citizens reduces perceived risk and increases perceived appropriateness of agency behavior received no support.

Kasperson, Roger E. 1992. "The Social Amplification of Risk: Progress in Developing an Integrative Framework." In S. Krimsky and D. Golding (Eds.) *Social Theories of Risk* (pp. 117-152). Westport: Praeger.

Abstract

This chapter provides an overview of the Social Amplification of Risk Framework which was developed in 1988. It responds to some of the criticisms that have been directed toward the framework. It also includes a review of the major findings from empirical studies of risk amplification and attenuation, including results from the 128-hazard-events study, several field studies, and other related studies.

Kasperson, Roger E. 2003. "The Social Amplification of Risk: Assessing 15 Years of Research and Theory." In *The Social Amplification of Risk*, edited by J. X. Kasperson, R. E. Kasperson, N. Pidgeon and P. Slovic. Cambridge, MA: Cambridge University Press, 13-46.

Abstract

This chapter begins with a brief overview of the social amplification of risk framework (SARF) that was introduced by the authors and colleagues in 1988. This is followed by a review of the literature of empirical work on SARF from the prior fifteen years. Topics covered in this review include the concept of "signal"; the 128-hazard-events study; qualitative field studies; desired risk; communications and the mass media; hidden hazards; organizational amplification and attenuation; imagery and stigma; trust and confidence; and ripple effects. The chapter concludes with a discussion on the critiques and contentions prompted by SARF and suggestions for policy and research priorities.

Causal Findings

Several causal findings are highlighted from the literature review, not all of which can be listed here. The findings include that, among "risk amplifiers," concern over risk is driven more by interpersonal communication than by mediated communication, as in the mass media; certain organizational characteristics, such as the lack of organizational commitment to the risk management function or the bureaucratic attenuation of information flow within the organization, serve to attenuate risk signals; and social distrust acts to heighten risk perceptions, to intensify public reactions to risk signals, to contribute to the perceived unacceptability of risk, and to stimulate political activism to reduce risk.

Kasperson, Roger E., Ortwin Renn, Paul Slovic, Halina S. Brown, Jacque Emel, Robert Goble, Jeanne X. Kasperson, and Samuel Ratick. 1988. "The Social Amplification of Risk: A Conceptual Framework." *Risk Analysis* 8(2):177-187.

Abstract

One of the most perplexing problems in risk analysis is why some relatively minor risks or risk events, as assessed by technical experts, often elicit strong public concerns and result in substantial impacts upon society and economy. This article sets forth a conceptual framework that seeks to link systematically the technical assessment of risk with psychological, sociological, and cultural perspectives of risk perception and risk-related behavior. The main thesis is that hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or risk event. A structural description of the social amplification of risk is now possible. Amplification occurs at two stages: in the transfer of information about the risk, and in the response mechanisms of society. Signals about risk are processed by individual and social amplification stations, including the scientist who communicates the risk assessment, the news media, cultural groups, interpersonal networks, and others. Key steps of amplifications can be identified at each stage. The amplified risk leads to behavioral responses, which, in turn, result in secondary impacts. Models are presented that portray the elements and linkages in the proposed conceptual framework.

Ketteridge, Anne-Michelle and Maureen Fordham. 1998. "Flood Evacuation in Two Communities in Scotland: Lessons from European Research." *International Journal of Mass Emergencies and Disasters* 16:119-143.

Abstract

In January 1993 and December 1994, two areas of Scotland experienced extensive flooding and large-scale evacuation of a spontaneous and unstructured nature. Both the flooding and the evacuation left their traumatic mark on the householders. The research reported here was qualitative, with the objective of investigating the evacuation process inductively--how it operated on the ground, what were the problems, and how the process could be enhanced to maximize effectiveness for those who have to experience the consequences. This long-term or extended process of evacuation is not complete until everyone has returned home. The elderly, children, and women are also identified by the research as groups which suffered particularly as a result of the poorly executed evacuations and which require special attention. Policy and practical recommendations are drawn from the research, which may be equally applicable to future floods in the U.K., Europe, and elsewhere.

Causal Findings

If the source of a warning is a non-official source, the receiver is more likely to believe the warning. Conversely, the study also found that if the source of the warning is an official source, the receiver is more likely to believe the warning, as well. The greater the perception of personal risk, the more likely a person is to believe a warning message. Discussing a hazard/disaster warning with others increases a persons' likelihood of understanding a warning message. The closer a person is to a hazard/disaster area, the more likely they are to understand a warning message. If no verbal warning message is received, the public is less likely to respond to the warning. The more disbelief a person has about an impending disaster, the less likely they are to respond to warning messages. If a person has had experience with hazards before, they are less likely to respond to warning messages. Inaccurately interpreting environmental cues decreases the likelihood of a person responding to a warning message. Believing a warning message increases the likelihood of responding to it. Receiving a warning message from a non-official source increases the likelihood of the receiver believing it. Receiving a warning message from an official source increases the likelihood of the receiver believing it.

Ketteridge, Anne-Michelle, Maureen Fordham, and Lisa Clarke. 1996. "Evacuation." Middlesex, UK: Flood Hazard Research Centre, University of Middlesex.

Abstract

This report focuses on the response phase of flood forecasting/warning/response systems (FFWRS), and particularly on the evacuation process. It examines the use and usefulness of evacuation plans or their equivalent; where such plans exist and have been implemented into practice; problems faced by emergency managers and an at-risk populace, and how these problems can be avoided or overcome; and identifies best practices evacuation processes that can be transferred to other, particularly European situations. Qualitative insights into flood evacuation takes into consideration topics such as impacts on the elderly and women, the decision to evacuate and to where, family separation, and those not evacuated. A descriptive study of the 1993 Canvey Island coastal flood evacuation is provided, with topics discussed such as the absence of a warning, long-term recovery, and current emergency procedures. Conclusions from the study include 1) despite the frequency of flooding and evacuation in the United Kingdom, planning procedures for evacuation do not correspond to this frequency; 2) householders cannot always rely on a warning being received through official channels and the evacuation experience can be traumatic and disruptive; 3) evacuation is a process with six identifiable stages: pre-flood preparedness, the flood emergency, evacuation, emergency accommodation, the return, and recovery; 4) in order to retain flexibility, emergency plans should not be overly specific; 5) unofficial networks should be encouraged in times of emergencies, but in parallel and in consultation with official lines of communication; and 6) rumors about the distribution of resources should be quashed immediately by provision of factual and specific information.   A questionnaire is reprinted that surveys to what extent evacuation planning has been established in the U.K.

Kilpatrick, F. P. 1957. "Problems of Perception in Extreme Situations." *Human Organization* 16 (2):20-22.

Abstract

Presents and discusses six hypotheses on perception in disaster suggested by laboratory research on perception.

Causal Findings

The more habituation of a disaster/hazard a person experiences, the less likely they are to respond to a warning message.

King, David. 2000. "You're on Your Own: Community Vulnerability and the Need for Awareness and Education for Predictable Natural Disasters." *Journal of Contingencies and Crisis Management* 8(4): 223-228.

Abstract

During a hazard event, individuals and communities are often isolated from the support and intervention of emergency service providers. Household and school-based studies have shown inadequate levels of awareness and preparedness for predictable and regularly occurring hazards like floods and tropical cyclones. Post-disaster studies have demonstrated both a lack of preparedness and the extent to which people are surprised by the ferocity or extent of the hazard. These research findings underscore the importance of providing specific and targeted education to enhance community capability to withstand a natural hazard with minimal harm and loss of property. At the same time, efforts must be enhanced to mitigate against disaster through better planning of urban development.

Lachman, Roy, Maurice Tatsuoka, and William Bonk. 1961. "Human Behavior during the Tsunami of 1960." *Science* 133:1405-1409.

Abstract

After a tsunami for which warning was given, but not heeded by a large number of people, interviews of both evacuees and non-evacuees were conducted. The principal finding was that the warning siren was incorrectly interpreted by the majority of non-evacuees. Socio-economic data on the two groups and prior disaster experience were also investigated as possible determinants of response.

Causal Findings

If the source of the warning is an official source, the receiver is more likely to believe the warning. If only sirens are used to deliver a warning, the public is less likely to understand the message. The more frequently a warning message is received, the more likely the public is to respond to it. If a person has had experience with hazards before, they are more likely to respond to warning messages. The greater the social influence, the greater the likelihood of a person responding to a warning message.

Lardry, Thomas and George Rogers. 1982. "Warning Confirmation and Dissemination."
Pittsburgh, PA: Center for Social and Urban Research, University of Pittsburgh.

Abstract

This report addresses the effectiveness of the diffusion of warning via social networks and how the informal system augments the technological warning system. 250 documents from the Crisis/Non-crisis conclusion archives were reviewed in order to provide a summary statement of a pervasive theme in warning messages pathways. The authors found that informal social networks can serve to enhance formal warning systems. They also found that existing formal warning systems could be enhanced by including within the official warning a directive to the public to pass the warning along to friends, family, neighbors, etc.

Causal Findings

If a person has had prior experience with a disaster, they more likely to hear a warning message. People who observe cues of the impending disaster/hazard are more likely to hear a warning message. If a person feels some personal efficacy, they are more likely to hear a warning message.   If a family experiences frequent kinship interaction, they are more likely to hear a warning message.

Lasker, Roz D. 2004. "Redefining Readiness: Terrorism Planning through the Eyes of the Public." New York, NY: The New York Academy of Medicine, 2004.

Abstract

This study examined how the public would react to protective instructions in two terrorist attacks--a smallpox outbreak and the explosion of a dirty bomb—as well as their interests in and perspectives about their community's terrorism planning activities. Preliminary work included in-depth conversations with government and private-sector planners, an extensive literature review and group discussions with community residents around the country. The main study involved a telephone survey of 2,545 randomly selected adult residents of households in the continental U.S. The survey results indicated that far fewer people than needed would follow protective instructions in the two terrorist attack scenarios, that many of them would face conflicting worries and trade-offs in these situations, and that they would want more information or advice to decide what to do in these situations.

Causal Findings

People who have trust in official instructions and actions are more likely to cooperate with protective instructions in smallpox and dirty bomb situations. People who are *only* worried about catching smallpox are more likely to cooperate with protective instructions than those who are not, but when they are also seriously worried about the effects of the vaccine, that increase in cooperation is completely eliminated. People who do not know a lot about their building's shelter-in-place plan and those who lack confidence in their community's preparedness plans are less likely to cooperate with protective instructions in a dirty bomb situation.

Legates, David R. and Matthew D. Biddle. 1999. "Warning Response and Risk Behavior in the Oak Grove - Birmingham, Alabama Tornado of April 8, 1998." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

On 8 April 1998, a long-track violent tornado killed 32 people and injured 300 in Jefferson County Alabama, near Birmingham. Within one week of the disaster, field surveys were collected from persons residing or working within the damage area (n=65) regarding their actions, and the actions of those in their care or company (n=232). Similar data were obtained for the fatalities (n=32). The purpose of the field operation was to collect spatial, demographic, behavioral, and attitudinal information from a sample of survivors, and to the fullest extent, for all victims. Morbidity and mortality data were analyzed for significant trends in warning access, source, compliance and lead time as well as shelter availability, cultural and architectural variables, hazard perception, and self assessment of warning systems. Goals were to catalog significant differences between victim and survivor traits, to identify successful warning operations and media practices, and to characterize emergent risk factors for death, injury, and damage. Major risk factors for death included living in a wooden house, a house with walls not anchored to the foundation, becoming airborne, and being elderly. Risk factors for survival included taking shelter below ground, having access to, and consulting televised warning information, being aware of the tornado watch, and familiarity with sources of weather information in general.

Causal Findings

If the public hears a warning via the television, they are more likely to positively respond to the warning.

Lehto, Mark R. and James M. Miller. 1986. *Warnings, Volume I: Fundamentals, Design and Evaluation Methodologies*. Ann Arbor, MI: Fuller Technical Publications.

Abstract

This volume is the first from a series that focuses on warning labels and other product and situation-related characteristics that serve or are intended to serve warning purposes. In this volume, the authors address what they identify as "warning issues." The book serves as a reference for a variety of professionals in emergency management, as it addresses the complexity and relationship to warnings information processing, the evaluation of warnings effectiveness, and the design and application of different types of warnings.

Causal Findings

The more credible the source of the warning information, the more likely the public is to believe the warning. The clearer the warning message, and/or if a person has knowledge of hazards, the more likely a person is to understand the warning message.

Leik, Robert K., Michael Carter, John P. Clark, and et.al. 1981. "Community Response to Minneapolis, MN: Natural Hazard Warnings: Final Report." University of Minnesota.

Abstract

This report summarizes the results, findings, and recommendations of a three-year research project dealing with the dissemination of the response to natural warnings. Among the many findings are 1) commercial telephone service was unreliable for the dissemination of warnings; 2) in 40% of the sites studied, the civil defense office could not communicate with any broadcast media station; 3) serious coordination problems will exist in sites which have separate city and county civil defense offices; 4) a serious lack of communication facilities and a splintered civil defense capability combine to exaggerate coordination problems caused by other deficiencies in the warning system; 5) individuals inexperienced with hazards take defensive action sooner when warnings are more frequent and more detailed; 6) more frequent and detailed messages produce longer delays among experienced individuals than do infrequent or incomplete messages; 7) a warning confirmation is a critical first step in the decision making process; 8) social contacts with friends, relatives, and neighbors are important during the decision making process; and 9) warning received directly from local officials facilitate decision making. Recommendations focus on three major areas: improving National Weather Service communication facilities, improving emergency service communication facilities, and improving warning message content and dissemination procedures.

Causal Findings

If the source of the warning is an official source, the receiver is more likely to believe the warning and respond to it. If a person has knowledge of hazards/disasters, they are more likely to believe and respond to a warning message. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it. A person is more likely to confirm a warning message if they have heard it. The greater a person perceives their personal risk in a disaster, the more likely they are to confirm the warning message they receive about that disaster.

Lerner, Jennifer S., Roxana M. Gonzalez, Deborah A. Small and Baruch Fischhoff. 2003. "Effects of Fear and Anger on Perceived Risks of Terrorism: A National Field Experiment." *Psychological Science* 14: 144-150.

Abstract

The aftermath of September 11th highlights the need to understand how emotion affects citizens' responses to risk. It also provides an opportunity to test current theories of such effects. On the basis of appraisal-tendency theory, we predicted opposite effects for anger and fear on risk judgments and policy preferences. In a nationally representative sample of Americans (N = 973, ages 13-88) fear increased risk estimates and plans for precautionary measures; anger did the opposite. These patterns emerged with both experimentally induced emotions and naturally occurring ones. Males had less pessimistic risk estimates than did females, emotion differences explaining 60 to 80% of the gender difference. Emotions also predicted diverging public policy preferences. Discussion focuses on theoretical, methodological, and policy implications.

Causal Findings

Fear increases risk estimates and plans for precautionary measures; anger does the opposite. Males have less pessimistic risk estimates than do females, emotion differences explaining 60-80% of this gender difference. Emotions also predict public policy preferences.

Li, Jinfang. 1991. "Social Responses to the Tangshan Earthquake Prediction" presented at *UCLA International Conference on the Impact of Natural Disasters*. Los Angeles, CA: University of California-Los Angeles.

Abstract

A successful earthquake prediction would be a great benefit to reduce social and economic losses in seismically threatened communities. However, the impact of an earthquake prediction itself upon a community may be great; therefore, research on the social consequences of earthquake prediction is vitally important. The Tangshan earthquake of July 28, 1976 was not predicted by a short-term or imminent prediction which resulted in enormous loss of life and huge property damage occurred. However, a mid-term prediction had been issued. Using data from the social and economic survey on the Tangshan earthquake, public responses in Tianjin and Tanshan to this mid-term earthquake prediction will be investigated in this paper.

Causal Findings

The public is more likely to believe and respond to a warning that comes from a government source and/or if the message is sent through scientific channels. The actions of a significant other influence whether or not a person believes a warning message. If a person has friends and/or family they are more likely to respond to a warning message.

Lindell, Michael K., Jing-Chein Lu, and Carla S. Prater. 2005. "Household Decision Making and Evacuation in Response to Hurricane Lili." *Natural Hazards Review* 6 (4):171-179.

Abstract

This study collected data on the evacuation from Hurricane Lili to answer questions about households' reliance on information sources, the factors affecting their decisions to evacuate, the timing of their hurricane evacuation decisions, and the time it took them to prepare to evacuate. The results replicated previous findings on the sources of hazard information, evacuation concerns, and the timing of evacuation decisions. In addition, they provide new information about evacuation preparation times and the finding that household characteristics are uncorrelated with evacuation decision times or evacuation preparation times.

Causal Findings

- There is no consistent pattern between demographic variables and utilization of various information sources about an impending hurricane. In contrast, living closer to the coast, rivers or lakes is associated with greater reliance on local authorities and on the internet as information sources.
- Utilization of peers and local authorities (as opposed to local news media) has the highest correlations with evacuation behavior.
- Environmental cues (i.e., proximity to the coast and inland waterways) and social cues (i.e., official evacuation recommendations, observations of peers evacuating and official watches and warning) correlate with evacuation decisions.
- Younger females with children in the home are more likely to evacuate.
- Personal experience (i.e., becoming trapped in a stalled evacuation, previous hurricane experience, previous experience of unnecessary evacuations) and evacuation impediments (e.g., protecting property from storm damage, expectations of looting, lost income) are not correlated with evacuation decisions.
- Evacuation decisions are strongly dependent on the time of day.
- Total household preparation time for evacuation negatively correlates with distance from the coast which is primarily due to the effects of packing items, protecting property and securing the home.

Lindell, Michael K. and Ronald W. Perry. 1983. "Nuclear Power Plant Emergency Warnings: How Would the Public Respond?" *Nuclear News* February:49-57.

Abstract

The researchers discuss the lack of clarity in available data on the publics' perceptions of reactor accident consequences and the efficacy of alternative protective actions. It is likely that a great deal of the public will evacuate in the case of a nuclear reactor accident, regardless of the recommendation, unless a highly credible source operating in a context of totally consistent information makes the effectiveness of the recommended protective actions very clear. Providing the public with clear, effective information about the efficacy of sheltering in a nuclear emergency should be routinely included in public information programs and can reduce the amount of psychological stress experienced by the public.

Causal Findings

The more credible the source of a warning message, the more likely the public is to respond to a warning message. The greater the consistency in a warning message, the more likely the public is to personalize the message.

Lindell, Michael K. and Ronald W. Perry. 1987. "Warning Mechanisms in Emergency Response Systems." *International Journal of Mass Emergencies and Disasters* 5 (2):137-153.

Abstract

The principal alternative mechanisms are described that might be considered by local governments for achieving prompt notification of the public in a natural or technological emergency. These alternatives include face-to-face warnings, mobile loudspeakers, sirens, commercial radio and television, NOAA Weather Radio, newspapers and telephones. Each of the alternatives is evaluated on the basis of the number of people who can effectively be warned, specificity of the message that can be transmitted, degree of message distortion, coverage of the population at risk, dissemination time and cost. Data collected following the eruption of Mt. St. Helens are presented that illustrate how rapidly informal warning networks act to disseminate threat information in an emergency.

Causal Findings

The public is more likely to hear a warning if it comes through multiple channels. The public is more likely to respond to a warning message if it comes from a familiar source. The more specific the warning message, the more likely the public is to respond to it. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages.

Lindell, Michael K. and Ronald W. Perry. 1992. *Behavioral Foundations of Community Emergency Planning*. Washington, D.C.: Hemisphere Publishing Corporation.

Abstract

This book addresses the need for integration of research findings directly relevant to emergency preparedness and response into emergency planning at the local level. The authors pursue three major themes: they examine emergency planning and response at the community level; they argue that emergency preparedness involves considerably more than the production of a paper emergency plan--that is an ongoing process, involving interaction among concerned organizations and local citizens; and finally, they attempt to understand disasters in terms of the demands they place on the affected communities. Hence, their presentation concentrates on the development and application of a systems approach that identifies emergency response functions common to a variety of hazards, as well as emergency management strategies that would be useful in a wide range of situations. The first four chapters address the history, context, and overall process of community emergency planning; the middle section addresses the public's behavior in response to warnings; and the concluding chapters return to an organizational perspective of the management of emergencies, integrating the information in the first two sections.

Lindell, M K, and R W Perry. 2004. *Communicating Environmental Risk in Multiethnic Communities*. Thousand Oaks, CA: Sage.

Abstract

How people interpret and respond to risk messages related to potential immediate or long-term environmental danger is largely influenced by such factors as age, ethnicity, community, and proximity to the health risk in question. Communicating Environmental Risk in Multiethnic Communities is the first book to address the theory and practice of disseminating disaster warnings and hazard education messages to multiethnic communities. Authors Michael K. Lindell and Ronald W. Perry introduce theory-based reasoning as a basis for understanding warning dissemination and public education, devoting specific attention to the community context of emergency warning delivery and response. Through these principles of human behavior, readers can apply risk communication information to virtually any specific disaster agent with which they may be concerned.

The authors review a variety of theories of emergency decision-making and develop a Protective Action Decision Model (PADM) as the foundation for understanding citizen response to both emergency and educational communications. Combining risk theory with practical application, Communicating Environmental Risk in Multiethnic Communities examines the research literature and identifies the important factors that affect people's decisions to comply with warnings. The authors present a review of a range of public education campaigns for different types of hazards.

Lindell, Michael K., Ronald W. Perry, and Majorie R. Greene. 1980. "Race and Disaster Warning Response." Seattle, WA: Battelle Human Affairs Research Centers.

Abstract

Data was collected from 158 flood victims living in Fillmore, TX via interviews. The four variables of interest were warning response, perceived personal risk, warning belief and warning message content. The four hypothesis tested included 1) the more specific the warning message, the higher the warning belief, 2) the more specific the message, the greater the perceived personal risk, 3) the higher the level of warning belief, the greater the probability that the warning recipient will engage in the suggested adaptive response, and 4) the greater the perceived personal risk, the more likely it is that the individual will undertake the suggested adaptive response.

The data collected supported all four hypotheses regarding the interrelationships among the warning system variables. Furthermore, three primary race differentials were discovered: 1) Mexican-Americans were more skeptical than whites about believing warning messages, 2) Mexican-Americans interpreted the same messages as indicating lower levels of personal danger, and 3) Mexican-Americans were less likely to evacuate than whites.

Causal Findings

The more specific a warning message is, the more likely the receiver will believe and respond to it. Believing a warning message increases the likelihood of responding to it.

Liu, Simin, Lynn E. Quenemoen, Josephine Malilay, Eric Noji, Thomas Sinks, James Mendlein. 1996. "Assessment of a Severe-Weather Warning System and Disaster Preparedness, Calhoun County, Alabama, 1994." *American Journal of Public Health* 86 (1):87-89.

Abstract

Tornado preparedness, warning system effectiveness, and shelter-seeking behavior were examined in two Alabama areas after tornado warnings. In the area without sirens, only 28.9% of 194 respondents heard a tornado warning; of these, 73.2% first received the warning from radios or television. In the area with sirens, 88.1% of 193 respondents heard a warning, and 61.8% first received the warning from a siren. Knowledge of warnings, access to shelter, and education were key predictors for seeking shelter. Our findings indicate that installing sirens, providing access to shelter, and teaching appropriate responses to warnings are important elements of an effective disaster prevention system.

Causal Findings

If a warning siren is issued in a persons' geographic area, a person is likely to hear it. If a message is not understandable, the public is not likely to respond to it. A person is less likely to respond to a warning message, if they perceive their resources to be insufficient. The lower the education a person has, the less likely they are to respond to a warning message. A person is less likely to respond to a warning message if they are unable to understand the message.

Liverman, Diana and John P. Wilson. 1981. "The Mississauga Train Derailment and Evacuation, 10-16 November 1979." *Canadian Geographer* 25 (4):365-375.

Abstract

The size, success, and implications of the Mississauga evacuation prompted this study, which seeks to describe the institutional responses to the accident and residents' responses to leaving their homes. Five-hundred eighty-one households were queried through a survey which included questions about the nature, timing, and site of the accident as perceived by residents; the sources and timing of information about the accident, its risks, and the evacuation; the basis and timing of individual decisions to evacuate; the patterns of evacuation; the impact of the evacuation; and the characteristics of respondents. Results included 1) most residents (91.7%) evacuated their homes; 2) ninety-five percent said they received evacuation advice or warnings before vacating the area; 3) for many households, departure from home was only the first in a series of evacuations. Some moved several times during the first day of the evacuation, propelled by the sequential expansion of the evacuated area; and 4) almost all the households identified one or more negative emotional impacts which they attributed to the evacuation.

Causal Findings

The more environmental cues the public observes, the more likely they are to respond to warning messages. Being in geographical proximity to the disaster/hazard increases the likelihood of a person responding to a warning message. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages. The better a person is able to perceive their time away from home, the more likely they are to respond to a warning message.

Mack, Raymond W. and George W. Baker. 1961. "The Occasion Instant: The Structure of Social Responses to Repeated Air Raid Warnings." National Research Council, Washington, D.C.: National Academy of Sciences.

Abstract

Chapter 6, "Some General Propositions and Hypotheses" is relevant to natural hazard research. About 50 propositions and hypotheses are stated concerning what factors influence an individual's interpretation of and behavior in response to a disaster warning. The propositions are based upon natural hazards literature and general psychological and sociological research as well as the research presented earlier in the report on reactions to air-raid warnings.

Causal Findings

The older a person is, the less likely they are to hear and/or believe a warning message. The more consistency with which a warning message is delivered, the more likely the receiver is to believe it. Women are more likely to believe a warning message, than are men. A person is more likely to believe a warning message if they observe cues that support the message. If a person has had previous hazards experience, they are more likely to believe a warning message. The more united a family is, the more likely they are to believe a warning message. If a person is with their peers, they are less likely to believe a warning message. Working in a large organization decreases the likelihood of a person believing a warning message.

Mann, Brad. 1995. "Leaving Home." *Emergency Preparedness Digest* 22:16-19.

Abstract

Based on the data gathered at a July 1994 forest fire near Pentiction, British Columbia, Canada that forced the evacuation of over 3,500 residents, the author presents four evacuation recommendations to assist in effective evacuation planning. Specifically, tips dealing with pre-evacuation information, procedures for allowing evacuees to return home for short periods of time during the evacuation period, considerations for pets and the security of the evacuated area.

Massachusetts Department of Public Health. 2004. "Seven Cardinal Rules of Risk Communication." MA: Massachusetts Department of Public Health.

Abstract

This document is a reprinted pamphlet from the Environmental Protection Agency and is based on the work of Vincent T. Covello and Frederick H. Allen. It also lists some additional resources on risk communication. The seven cardinal rules of risk communication listed are: accept and involve the public as a legitimate partner; plan carefully and evaluate your efforts; listen to the public's specific concerns; be honest, frank, and open; coordinate and collaborate with other credible sources; meet the needs of the media; and speak clearly and with compassion.

McDavid, J. and M. Marai. 1968. *Social Psychology*. New York, NY: Harper and Row.

Abstract

While using a primarily psychological point of view, this introduction to the inherently interdisciplinary field of social psychology seeks to weld parts of all of the social sciences – anthropology, economics, political science, psychology and sociology – into one amalgamation. More specifically, the text introduces and defines the field and presents the dominant theoretical foundations of contemporary social psychology; looks at the socialization process; explores social cognition, the process of perception; delves into group dynamics and the more general study of social systems. An appendix that includes considerations of the methods of research as well as areas of application of social psychology is included.

Causal Findings

The more consistency with which a warning message is delivered, the more likely the receiver is to personalize the warning.

McGlown, K. Joanne. 2001. "Evacuation of Health Care Facilities: A New Twist to a Classic Model." *Emergency Preparedness Digest* 2:90-99.

Abstract

Disasters and their potential for damage are increasing in the United States and worldwide. Government officials warn that disasters will be occurring at an increasing rate and will worsen in the future. As these risks increase, the likelihood of evacuation of a health care facility grows. We know much about the role of hospitals in evacuation, yet little about how the decision to evacuate a facility is initially made. This study compares two models from studies related to the evacuation process; Vogt's adaptation of Quarantelli's classic model examining organizational ability to cope, and McGlown's model from variables considered critical to health care executives in the decision to evacuate a health care facility. This study contributes to the literature on evacuation behavior of health care organizations by examining the variables perceived by decision makers as critical in their decision to evacuate their facility compared to variables identified in the literature. These findings may form the first constructive step toward the development of an empirically based decision framework for health facility evacuation.

Causal Findings

There is no relationship between the cost of an evacuation the public's likelihood for responding to a warning message. There is no relationship between the weather and a person's likelihood of responding to a warning message. If a person perceives an increased risk or loss, they are more likely to respond to a warning message.

Mikami, Shunji and Ken'ichi Ikeda. 1985. "Human Response to Disasters." *International Journal of Mass Emergencies and Disasters* 3(1): 107-132.

Abstract

We first discuss psychological response and coping behavior in disaster situations. We confirm earlier findings that people have a tendency to interpret the signs of danger within their daily context and to underestimate the possibility of a disaster. It is suggested that the repetitive and consistent information would help to induce adaptive responses. The typical coping patterns found were: 1) information gathering behavior, 2) activities closely related to one's family, 3) preventative or protective behaviors, and 4) self protection by moving. We found the following six psychological determinants of coping behavior: 1) recognizing the seriousness of the situation, 2) knowing appropriate behavior for the situation faced, 3) expecting the projected coping response to be feasible, 4) perceiving the cost and reward of acting, 5) feeling of imminence of danger, and 6) the state of emotion of those involved.   In the last part of the article, we examine evacuation behavior in particular, based on our surveys in four communities in Japan. The central factors which determine evacuation decisions were: 1) direct perception of threat, 2) exposure to the evacuation advice, 3) factors relating to family, 4) community preparedness, and 5) demographic characteristics. We distinguish three basic phases in the evacuation process, that is, the timing of evacuation, the choice of transportation and the sheltering activity. Threat conditions, exposure to evacuation advice, and one's location were found to relate to the timing of evacuation. Most people evacuated by car. No consistent pattern was found in the choice of shelters.

Causal Findings

The more frequently a warning message is delivered, the more likely the receiver is to
     understand it.

Mileti, Dennis S. 1974. *A Normal Causal Model Analysis of Disaster Warning Response.*
Boulder, CO: University of Colorado.

Abstract

This dissertation investigated how the experience of an actual flood event in a community
affected response to warnings of a subsequent flood disaster. A normative causal model was
built on the basis of past research and the stimulus-response learning theory paradigm. It was
estimated on data gathered in Rapid City, South Dakota. The study was built as a quasi-
experimental field design in which an actual flood event was both preceded and followed by two
separate warning events. The principal objective of the study was to determine the effect that the
flood experience had on response to warnings by comparing pre-event and post-event estimates
of the parameters of the model. In addition, the dissertation sought to determine and explain
some of the processes associated with a response to disaster warnings in general.

Two general conclusions were reached on the basis of the findings obtained from the quasi-
experimental design. First, it was concluded that the flood experience was a learning experience
through vicarious reinforcement for those not affected by the flood. However, for those who
were affected, the experience actually retarded adaptive response to warning of the second event.
This suggested that learning--or the performance of a previously rewarded behavior--can be
blocked by fear in very negative events. It also suggested that warnings should be designed to
elicit middle levels of anxiety to maximize adaptive response in a community undergoing threat.
Second, it was concluded that the flood experience allowed earlier definitions of situational
danger to emerge in the second warning event, which served as a mechanism to escalate levels of
fear and retard adaptive response for those persons directly affected by the prior flood event.

Causal Findings

There is no relationship between family unity and that family's likelihood for responding to a
warning message.

Mileti, Dennis S. 1975. "Natural Hazard Warning Systems in the United States: A Research Assessment." Program on Technology, Environment and Man, Boulder, CO: Institute of Behavioral Sciences, University of Colorado.

Abstract

Natural hazard warning systems are assessed from an integrated perspective that includes evaluation, dissemination and response. Fields in which new research would be most useful are 1. The social and psychological factors affecting public warning response, 2. The organizational links in warning systems between the variety of groups and agencies that evaluate threat information and disseminate public warnings, and 3. Means of encouraging integrated warning systems as part of preparedness programs.

Causal Findings

The older a person is, the less likely they are to hear a warning message. The more consistency with which a warning message is delivered, the more likely the receiver is to believe it. The more frequently a warning message is delivered, the more likely the public is to believe it, but the less likely they are to confirm it.

Mileti, Dennis S. 1993. "Communicating Public Earthquake Risk Information." In *Prediction and Perception of Natural Hazards*, edited by J. Nemec, J. M. Nigg and F. Siccardi. The Netherlands: Kluwer Academic Publishers.

Abstract

Assessed, within the framework of interactionist theory, public response to an earthquake prediction for the San Francisco Bay Area on a sample of households from 8 counties. A magazine-like insert predicting a quake was distributed in newspapers to inform citizens about disaster preparation. To gauge public reaction, 806 individuals provided data on social position, damage to home in the Loma Prieta quake, prior readiness actions, remembrance of seeing the newspaper insert, perceived risk, objective risk by county, if S sought out additional information, and readiness actions taken since the insert. Results suggest that prediction science was salient for the public and that an earthquake culture exists in this population. The Ss' information searching behavior was more the consequence of channels of communication and seeing others prepare for a future quake than of one's social position. Searching for additional information had the strongest effect on readiness, and the receipt of specific information about what to do to get ready was the most important information in predicting action.

Causal Findings

Factors that were positively and significantly related to preparedness and mitigation actions were risk information consistency, perceived certainty of the predicted earthquake, receipt of information about what to do to get ready, receipt of information over varied communication channels (including the receipt of printed materials) and sources such that the information was reinforced, and searching for more information about getting ready on their own.

Mileti, Dennis S. and E. M. Beck. 1975. "Communication in Crisis: Explaining Evacuation Symbolically." *Communication Research* 2(1):24-49.

Abstract

The communication of messages of the impending impact of some natural disaster agent can play a key role in averting natural catastrophe. This article examines the social processes involved in disaster warnings that function to elicit evacuation in such threat situations. These processes and the role of the mass media in forming situational definitions requisite for evacuation are examined in reference to data gathered in Rapid City, South Dakota where on June 9, 1972 a flash flood produced a major disaster.

Causal Findings

The more certainty with which a warning message is delivered, the more likely the receiver is to believe it. The more frequently a warning message is delivered, the more likely the public is to believe it. If confirmation of the disaster/hazard happens, people are more likely to believe a warning message. A person is more likely to personalize a message if it is delivered frequently. The more frequently a warning message is delivered, the more likely the public is to respond to it. The public is more likely to respond to a warning message if it receives that message from the mass media. The more specific a warning message is, the more likely the public is to respond to it. Believing a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it. The older a person is, the less likely they are to respond to a warning message. The more cues a person receives, the more likely they are to believe a warning message.

Mileti, Dennis S. and JoAnne DeRouen Darlington. 1995. "Societal Response to Revised Earthquake Probabilities in the San Francisco Bay Area." *International Journal of Mass Emergencies and Disasters* 13:119-145.

Abstract

Using data collected on the general public, health, safety and welfare agencies and organizations, and businesses in the San Francisco Bay Area we describe what people thought and did in response to receiving an informational newspaper insert about revised probabilities for the next damaging Bay Area earthquake. Our findings suggest that the insert was relatively successful in reaching all groups, that Bay Area residents are making earthquakes a permanent part of local culture, and sufficient knowledge may be in hand with which to effectively and productively manage public earthquake predictions.

Causal Findings

The public is more likely to hear and/or respond to a warning message that is delivered via multiple channels. The more clarity with which a warning message is delivered, the more likely the receiver is to understand it. A person is more likely to understand a warning message if it is sent via multiple channels, from an official source, and/or consists of credible information. The public is likely to respond to warning message if that message is received via a newspaper insert. The more searching for information a person does, the more likely they are to respond to a warning message. People are less likely to understand a warning message if it is communicated with geological risk maps.

Mileti, Dennis S. and Joanne DeRouen Darlington. 1997. "The Role of Searching in Shaping Reactions to Earthquake Risk Information." *Social Problems* 44:89-103.

Abstract

The authors assessed public response to an earthquake prediction for the San Francisco Bay Area on a sample of households from eight bay counties. Descriptive findings suggested that an earthquake culture exists in the study population. The authors tested criticisms of interactionist theory - its failure to take motives for behavior and social position into account - using multiple regression analysis. They conclude that the motives and social position matter little in determining social action, and that more work is needed to determine how variations in new information create ambiguity, which differentially fosters searching, the formation of alternative definitions, and subsequent action.

Causal Findings

The more risk information the public has the more likely they are to believe a warning message. A person is more likely to personalize a message if the message contains risk information. White people are less likely to personalize a warning message than are persons of color. There is no relationship between a person having prior hazard experience and their likelihood of personalizing a warning message. The greater a person perceives their hazards risk, the more likely they are to personalize a warning message. A person is more likely to personalize a warning message if they observe others preparing for the disaster. The more informative guidance a person receives in warning message, the more likely they are to respond to it. There is no relationship between age and the likelihood of a person responding to a warning message. There is no relationship between a persons' education and their likelihood for responding to warnings. There is no relationship between gender and a person's likelihood for responding to a warning message. There is no relationship between a persons' income and their likelihood for responding to a warning message. There is no relationship between level of objective risk and a persons' likelihood of responding to a warning message. There is no relationship between a persons' occupation and their likelihood of responding to a warning message. There is no relationship between the motivation of prior actions and the likelihood of a person responding to a warning message. There is no relationship between a persons' perceived risk and their likelihood for responding to a disaster. There is no relationship between race/ethnicity and a persons' likelihood of responding to warning message. The more searching for information a person does, the more likely they are to respond to a warning message.

Mileti, Dennis S., JoAnne DeRouen Darlington, Colleen Fitzpatrick, and Paul W. O'Brien. 1993. "Communicating Earthquake Risk: Societal Response to Revised Probabilities in the Bay Area." Fort Collins, CO: Hazards Assessment Laboratory, Department of Sociology, Colorado State University.

Abstract

After scientists calculated increased probabilities for major earthquakes in the San Francisco Bay Area following the 1989 Loma Prieta quake, a major campaign was undertaken to explain the significance of these increased likelihood to the public. A multidisciplinary team prepared and distributed a 24-page color newspaper insert across the region that described the science of earthquakes and earthquake prediction and suggested what people should do to prepare. This report describes how and why various sectors of the public responded to the newspaper insert and concludes with recommendations for improving future prediction information. Some of the findings: work beforehand to get organizations to network with one another regarding the quake hazard; written documents are essential to effective risk communication--a newspaper insert works well to reach most organizations, and a direct mail brochure is much more expensive to produce but is only slightly more effective in reaching the public; detailed risk maps based on geological and seismological considerations alone are not well understood by the public; and written documents are not enough--other means of communication are needed to supplement and reinforce written messages.

Causal Findings

The more consistency with which a warning message is delivered, the more likely the receiver is to personalize the warning. The public is likely to respond to warning message if that message is received via a newspaper insert. There is no relationship between age and the likelihood of a person responding to a warning message. There is no relationship between a persons' education and their likelihood for responding to warnings. There is no relationship between gender and a person's likelihood for responding to a warning message. There is no relationship between a persons' income and their likelihood for responding to a warning message. If a person has insufficient resources, they are less likely to respond to a warning message. There is no relationship between the level of objective risk and a persons likelihood of responding to a warning message. There is a relationship between a persons' organizational culture and their likelihood for responding to a warning message. There is no relationship between race/ethnicity and a persons' likelihood of responding to warning message. The more searching for information a person does, the more likely they are to respond to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Mileti, Dennis S., Thomas E. Drabek, and J. Eugene Hass. 1975. *Human Systems in Extreme Environments: A Sociological Perspective.* Boulder, CO: Institute of Behavioral Science, University of Colorado.

Abstract

In an attempt to answer the question "what is in now known about human adaptation and response to natural hazards and disasters?" the authors endeavor to codify what the social science literature reveals about how humans, individually and collectively, adapt and respond to natural hazards and disaster. The book covers aspects such as preparedness, warning, organizational and social system mobilization, immediate responses following impact, and restoration and reconstruction.

Causal Findings

People who are in close proximity to the impact point of a disaster are more likely to hear a warning message. The clearer the warning message is, the more likely the public is to respond to the warning. The more consistent a warning message is, the more likely the public is to respond to it. A person with a high socio-economic status is more likely to believe a warning message.

Mileti, Dennis S. and Colleen Fitzpatrick. 1991. "Communication of Public Risk: Its Theory and its Application." *Sociological Practice Review* 2 (1): 20-28.

Abstract

Various natural and technological hazards pose risk to human collectives. Communicating information and educating an at-risk public about such hazards is an ongoing effort throughout the nation. Central to the outcome of risk communication and education efforts are the perceptions that the public holds about the risk. Communications of risk influences these perceptions and behavior. Risk communication is not a simple act of stimulus-response; rather, it is a process. This paper details the process of risk communication that involves characteristics of the message itself and personal characteristics of those receiving the message. A general model representing the interrelationship of these various factors that serve to influence risk perception behavior is presented. This model has been put into practice by those responsible for communicating risk to endangered publics. Example applications are also presented.

Mileti, Dennis S. and Colleen Fitzpatrick. 1992. "Causal Sequence of Risk Communication in the Parkfield Earthquake Prediction Experiment." *Risk Analysis* 12 (3): 393-400.

Abstract

A model of public perception and response of communication about natural hazards risk was constructed. It was estimated on date from samples of households in three communities at risk in the Parkfield earthquake prediction experiment. Estimated model parameters revealed consistent conclusions. Communicated risk information that was reinforced through additional communications and/or social cues precipitated an interactive personal search for more information; personal definitions of risk and what to do emerged; and these social constructions directed how the public responded. Perceived risk only indirectly impacted public action through information searching. This suggests that searching behavior should intervene between perception of risk and response in the theory of public risk communication.

Causal Findings

The more consistency with which a warning message is delivered, and/or if the message comes from a familiar source, the more likely the receiver is to believe it and/or respond to it. The more frequently a warning message is delivered, the more likely the public is to believe it. The more salient a warning is to a person, the more likely they are to believe it. A person is more likely to personalize a message if they receive message reinforcement. The greater a person perceives their hazards risk, the more likely they are to personalize a warning message. A person is more likely to personalize a warning message if they observe others preparing for the disaster. The clearer the warning message is, the more likely the public is to respond to the warning. The more specific a warning message is, the more likely the public is to respond to it. The more searching for information a person does, the more likely they are to respond to a warning message. If a person receives social cues about a disaster, they are more likely to respond to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Mileti, Dennis S. and Colleen Fitzpatrick. 1993. *Great Earthquake Experiment: Risk Communication and Public Action.* Boulder, CO: Westview Press.

Abstract

The U.S. currently has two official governmental bodies that review earthquake predictions--the National Earthquake Prediction Evaluation Council (NEPEC) and the California Earthquake Prediction Evaluation Council (CEPEC). The Parkfield earthquake prediction experiment, the first in the U.S. to be formally sanctioned by these two councils, began in 1985. This prediction experiment was followed later by a comprehensive information campaign to advise the public in the Parkfield area about the earthquake risk. This book recounts the history of large earthquakes, the evolution of earthquake-related policy and the various adjustments intended to reduce risk. The authors describe the evolution of earthquake warnings and the public reaction to the Parkfield prediction, and they suggest ways to convince the public that the earthquake risk is real and that they should engage in protective actions. They conclude with ideas about current and future earthquake predictions.

Causal Findings

A person is more likely to personalize a message if it is delivered via multiple channels. A person is more likely to personalize a warning message if they observe others preparing for the disaster. The more a person seeks out information on the impending disaster/hazard, the more likely they are personalize a warning message. The more searching for information a person does, the more likely they are to respond to a warning message.

Mileti, Dennis S., Colleen Fitzpatrick, and Barbara C. Farhar. 1992. "Lessons from the Parkfield Earthquake Prediction." *Environment* 34:16-39.

Abstract

As is the case with all environmental risks, a significant obstacle in the management of earthquakes is the lack of an effective communication mechanism to engender sincere public concern and action. To determine if, how and why individuals attempt to mitigate and prepare for the forecasted earthquake, this article looks at three predicted high-risk communities within the Parkfield, CA area. Two of the communities have recent damaging earthquake experience; the third does not and thus serves as a comparison. Additionally, the authors seek to advance risk communication theory by determining what would convince people to action is such situations. Data was collected from each of the communities in April of 1989 from mailed surveys. It was found that risk management agencies should communicate risk with the public with a variety of media, in particular, with written brochures. The communication should be made on several occasions and be written in an easily understandable, yet convincing way that encourages individuals to spread the information informally through discussion with friends and neighbors. The communication should also engender a sense of 'ownership' in the preparedness and mitigation actions.

Causal Findings

The public is more likely to hear and/or respond to a warning message that is delivered via multiple channels. The public is more likely to believe a warning when the warning is in the form of printed materials. A person is more likely to understand a warning message when it comes in the form of print media.

Mileti, Dennis S., Janice R. Hutton, and John H. Sorensen. 1981. "Earthquake Prediction Response and Options for Public Policy." Boulder, CO: Institute of Behavioral Science, University of Colorado.

Abstract

This volume attempts to bridge the gap between social science research related to earthquake prediction and the decision-making agents who will plan and implement tangible mitigative measures. Major issues are defined, successful predictions analyzed, and scenario methods discussed. Findings about earthquake prediction and warning are cast in a model analogous to other natural hazard warning systems, and a specific earthquake prediction-warning system is discussed within the context of giving, interpreting, and responding to information. Conclusion reached by the authors suggest that 1) earthquake prediction is useful only if social policy is in effect to insure that the benefits of using predictive technology will exceed its development costs; 2) many lessons from the study and implementation of other natural hazard warning systems are being ignored; 3) serious problems arise in coordinating the efforts of various risk assessors; 4) identification of the official risk assessor will be a major stumbling block; and 5) the issuance of a legitimate prediction will tax the ability of social channels disseminate useful information to the public.

Causal Findings

The more certainty with which a warning message is delivered, the more likely the receiver is to believe it. The more credibility the sender of a warning message has, the more likely the receiver is to believe it. People with low socio-economic status are less likely to personalize a warning message. A person with membership in social networks is more likely to respond to a warning message. The greater a persons' perceived risk or loss, the more likely that person is to respond to a warning message. If a person has resources, they are more likely to respond to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Mileti, Dennis S. and Paul W. O'Brien. 1991. "Public Response to the Loma Prieta Earthquake Emergency and Aftershock Warnings: Findings and Lessons." Fort Collins, CO: Hazards Assessment Laboratory, Colorado State University.

Abstract

In attempt to determine the reasons why the public mitigated and prepared for aftershocks following the 1989 Loma Prieta Earthquake the processes that operated to convince people to take action so that future recommendations can be made. The authors also sought to determine if the public responds differently to warnings made during an emergency as compared to warnings issued before a natural disaster occurs, as well as the role of media coverage in the process. Particular attention is focused upon how and to what extent the public responded to the earthquake emergency. Data was collected with questionnaires mailed to a random sample of residents of San Francisco and Santa Cruz counties in June of 1990; 1652 questionnaires were returned. Findings regarding the public's emergency response actions focus on people's experience with the earthquake, the nature of the response and the differences between those who did and did not respond. Findings on the aftershock warning response focus on exposure to media warnings, individuals' perceived aftershock risk, the nature of the public response to short-term and two-month aftershock warnings and the differences between those who did and did not respond. Specific implications for planning are given.

Causal Findings

If a person has experienced hazard damages in the past, they are more likely to hear warning messages. The more consistent a warning message is, the more likely the public is to respond to it. The more frequently a warning message is delivered, the more likely the public is to respond to it. The more informative guidance a person receives in a warning message, the more likely they are to respond to it. The more specific a warning message is, the more likely the public is to respond to it. Men are less likely to respond to a warning message than are women. Being older in age makes a person less likely to respond to a warning message. There is no relationship between community integration and that community's likelihood for responding to a warning message. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person is more likely to respond to a warning message if they are experiencing damage during the disaster/hazard. There is no relationship between gender and a person's likelihood for responding to a warning message. If a person is involved with a community response to a hazard/disaster, they are more likely to respond to a warning message. A person with membership in a minority group is less likely to respond to a warning message. If a person is prepared for a disaster/hazards response, they are more likely to respond to a warning message. There is no relationship between a persons' socio-economic status and their likelihood of responding to a warning message.

Mileti, Dennis S. and Paul W. O'Brien. 1992. "Warnings During Disaster: Normalizing Communicated Risk." *Social Problems* 39:40-57.

Abstract

To test hypotheses about communicating risk to the public, surveys were conducted among households in Santa Cruz and San Francisco Counties to ascertain how residents perceived the threat from Loma Prieta earthquake aftershocks. The samples were chosen to contrast an area (Santa Cruz County) that experienced proportionally greater damage and little media coverage, with an area (San Francisco County) that had high post-mainshock media exposure and highly publicized damage. Findings from the study included 1) both the quality and quantity of aftershock risk warning information had positive direct and indirect--through aftershock risk perception--effects on public warning response; 2) mainshock damage had a positive indirect effect on aftershock warning response through people being aware of emergency response efforts; 3) pre-mainshock earthquake awareness played a strong role in predicting public response to aftershock warnings; 4) perceived risk has a direct and positive impact on warning responses and the employment of protective actions; and 5) selected demographic characteristics can constrain both perception of risk and warning response.

Causal Findings

The more certainty with which a warning message is sent, the more likely the public is to respond to the warning. The more consist a warning message is, the more likely the public is to respond to it. The more frequently a warning message is delivered, the more likely the public is to respond to it. The more specific a warning message is, the more likely the public is to respond to it. Men are less likely to respond to a warning message than are women. Being older in age makes a person less likely to respond to a warning message. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person is more likely to respond to a warning message if they are experiencing damage during the disaster/hazard. A person is more likely to respond to a warning message if they have had prior hazards experience. If a person perceives an increased risk or loss, they are more likely to respond to a warning message. If a person is involved with a community response to a hazard/disaster, they are more likely to respond to a warning message.

Mileti, Dennis S. and Paul W. O'Brien. 1993. "Public Response to Aftershock Warnings."
Geological Survey, U.S. Department of the Interior, Washington, D.C.

Abstract

This report is on public response to aftershock warnings after the Loma Prieta earthquake. The
report reviews the short and long-term aftershock warnings issued to the public after the
earthquake. The results of past research are then synthesized into hypotheses tested in this
research. Descriptive findings about pubic aftershock warnings response in both San Francisco
and Santa Cruz Counties are then reported. Finally, the causal theory of risk communication was
tested on public perception of risk and response to aftershock warnings during the post-impact
Loam Prieta earthquake emergency. Findings from samples of households in Santa Cruz and San
Francisco Counties were consistent, confirm established propositions and suggest theoretical
refinement. It was concluded that the social psychological process that explains post-impact
public warning response is not identical to the one that explains public response to pre-impact
warnings. The lack of mainshock damage created a 'normalization bias' for non-victims. This
bias limited their perception of risk to damaging aftershocks and protective response to warnings.

Causal Findings

A person is more likely to believe a warning message if they observe cues that support the
message. The more certainty with which a warning message is sent, the more likely the public is
to respond to the warning. The more consist a warning message is, the more likely the public is
to respond to it. The more frequently a warning message is delivered, the more likely the public
is to respond to it. The more specific a warning message is, the more likely the public is to
respond to it. A person is more likely to respond to a warning message if they are experiencing
damage during the disaster/hazard. A person is more likely to respond to a warning message if
they have had prior hazards experience. If a person is involved with a community response to a
hazard/disaster, they are more likely to respond to a warning message.

Mileti, Dennis S. and Lori Peek. 2000. "The Social Psychology of Public Response to Warnings of a Nuclear Power Plant Accident." *Journal of Hazardous Materials* 75:181-194.

Abstract

This article reviews the process of public response to warnings of an impending nuclear power plant emergency. Significant evidence exists to suggest that people engage in protective action in response to warnings based upon the substance and course through which emergency warning information is disseminated. The three basic components of a warning system are defined, and the elements of public response to warnings are summarized. Popular myths about public response to warnings are outlined and dispelled based upon current research verification. The conclusion provides an overview and synthesis of the warning response process.

Mileti, Dennis S. and John H. Sorensen. 1988. "Planning and Implementing Warning Systems." Pp. 321-345 in *Mental Health Response to Mass Emergencies*, edited by M. Lystad. New York, NY: Brunner-Mazel.

Abstract

There are disaster situations in which warnings are issued, the public responds, and several lives are saved; there are disaster situations in which warnings are issued and, despite warnings, many lives are lost. In this chapter, the authors characterize various patterns in public responses to warnings in order to determine gaps in knowledge and implications for research and policy. Included are discussions on perception and consequent behavior, the non-behavioral aspects of response, response process determinants, and the confirmation process, as well as the implications of each for policy and application.

Mileti, Dennis S. and John H. Sorensen. 1990. "Communication of Emergency Public Warnings: A Social Science Perspective and State-of-the-Art Assessment." Oak Ridge, TN: Oak Ridge National Laboratory, U.S. Department of Energy.

Abstract

More than 200 studies of warning systems and warning responses were reviewed during the course of this assessment project. Current warning systems are evaluated for 13 natural or human-caused hazards, a warning system is defined in terms of a system structure and subsystem components and processes, and organizational aspects of warning systems are discussed. Other topics analyzed in the study include 1) building and evaluating a warning system, including the decision to warn, and writing and disseminating the warning message; 2) public response aspects of warning systems; 3) hazard-specific aspects of warning systems, including specifying hazard characteristics in warning systems and refining a generic warning system type; and 4) problems and limitations of warning systems, together with suggestions for improving such problems. Among the findings, it is stated that many current myths about public response to emergency warning are at odds with knowledge derived from field investigations. Some of these myths include the "keep it simple" notion, the "cry wolf" syndrome, public panic and hysteria, and those concerning public willingness to respond to warnings.

Mileti, Dennis S. and John H. Sorensen. 1995. "Warning Systems: A Social Science Perspective." Pp. 337-375 in *Preparing for Nuclear Power Plant Accidents,* edited by D. Golding, J. X. Kasperson, and R. E. Kasperson. Boulder, CO: Westview Press.

Abstract

This chapter reviews some neglected aspects of the present generation of state-of-the-art public-warning systems for nuclear power plants. First, the authors offer a broader and more inclusive definition of a warning system than the common narrow focus on alert and notification. Second, the authors examine organizational linkages -- such as those between power plants and off-site organizations -- and discuss the organizational aspects of warning systems. Third, the authors examine public response to warnings, comparing popular myths with what the research has shown actually determines public response. Fourth, the authors discuss the style and content of effective public-warning messages. Fifth, the importance of monitoring public response to emergency warnings is addressed. Finally, many of the concepts and ideas developed in the first sections of the chapter are used to evaluate the existing warning system for Three Mile Island and to recommend an alternative warning plan.

Mitchem, Jamie D. 2003. "Analysis of the September 20, 2002 Indianapolis Tornado: Public Response to a Tornado Warning and Damage Assessment Difficulties." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

This report summarizes the research regarding the September 20, 2002 Indianapolis tornado, with a particular focus on the public response to the warnings and damage assessment difficulties. This storm is of particular interest in that it primarily affected urban areas. It is thought that urban dwellers might face a unique situation that affects their responses to such as being in their cars, being at work, eating in restaurants, walking on streets and living in apartment buildings. Two primary research questions are addressed: What type of damage are seen in urban areas and do these damage patterns have an effect on the Fujita Scale ranking of tornadoes? How does the public receive, perceive and react to tornado warning information? Data was collect from aerial photographs surveys and media coverage content analysis. Conclusions include: 1) urban areas are biased in damage estimates based upon the Fujita Scale; 2) the majority (61%) of residents did not take the tornado warning seriously and that disseminating warnings in different ways is crucial to reach the most people, and; 3) a large proportion of people (46%) did not take shelter during the tornado.

Causal Findings

People involved with recreational activities at the time of the disaster, are less likely to hear a warning message. Households experiencing power outages, are less likely to hear a warning message. If someone is traveling at the time of a disaster, they are less likely to hear a warning message. The public is more likely to respond to a warning if they receive that warning via multiple channels. Hearing a warning message increases the likelihood of responding to it.

Moore, Harry E., Frederick L. Bates, Marvin V. Layman, and Vernon J. Parenton. 1963. "Before the Wind: A Study of Response to Hurricane Carla." Washington, D.C.: National Research Council, National Academy of Sciences.

Abstract

A detailed field study of five areas hit by Hurricane Carla, chosen for urban-rural and high evacuation level-low evacuation level comparisons. The study focused upon the effectiveness of the warning system; how the decision to evacuate was made; how public shelters were established and how people were allocated to shelters, private homes, and commercial dwellings; how the disaster oriented organizations functioned during the disaster; the problems for agencies in the task of returning evacuees; and a comparison between voluntary and involuntary evacuation.

Causal Findings

A member of a minority group is less likely to believe a warning message. The older a person is, the less likely they are to respond to a warning message. If a person has had a recent experience with a hazard/disaster, they are more likely to respond to a warning message. Receiving a warning message through a personal channel, increases the likelihood of a person believing the message. Working in a large organization decreases the likelihood of a person believing a warning message.

Moore, Walter L., Earl Cook, Robert S. Gooch, and Carl F. Nordin, Jr. 1982. *The Austin Texas Flood of May 24-25, 1981.* National Academy Press, Washington, D.C.

Abstract

This report summarizes factual information about the flood and its consequences, presents information on local governmental policies in force that related to urban drainage, examines the response of governmental agencies and citizens to the flood event, and draws implications from the event that might aid other communities that also exist with the threat of similar floods. Topics investigated include the possibility of a false sense of security among the storm's victims, the low number of flood insurance policies in effect in the afflicted areas, and how the flood damage would be paid for. Findings suggest that property damage could be significantly reduced by moving items a few feet above the floor; that it is doubtful whether workable programs for security against flooding can be maintained without an adequate background of public awareness and support; and that the overriding reality is that Austin must continue to live with the flash flood hazard. The meteorological conditions that caused the storm are analyzed, and a list of 33 NRG post-disaster studies (1964-1982) completes the report.

Causal Findings

The more specific a warning message is, the more likely the public is to respond to it.

Mulilis, John-Paul and T. Shelley Duval. 1995. "Negative Threat Appeals and Earthquake Preparedness: A Person-Relative-to-Event (PrE) Model of Coping with Threat." *Journal of Applied Social Psychology* 25(15): 1319-1339.

Abstract

Individual preparation, or the lack thereof, for the occurrences of external events that threaten the well-being of individuals is an issue of worldwide concern. The present studies were designed to investigate the impact of a particular type of persuasive communication (i.e., fear-arousing or negative threat appeals) on preparedness behavior regarding the possible occurrence of a damaging earthquake. A general model of coping, the person-relative-to-event (PrE) model, emphasizing the relationship between level of appraised threat and person resources, was applied to this issue. It was predicted that negative threat appeals using combinations of levels of factors that cause a person to appraise their resources as sufficient in quantity and quality to obviate or minimize the negative consequences of a threatening earthquake would increase levels of earthquake preparedness to a greater extent than would communications that do not. Results of Study 1 were partially supportive of these predictions. In Study 2, patterns of changes in preparedness behavior fit predictions generated by the PrE model to a greater extent when felt responsibility for preparing for the occurrence of an earthquake was high than when it was low. Implications of the research and theory underlying this investigation are discussed.

Causal Findings

The hypothesis that behavior change in level of earthquake preparedness depends on appraised level of person resources relative to appraised threat is partially supported. Furthermore, felt responsibility for preparing for an earthquake moderates this effect.

Munich Re Group. 2002. "Risk Communication: What Happens When Something Happens?" Munich, Germany: Munich Re Group.

Abstract

Since every crisis meets with public interest, the focus of the approaches to risk communication presented in this report lies on interaction with the media. The first part of the report is based on the findings of research into risk communication and the practical principles of media activity. To provide theoretical support, the second part of the report outlines the complex structures of such crises and how they are dealt with from the point view of economics, social sciences and communication studies

National Fire Protection Association. 1993. "The Oakland-Berkeley Hills Fire." Quincy, MA: National Fire Protection Association.

Abstract

This report discusses the conditions that existed prior to and during the Oakland/Berkeley Hills fire of October 1992 that killed 25 people, injured 150 others, and destroyed 2,449 single-family homes and 437 attached units. It examines the difficulties encountered by firefighters and others who responded to the fire, residential construction and land use practices in the area, weather conditions, the fire intensity, communications, water availability, transportation routes, public utilities, and evacuation procedures. In addition, to mitigate future fire impacts, the booklet provides recommendations regarding construction practices; landscaping; building maintenance; and measures for fire local fire departments, such as developing mutual aid plans, conducting regular drills, and improving communications systems.

National Research Council. 1991. "Real-Time Earthquake Monitoring: Early Warning and Rapid Response." Washington, D.C.: National Academy Press.

Abstract

Need to be abstracted.

Causal Findings

Probably not any.

Nehnevajsa, Jiri. 1985. "Western Pennsylvania: Some Issues in Warning the Population Under Emergency Conditions." Pittsburgh, PA: University Center for Social and Urban Research, University of Pittsburgh.

Abstract

Attempting to locate document.

Causal Findings

People with memberships in social networks are more likely to hear warning messages. A person who sleeps with the windows open is more likely to hear a warning message. The larger a persons household size, the more likely they are to understand a warning message.

Nelson, Carnot E. and et.al. 1988. "Post-Hurricane Survey of Evacuees Sheltered in the Tampa Bay Region During Hurricane Elena in 1985." Tampa, FL: Department of Community Affairs, Division of Emergency Management, with support of the Tampa Bay Regional Planning Council, University of South Florida.

Abstract

The response to hurricanes requires the evacuation of large numbers of people form broad geographical regions in at relatively short period of time, a situation not encountered in other types of disasters, and one that presents problems unique to hurricane evacuation. Presently, most evacuation plans are based upon behavioral and psychological findings that reflect what people say they would do, rather than what they actually do. Following Hurricane Elena in 1985, the authors of this article sought to answer the following questions: 1) who evacuated, and did they do so voluntarily and/or unnecessarily? 2) Where did people go, and if to public shelters, did they go to their assigned shelter? 3) What were the ages and special needs of the evacuees? And 4) How did actual behavior compare with predictions of the behavioral studies? In order to address the questions, five studies were conducted, all of which involved respondents from the Tampa Bay area of west-central Florida. Data for two studies involving public shelters was collected from American Red Cross shelter registration materials, while the data on the general public's response behavior was collect in a follow-up survey of respondents having been previously questioned as to their intended hurricane evacuation behavior. Findings include discussions on the importance of defining and communicating risk-zones to the public; the special needs of mobile home residents and the elderly and difficulties in designating public shelters by zone. Findings on the accuracy of previous behavioral and psychological based surveys were mixed, but overall suggest that behavioral intentions are useful in predicting actual behavior.

Causal Findings

The public is more likely to hear a warning message if it is delivered via the television. The more specific a warning message is, the more likely the public is to respond to it. The older a person is, the less likely they are to respond to a warning message. The greater a persons' perceived risk or loss, the more likely that person is to respond to a warning message.

Nemec, J., J. M. Nigg, and F. Siccardi, eds. 1993. *Prediction and Perception of Natural Hazards.* Boston, MA: Kluwer Academic Publishers.

Abstract

The International Decade for Natural Disaster Reduction (IDNDR) recognizes warning systems as part of most hazard reduction schemes. Concurrently, scientists have recognized that warning systems are complex arrangements for transmitting information about increased risk to individuals so that they take appropriate action. Thus, warning systems involve both prediction of a hazard and perception of the risk posed. In the fall of 1990 the National Science Foundation, the National Research Council of Italy, and the U.N. IDNDR Secretariat sponsored a meeting in Perugia, Italy, of physical scientists, social scientists, and engineers involved in disaster research addressing 2 topics: 1) methods for predicting disasters across different natural hazard agents, and 2) factors associated with the appropriate interpretation of hazard warnings. The discussion focused on the uncertainties in detection and prediction and how these affect decision makers and the general public.

Neuwirth, Kurt, Sharon Dunwoody and Robert J. Griffin. 2000. "Protection Motivation and Risk Communication." *Risk Analysis* 20:721-734.

Abstract

The purpose of this study was to explore the utility of protection motivation theory (PMT) in the context of mass media reports about a hazard. Content elements of a hazard's severity, likelihood of occurring, and the effectiveness of preventive actions were systematically varied in a news story about fabricated risk: exposure to fluorescent lighting lowering academic performance. Results of this experiment (N=206) suggest that providing information about the severity of a hazard's consequences produces greater information seeking. In addition, rates of willingness to take actions designed to avoid the hazard. Results are seen as providing general support for PMT and are discussed within the broader framework of information seeking and heuristic and systematic information processing.

Causal Findings

The public is more likely to respond to a warning message if that message contains risk information and/or information about the severity of the threat. If a person feels some personal efficacy, they are more likely to respond to a warning message.

Newhall, Christopher G. and Raymundo S. Punongbayan. 1996. *Fire and Mud: Eruptions and Lahars of Mount Pinatubo, Philippines*. Seattle, WA: University of Washington Press.

Abstract

This publication documents the devastating reawakening of Mount Pinatubo following a 500-year sleep; it includes 21 technical papers describing the scientific and human story of the 1991 eruption. Ten times larger than the Mount St. Helens explosion in the U.S., this eruption threatened a million people, sent a giant ash cloud 35 kilometers into the sky, and seared the surrounding area with hot blasts. In this book, volcanologists and other experts from 10 countries explore the precursors, processes, and products of the eruption, as well as the record-setting erosion and lahars that followed. Of particular interest are papers on eruption hazard assessments and warnings, building damage, socioeconomic impacts, impacts on aircraft operations, and atmospheric impacts.

Ngyuen, Loc H., Haikang Shen, Daniel Ershoff, Abdelmonem A. Afifi and Linda B. Bourque. 2006. "Exploring the Causal Relationship between Exposure to the 1994 Northridge Earthquake and Pre- and Post-Earthquake Preparedness Activities." *Earthquake Spectra* 22 (3): 569-588.

Abstract

Whether, when, and why individuals prepare for disasters are major concerns of disaster preparedness researchers. Using population-based survey data collected after the 1994 Northridge earthquake, multinomial logistic models are imposed to examine if preparedness activities were adopted after the quake because of quake-related financial loss, physical and emotional injury, and proximity to the earthquake epicenter and shaking. The extent to which people invest in sustained preparedness was also examined by comparing the preparedness activities occurring both before and after the earthquake.

The results indicated that exposure to physical, financial, and emotional injuries, and to shaking increased post-quake preparedness. Engaging in certain types of pre-quake preparedness increased the likelihood of post-quake preparedness. Post-quake preparedness is not affected by socioeconomic status or demographic factors, except that married persons are more likely to prepare in all situations and immigrants are more likely to adopt post-quake preparedness activities.

Causal Findings

People who suffered physical injuries, financial loss and/or emotional injuries from an earthquake are more likely to perform preparedness actions after the earthquake. People who engaged in survival preparedness activities (e.g., having food, water, flashlights) prior to an earthquake are also more likely to implement preparedness following an earthquake. Shaking intensity is a third factor that is positively associated with the likelihood of post-earthquake preparedness. Finally, married persons and immigrants are more likely to adopt preparedness activities after experiencing an earthquake, while other socioeconomic and demographic factors have no effect.

Nigg, Joanne M. 1982. "Communication Under Conditions of Uncertainty: Understanding Earthquake Forecasting." *Journal of Communication* 32(1):27-36.

Abstract

Focusing on earthquake prediction, this article addresses the question of how media coverage relates to a community's information-seeking and information-exchange behavior when that community is faced with an unspecific warning of a widespread disaster. In doing so, it draws on Ball-Rokeach and DeFleur's 'dependency model' of mass media effects to examine the interrelationships between formal and informal communication processes when a community is exposed to a threat of impending disaster. The data comes from a three-year study of community response to earthquake threat in southern California that included over 1700 randomly selected residents of Los Angeles County. Additionally, data included information from six major Los Angeles newspapers that were monitored for coverage of earthquake topics as well as interviews and the organizational records of scientific and emergency preparedness agencies. Findings are presented as a four-stage flow model developed to explain the discrepancy between widespread informal discussion of earthquake topics and the relatively low level of information sought form southern California earthquake experts following extensive media coverage of earthquake prediction in 1976.

Causal Findings

If confirmation of the disaster/hazard happens, people are more likely to believe a warning message. The more frequently a person receives a warning message, the more likely they are to confirm it.

Nigg, Joanne M. 1987. "Communication and Behavior: Organizational and Individual Response to Warnings." Pp. 103-117 in *Sociology of Disasters*, edited by R. R. Dynes, B. DeMarchi, and C. Pelanda. Milan, Italy: Franco Angeli Libri.

Abstract

This review focuses on the communication research of the warning-response process during the pre-impact phase of disaster. The review differentiates between two units of analysis: organizational behavior and individual behavior. Individual response behavioral features examined more specifically include source credibility, message content and warning confirmation. Additionally, an assessment the extent to which research endeavors focusing on the role of communication in determining emergency response behavior include a formulation of middle-range theories is included.

Causal Findings

The more certainty with which a warning message is delivered, the more likely the receiver is to believe the message. If a sender uses electronic media to relay a warning message, the receiver is more likely to believe it. If a warning message comes from an official source, the receiver is more likely to believe it. If a person has had prior hazards experience, they are less likely to believe a warning message, but more likely to personalize it. If a person has membership in a minority group, they are less likely to believe a warning message. The less certain a sender is about a warming message, the less likely the receiver is to confirm that message. The more clarity with which a warning message is sent, the more likely the receiver is to personalize it. The more consistency with which a warning message is sent, the more likely the receiver is to personalize it. The more specific a warning message is, the more likely the receiver is to personalize it. If a person receives confirmation of a warning message, they are more likely to personalize it. The more clarity with which a warning message is sent, the more likely the receiver is to respond to it. The more consistency with which a warning message is sent, the more likely the receiver is to respond to it. A person is more likely to believe a warning message if that message is received through a personal channel.

Nigg, Joanne M. 1995. "Risk Communication and Warning Systems." Pp. 369-382 in Natural Risk and Civil Protection, edited by T. Horlick-Jones, A. Amendola, and R. Casale. London, UK: E&FN SPON.

Abstract

This paper focuses on how warnings can be effectively disseminated when the threat is from a relatively rapid onset hazard agent. Because empirical research has demonstrated that risk communication processes are qualitatively different between long term and short term warnings, this paper is purposely limited to situations in which short term warning is appropriate rather that situations for which a long-term forecast of danger is necessary. The first part of this paper reviews the components of a warning system that allow warning information to be formulated rapidly and disseminated widely, once the danger has been confirmed. The second half of the paper reviews the components of a warning message that are necessary to convince people they must take actions to protect themselves.

Norris, Fran H. 1997. "Frequency and Structure of Precautionary Behavior in the Domains of Hazard Preparedness, Crime Prevention, Vehicular Safety, and Health Maintenance." *Health Psychology* 16 (6): 566-575.

Abstract

A sample of 831 adults was interviewed by researchers using a 72-item inventory about their precautionary behaviors and attitudes. Exploratory and confirmatory factor analyses conducted on random halves of the sample provided evidence of consistency and structure in precautionary behavior both within and across domains of concern. Hazard preparedness activities clustered into having basic supplies on hand, advance planning, and hazard alertness. Crime prevention acts organized according to person protection, neighborly cooperation, and professional guidance. Vehicular safety factored into auto care, responsible driving, and seat belt use. Health maintenance activities entailed healthy habits (diet and exercise), risk monitoring, and avoiding tobacco and alcohol. Higher order factor analyses evidenced intra-individual consistency in the use of Disciplined, Vigilant, and Proactive Behaviors across precautionary domains. At all levels, perceptions of the usefulness of precautionary measures were related strongly to the frequency of self-protective acts.

Causal Findings

Precautionary behavior tends to be consistent within individuals across different types of hazards. People who perceive precautionary measures, including hazard preparedness, crime prevention, vehicular safety, and health maintenance, as useful, are more likely to engage in self-protective acts.

O'Brien, Paul W. 1992. "Aftershock Warnings Following the Loma Prieta Earthquake: A Theoretical Assessment." Doctoral Thesis, Department of Sociology, Colorado State University, Fort Collins, CO.

Abstract

Collective behavior has a long history within American sociology. Its application has waned in the past twenty years largely because of its purely social psychological framework. Resource mobilization theory has become the dominant paradigm to explain crowd behavior because of its more macro level emphasis. This dissertation synthesizes these two theories. The synthesized theory was then tested on public response data in the aftermath of the Loma Prieta earthquake. The Loma Prieta earthquake struck northern California on October 17, 1989 at 5:04 p.m. It measured 7.1 on the Richter scale. It caused widespread damage to Santa Cruz County and also to the San Francisco Bay Area. There were 61 fatalities and estimated economic losses were over seven billion dollars. This research was also the first attempt to study public response to warnings issued in the context of an on-going emergency. Consequently, it tested the well-established theory of risk communication that explains public response to pre-impact disaster warnings was applicable to settings when public attention is diverted by an ongoing emergency. Risk communication theory provided an explanation for how people form perceptions of risk on the basis of received information. The conclusions of this dissertation have both theoretical and applied implications. It was initially hypothesized that citizens affected by the main shock would tune-out aftershock warnings, however the data showed the opposite occurred. People who had experienced damage from the main shock were more likely to hear aftershock warnings. Conversely, citizens who did not experience damage tuned-out the aftershock warnings. This suggests that future aftershock warnings should especially target citizens that were sparred main shock damage. Finally, the synthesis of collective behavior and resource mobilization theories provided an explanation for citizen participation in emergency response. This suggested that a blending of these two theories is theoretically warranted.

O'Brien, Paul W. and Patricia Atchison. 1998. "Gender Differentiation and Aftershock Warning Response." Pp. 173-180 in *The Gendered Terrain of Disaster: Through Women's Eyes*, edited by E. Enarson and B. H. Morrow. Westport, CT: Greenwood Publishing Group.

Abstract

Theory suggests and research shows clear contrast in how men and women are socialized. Different socialization patterns are manifest throughout the life course in routine, as well as catastrophic context. Our empirical investigation reports gender differences in the context of official government aftershock warnings issued immediately following the 1989 Loma Prieta earthquake in northern California. This study provides useful information on the understudied dimension of gender in the disaster context. Specifically, the authors find evidence of gender differences in four areas: reported earthquake experience, early actions undertaken, information received and actions undertaken for three months after the event. Results show that the women and men in the study saw the event differently, sought information differently and had different long-term reactions to the event.

Causal Findings

Women are more likely to believe a warning message, than are men.

Ockerby, Peter. 2001. "Evacuation of a Passenger Ship - Is Panic a Major Factor?" *Australian Journal of Emergency Management* 16:8-14.

Abstract

This article explores the actions that may be taken by those responsible for the safety of passengers on a ship and suggest that customary procedures are based upon incorrect assumptions about how passengers will behave in an emergency. The research tests four hypotheses: panic is natural in emergencies; 2) sounding an alarm will cause panic; 3) and because of such alarms should be delayed as long as possible; 4) such assumptions are the result of the medias manner of reporting such occurrences. Findings of the data collected from surveys is used to test the hypotheses and four recommendations are provided: ship's officers and safety personnel should 1) distinguish between stress and panic, 2) the use multiple methods of communication (more than jus the alarm); plans for evacuation need to be clearly known, and 4) explicitly teaching the difference between stress and panic.

Oliver, John and G.F. Reardon. 1982. "Tropical Cyclone "Isaac:" Cyclonic Impact in the Context of the Society and Economy of the Kingdom of Tonga." Centre for Disaster Studies, James Cook University of North Queensland, Townsville, Australia.

Abstract

This report summarizes the finds of researchers investigating the effects of Tropical Strom 'Isaac', which devastated different parts of the Kingdom of Tonga March 2 & 3, 1982. It is hoped that the findings presented will clarify the characteristics of a tropical cyclone disaster in a society that in socioeconomic terms is in the development stage and classified as a folk or pre-industrial society in its typical response to natural disasters. In such both the unique features as well as those comparative qualities, generalizable to other societies and disasters are asserted as important contributions toward improved disaster management and planning.

Causal Findings

People living in rural residences are more likely to understand warning messages.

Olson, Robert A. and Richard Stuart Olson. 2001. "Socioeconomic Reverberations of Earthquake Prediction: Snapshot in Time, Peru 1979-1981." *Natural Hazards Review* 2:124-131.

Abstract

Although the scientific capability to predict earthquakes has proven more elusive than was hoped for several decades ago, the concern over the social and economic response to prediction of an earthquake remains high. This paper examines the social and economic response to prediction for a strong earthquake to occur off Lima, Peru in mid-1981. The principal findings are that (1) public knowledge and anxiety over the prediction was widespread in Peru, but the behavioral response was relatively modest; and (2) corporations reviewed emergency plans and contingencies, especially insurance coverage, which saw a significant but temporary rise at the national level.

Packham, David R. 1995. "Evacuation in Wild Fires: The Australian Experience." *Australian Journal of Emergency Management* 10:39-44.

Abstract

The paper examines the known facts regarding evacuations from wild fires and argues for a policy of non-evacuation. Based upon empirical evidence suggesting that non-evacuation may result in fewer deaths and premises that acknowledge evacuees' sense of responsibility for the protection of life and property the author concludes that evacuation is a most difficult and doubtful strategy to combat a rampant wild fire. Further, it is suggested that the continuation of such practices will increase life and house loss, while a policy of support, education and containment along with large area fuel reduction would be likely to almost remove the problem from areas of rural-urban interface.

Panel on Real-Time Earthquake Warning. 1991. "Real-Time Earthquake Monitoring: Early Warning and Rapid Response." Washington, D.C.: Committee on Seismology, Board on Earth Sciences and Resources, Commission on Geosciences, Environment and Resources, National Research Council.

Abstract

Systems for "real time" warning of earthquake ground motion have been used for about two decades in Japan, particularly to mitigate damage to rapid transit systems. However, such warning systems have had only limited use in the U.S., and prior to the publication of this report, they had not been systematically addressed at the national level as mitigation tools. The panel that undertook this study concluded that, although earthquake prediction remains a difficult task, present technology has the potential to determine the magnitude of a quake while it is still in progress and to relay that information to nearby communities before the onset of damaging shaking. The panel also suggests that, besides providing warnings, with adequate sensor coverage and distributed processing, the same technology, used in conjunction with damage estimation models, could provide post earthquake information on severity and extent within minutes of the event. Although it is clear that the technology for such systems exists, or can be readily developed, the panel cautions that it is less certain that such systems would be acceptable to potential users without familiarization and demonstration.

Parker, Dennis, Maureen Fordham, Sylvia Tunstall, and Anne-Marie Ketteridge. 1995. "Flood Warning Systems Under Stress in the United Kingdom." *Disaster Prevention and Management* 4:42-32.

Abstract

This article discusses the results of evaluations of flood forecasting, warning, and response systems in England, Wales, Scotland, and Northern Ireland. It reveals that in England and Wales flood warning systems often under perform. Despite technical sophistication and their elevation to high priority in central government's flood defense strategy, arrangements for flood warnings are now under considerable stress because of lack of agreement over organizational roles and responsibilities. Legal ambiguities, funding difficulties and ideological positions lie behind these problems. Flood warning systems are developing in Scotland, and there is now a "fledgling" system in Northern Ireland, but both lag behind England and Wales. The article also examines implications for the future.

Parker, Dennis J. and John W. Handmer. 1998. "The Role of Unofficial Flood Warning Systems." *Journal of Contingencies and Crisis Management* 6 (1): 45-60.

Abstract

Most research on local flood warning systems focuses on systems designed, installed, and maintained by governments or other official agencies. Little attention has been paid to so-called "folk" or unofficial conduits of information embedded within local societies. The authors of this paper argue that the designers of official warning systems often are ignorant of, or ignore unofficial warning networks that, if taken into account by government, could improve the total warning effort. This paper examines the structure of both official and unofficial warning systems, explores how local knowledge and personal networks transmit flood warning information, and presents constructive means by which informal and unofficial warning information can be integrated into official local warning systems. Topics addressed also include the ineffectiveness of official flood warning systems; interpersonal networks (family, friends, the homeless, fellow workers, etc.) as information sources; and policy implications associated with integrating informal social networks into a formal warning system.

Parr, Arnold R. 1987. "Disasters and Disabled Persons: An Examination of the Safety Needs of a Neglected Minority." *Disasters* 11:148-159.

Abstract

The author contends that the disaster literature is curiously silent with regard to the special contingency needs of the one person in ten who suffers from some type of physical or mental disability. Using data collected from research conducted during 1986 in Christchurch, New Zealand, the study discusses the nature of disablement in a disaster situation, explores the philosophical and theoretical context of risk and safety associated with the disabled, and examines special needs of the disabled in the pre-disaster planning and the post-disaster assistance timeframes. Among the conclusions, it is stated that 1) as much as possible, disabled persons must be prepared to help themselves in a disaster; 2) the research project itself helped to raise awareness about the ways in which the disabled can be helped during emergencies; 3) disabled persons should be centrally involved in disaster planning and preparedness; 4) a moral dilemma is created when safety planning for the disabled may compromise the safety of non-disabled helpers; and 5) children and elderly persons often have safety needs in disasters similar to those of disabled persons. An appendix presents a partial classification of the disaster safety needs for 13 types of disabilities.

Parr, Arnold R. 1998. "Disasters and Human Rights of Persons with Disabilities: A Case for an Ethical Disaster Mitigation Policy." *Australian Journal of Emergency Management* 12(4): 2-4.

Abstract

Stating that disaster management for disabled persons is a neglected topic that requires urgent attention, this article argues that disaster mitigation policy needs to take into account a 'bill of rights' for persons with disabilities. More so, it is asserted that the continued neglect of this of this issue in research constitutes a serious violation of disabled person's human rights and fundamental freedoms. Such is best accomplished through an intensive public education campaign.

Paulsen, R. L. 1981. "Human Behavior and Fire Emergencies: An Annotated Bibliography." Washington, D.C.: National Bureau of Standards, U.S. Department of Commerce.

Abstract

Attempting to locate document.

Causal Findings

A person is more likely to confirm a warning message if they have heard it. The more specific a warning message is, the more likely the public is to respond to it. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it.

Peguero, Anthony A. 2006. "Latino Disaster Vulnerability: The Dissemination of Hurricane Mitigation Information Among Florida's Homeowners." *Hispanic Journal of Behavioral Sciences* 28 (1):5-22.

Abstract

When a natural or manmade disaster strikes, there is usually little time for citizens to prepare and protect themselves. In September 2003, the U.S. Department of Homeland Defense implemented a National Response Plan dealing with many forms of disaster. However, when a disaster hits, not all citizens are equally prepared or protected. A sample of 165 Latino and 1,069 Non-Latino Florida single-family homeowners is drawn from the 1999 Florida Statewide Mitigation Survey (SMS) to investigate the problems associated with the dissemination of hurricane mitigation information among Florida's Latino homeowners. Results from logistic regression analyses reveal that Latino homeowners prefer to utilize friends and family as sources of disaster preparation information. The significance of research findings and policy implications are discussed.

Causal Findings

Latino homeowners prefer friends and family as sources of disaster information.

Perry, Ronald W. 1979. "Evacuation Decision-Making in Natural Disasters." *Mass Emergencies* 4:25-38.

Abstract

In response to the relative lack of attention devoted to examining which variables are important in determining individuals' decisions to evacuate in response to a disaster warning, this paper reviews the empirical studies of warning response, particularly focusing upon pre-impact evacuation of threatened populations and summarizes the available findings. The summary may be seen as a conceptual framework of inter-related hypotheses describing the relationships among variables that past research suggests are important in individuals' decisions to evacuate. This paper further represents an effort to order the empirical literature by organizing existing findings into a general conceptual framework. The remainder of the paper is structured around three primary tasks: 1) development of a theoretical perspective of evacuation behavior; 2) a review of the empirical literature; and 3) the assembling of findings into a tentative framework.

Causal Findings

The older a person is, the less likely they are to hear a warning message. The more credibility the sender of a warning message has, the more likely the receiver is to believe it. The more frequently a warning message is delivered, the more likely the public is to believe it. The more specific the warning message is, the more likely the receiver is to believe it and personalize it. If a person has had previous hazards experience, they are more likely to believe a warning message. A person is more likely to personalize a message if it comes from a credible source. A person is more likely to personalize a message if it is delivered frequently. The more hazards experience a person has had, the more likely they are to personalize a warning message. The more specific a warning message is, the more likely the public is to respond to it. The older a person is, the less likely they are to respond to a warning message. A person is more likely to respond to a warning message if they have had prior hazards experience. If a person has knowledge about a protective response, they are more likely to respond to a warning message. A person with membership in social networks is more likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it. If a family experiences frequent kinship interaction, they are more likely to hear a warning message.

Perry, Ronald W. 1981. "Citizen Evacuation in Response to Nuclear and Non-Nuclear Threats." Seattle, WA: Battelle Human Affairs Research Center.

Abstract

The purpose of this report is to describe the results of a comparative analysis of data on citizen evacuation behavior in response to nuclear and non-nuclear threats. Two issues in particular are examined: 1) citizen warning sources and perceived credibility of warnings; and 2) citizen evacuation decision-making. The authors review citizens' source of first warning, the relative utility of warning information and the perceived reliability of different warning sources. Cross-hazard comparisons are made among the total numbers of citizens who evacuate, reasons given for evacuation or not evacuating and citizen beliefs about the nature of the threat to their families are examined. Lastly, implications and recommendations for further study are discussed.

Causal Findings

The public is more likely to believe a warning from an official source. The more consistent a warning message is, the more likely the public is to respond to it. The public is more likely to respond to a warning message if it comes from an official source. People are more likely to respond to a warning message when that message comes from a familiar source. The more specific a warning message is, the more likely the public is to respond to it. A person with children is more likely to respond to a warning message than someone without children. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person is less likely to respond to a warning message if they have a fear of looting. If a person has fear over a forced evacuation, they are more likely to respond to a warning message. If a person has freedom to leave their place of employment, they are more likely to respond to a warning message. The closer in geographical proximity a person is to the impending disaster/hazard, the more likely they are to respond to a warning message. If a person receives social cues about a disaster, they are more likely to respond to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Perry, Ronald W. 1982. *The Social Psychology of Civil Defense*. Lexington, MA: Lexington Books.

Abstract

This book addresses the feasibility and consequences of crisis relocation plans in response to a nuclear attack. Insomuch as such an event where forewarning was given is unprecedented, the author makes carefully qualified comparisons between warning response tin natural disasters and likely warning responses under a crisis relocation plans. Three important questions are addressed: 1) will a nuclear strike be preceded by several weeks of warning? 2) Will the US intelligence community be able to identify far enough in advance a period of intense international crisis that is likely to culminate in a nuclear attack? 3) In the case of a nuclear exchange, will there even be a safe location anywhere on earth where one might seek safety? To begin to answer the questions, the author examines four issues: 1) the theoretical bases in social science for civil-defense programs; 2) the logic that underlies the comparisons of nuclear attack with natural disasters; 3) the extent and nature of comparisons that can be made based upon warning-response research in natural disasters; and 4) the implications of these comparisons of the design and implementation of crisis-relocation planning. Additionally, and historical overview of civil-defense efforts in the US is included.

Causal Findings

The more credibility the sender of a warning message has, the more likely the receiver is to believe it. A person is more likely to understand a warning message if they have received confirmation of the disaster/hazard. If a family is together in the same place at the same time, they are more likely to respond to a warning message.   The more a person personalizes a warning message, the more likely they are to respond to it.

Perry, Ronald W. 1983. "Population Evacuation in Volcanic Eruptions, Floods and Nuclear Power Plant Accidents: Some Elementary Comparisons." *Journal of Community Psychology* 11:36-47.

Abstract

This paper reports a comparative analysis of citizen evacuation response to three different types of environmental threats; a riverine flood, a volcanic eruption, and the nuclear reaction accident at Three Mile Island, Pennsylvania. While there have been numerous discussions in the theoretical literature regarding the extent to which human response to nuclear and non-nuclear threats are likely to be comparable, to date there have been no empirical studies of the phenomenon. It was found that citizen belief in real situational danger and warnings from authorities were most frequently cited by evacuees as reasons for leaving in both nuclear and non-nuclear incidents. Mass media warnings were infrequently cited as important reasons for evacuating, and social network contacts were relatively more important to evacuation decision-making in the natural disasters than at Three Mile Island. For both the natural disasters and the nuclear accident, most citizens who did not evacuate chose not to do so because they did not believe that a real danger existed. The public is more likely to respond to a warning message if it comes from an official source.

Causal Findings

The more consist a warning message is, the more likely the public is to respond to it. People are more likely to respond to a warning message when that message comes from a familiar source. The more specific a warning message is, the more likely the public is to respond to it. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person is less likely to respond to a warning message if they have a fear of looting. A person with membership in social networks is more likely to respond to a warning message. If a person receives social cues about a disaster, they are more likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it.   The more a person personalizes a warning message, the more likely they are to respond to it.

Perry, Ronald W. 1985. *Comprehensive Emergency Management: Evacuating Threatened Populations.* Greenwich, CT: JAI Press.

Abstract

The author defines comprehensive emergency management (CEM) as the capacity to handle all phases of activity--mitigation, preparedness, response, and recovery--in various types of disasters by coordinating the efforts and resources of many different organizations and agencies. Such an approach depends on the identification of generic functions common to the management of all hazards. This volume examines the concept of CEM by developing a theoretical framework for comparing natural and human-caused disasters and analyzing the data on human response to various disaster agents. It then reviews the techniques of emergency management, particularly emphasizing findings concerning human behavior during pre-impact warning and evacuation, which seem applicable across this range of disaster agents. A systematic framework is presented for understanding citizen emergency decision-making and describes techniques based on that framework for managing evacuations.

Perry, Ronald W. 1987. "Disaster Preparedness and Response Among Minority Citizens." Pp. 135-151 in *Sociology of Disasters,* edited by R. R. Dynes, B., DeMarchi and C. Pelanda. Milan, Italy: Franco Angeli Libri.

Abstract

This article highlights the relative sparseness of empirical data regarding minority groups in terms of developing sociological theories of disaster behavior. Despite intuitive and empirical evidence that ethnicity is related to citizen behavior and experience in all phases of disaster management, race and ethnicity rarely appear as variables in models and theories of disaster response. Considering such, the author asserts that these conditions demand that researchers and theorists begin a more systematic exploration of the role of ethnicity in disaster behavior.

Causal Findings

A person is more likely to hear a warning message if it is delivered in the language in which they speak. A person with majority group membership is less likely to understand a warning message. The public is more likely to respond to a warning message if the message comes from a credible source. A person with membership in a minority group is less likely to respond to a warning message. If a person feels some personal efficacy, they are more likely to respond to a warning message. If a family is together in the same place at the same time, they are more likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it.   The more a person personalizes a warning message, the more likely they are to respond to it. A person with a high socio-economic status is more likely to believe a warning message.

Perry, Ronald W. 1990. "Evacuation Warning Compliance Among Elderly Citizens." *Disaster Management* 3:94-96.

Abstract

Evacuation-the movement of threatened citizens from a place of relative danger to a place of relative safety-is a commonly used protective measure in the face of a variety of disaster agents. It is thus important that in planning and executing evacuations, authorities have technically accurate visions of the likely response of citizens to such events. The research literature for decades has remained unclear on the performance of elderly citizens during evacuations; many very old studies say elderly tend to not co-operate and there are few recent studies at all. This paper examines the evacuation warning compliance patterns of evacuees of differing age groups in response to three riverine floods, one volcanic eruption and one hazardous materials incident. The data indicate, contrary to the research done in the 1940's and 1950's that elderly citizens are either more likely or equally likely to comply with evacuation warnings than younger age groups. These findings suggest that the disaster planning literature that warns that the elderly constitute special compliance problems during disasters is at best highly misleading.

Causal Findings

A person who is older in age is more likely to respond to a warning message.

Perry, Ronald W. and Marjorie R. Greene. 1982a. "Emergency Management in Volcano Hazards: The May 18, 1980 Eruptions of Mt. St. Helens." *Environmental Professional* 4(4):341-350.

Abstract

The purpose of this paper is to examine the management of, and citizen response to, the emergency evacuation strategy used in the communities of Toutle and Silver Lake, Washington. These towns are approximately 40 kilometers northwest of Mt. St. Helens volcano, and lie near the danger zone established (during May 1980) by Washington State authorities in conjunction with the U.S. Geological Survey and the U.S. Forest Service. Data for this study was generated from a probability sample of size 102 drawn from a sample frame constructed form combined telephone and postal route records. Of the 102 dwellings units selected, personal interviews were completed with 90 families. The data show that individual's decisions to comply with emergency procedures were made largely on the basis of perceived personal risk, and belief in the validity of the warning message. Citizens reported a positive evaluation of the warning system implemented by county sheriff's authorities. The paper also describes issues related to the logistics of relocating and sheltering citizens.

Causal Findings

The more a person personalizes a warning message, the more likely they are to respond to it.

Perry, Ronald W. and Majorie R. Greene. 1982b. "The Role of Ethnicity in the Emergency Decision-Making Process." *Sociological Inquiry* 52:309-334.

Abstract

Although sociologists have studied for decades the process whereby citizens make emergency decisions in response to disaster warnings, very little attention has been given to understanding the role of ethnicity in this process. Data derived from fatality and injury counts following disasters, though sparse, documents that minority group citizens tend to suffer disproportionately high negative consequences in connection with the impact of disasters. On the basis of this information, it is inferred that differences exist between the emergency decision making processes of minority and majority citizens. This paper lays the theoretical groundwork for beginning to revise existing conceptual models of warning response behavior to address more adequately the variation associated with minority group status. T his goal is accomplished through pursuing three general tasks: (1) examining the process through which personal emergency decisions are made, (2) delineating social factors which impinge upon the outcomes of this decision making process and (3) integrating into an existing model of warning response behavior, additional variables which are related to minority status.

Causal Findings

The more community involvement a person has, the more likely they are to hear a warning message. People with high socio-economic status are more likely to hear a warning message. People with low socio-economic status are less likely to personalize a warning message. The more credibility the sender of a warning message has, the more likely the receiver is to believe it. The more frequently a warning message is delivered, the more likely the public is to believe it. A person is more likely to believe and/or personalize a warning message if they observe cues that support the message. If a person has had previous hazards experience, they are more likely to believe a warning message. If confirmation of the disaster/hazard happens, people are more likely to believe and/or personalize a warning message. A person is more likely to personalize a message if it comes from a credible source. The more specific a warning message is, the more likely a person is to personalize it. The more hazards experience a person has had, the more likely they are to personalize a warning message. Members of disenfranchised ethnic groups are less likely to personalize warning messages. The more specific a warning message is, the more likely the public is to respond to it. A person is more likely to respond to a warning message if they have had prior hazards experience. If a person has knowledge about a protective response, they are more likely to respond to a warning message. If a person feels some personal efficacy, they are more likely to respond to a warning message.   Believing a warning message increases the likelihood of responding to it.   The more a person personalizes a warning message, the more likely they are to respond to it. If a family experiences frequent kinship interaction, they are more likely to hear a warning message.

Perry, Ronald W. and Marjorie R. Greene. 1983. *Citizen Response to Volcanic Eruptions: The Case of Mt. St. Helens*. New York, NY: Irvington Publishers.

Abstract

Two National Science Foundation grants enabled the researchers to study short-term citizen response to Mount St. Helens eruptions from the first steam and ash eruption of March 17, 1980, until several months after the May 18th blast. Specifically, the research documented human response patterns to volcanic eruptions, and identified important influences on individuals' decisions to undertake specific protective actions when an eruption threatened. Data allowed the researchers to assess people's beliefs about the volcano prior to the May eruption, and to examine protective strategies adopted to cope with the volcano during and after the May event. Specific topics investigated include individual hazard perception, citizen awareness, emergency preparedness information, response to the May 18 eruption, the nature and types of protective actions, belief in the warnings that were issued, the role of family emergency planning, evacuation behavior, and emergency response policy issues.

Causal Findings

People are more likely to believe a warning message if it is delivered via electronic media. The more frequently a warning message is delivered, the more likely the public is to believe it. The public is more likely to believe a warning from an official source. The greater a persons perceived risk, the more likely they are to believe a warning message. If a person has had hazard experience in the past, they are more likely to understand a warning message. The more specific a warning message is, the more likely a person is to personalize it. The more a person believes a warning message, the more likely they are to personalize it. The more specific a warning message is, the more likely a person is to confirm the message. The more specific a warning message is, the more likely the public is to respond to it. If a family is together in the same place at the same time, they are more likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it. Receiving a warning message through a personal channel, increases the likelihood of a person believing the message.

Perry, Ronald W., Marjorie R. Greene, and Michael K. Lindell. 1980. "Enhancing Evacuation Warning Compliance: Suggestions for Emergency Planning." *Disasters* 4 (4):433-449.

Abstract

This article reviews a number of possible incentives that are suggested by the authors as general elements of more specific plans. A primary objective of the article is to underscore the importance of advance planning in coping with hazards and to argue that, even though limited, existing research can be productively used in the planning process. The empirical data collected from five northwest Washington communities, each of which have experienced flooding, tentatively suggest that emergency plans that guide and channel citizen action into complementary and productive behavior patterns are the most effective. The types of incentives to evacuate specifically considered are sheltering, transportation, the role of the family and security and property protection.

Causal Findings

The more experience a person has with disasters/hazards, the more likely they are to respond to a warning message. The better a person is able to perceive their time away from home, the more likely they are to respond to a warning message. If a person has had a recent experience with a hazard/disaster, they are more likely to respond to a warning message. The more time there is to impact of a disaster, the less likely a person is to respond.

Perry, Ronald W., Marjorie R. Greene, and Alvin Mushkatel. 1983. "American Minority Citizens in Disaster." Seattle, WA: Battelle Human Affairs Research Center.

Abstract

Results are presented of a multi-year study of minority citizen behavior in disasters. Three aspects of emergency management are addressed: warning response, preparedness behavior, and community relocation as a flood mitigation measure. Study findings support the hypotheses that as levels of perceived personal risk and warning belief increase, citizens are more likely to comply with evacuation warnings. Blacks who perceive risk to be low are more likely to undertake some protective action as warning belief increases, but the majority still do not evacuate. Whites and Mexican Americans tend to continue their normal routine when they believe their risk is low, even if risk warnings increase.

Causal Findings

People are more likely to believe a warning message if it is delivered via electronic media. The public is more likely to believe a warning from an official source. The greater a persons perceived risk, the more likely they are to believe a warning message. If confirmation of the disaster/hazard happens, people are more likely to believe a warning message. A person is more likely to personalize a message if it comes from a credible source. The more specific a warning message is, the more likely a person is to personalize it. A person is more likely to confirm a warning message if they have heard it. Black people are more likely to respond to a warning message than are non-blacks. If a person has knowledge about a protective response, they are more likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it. Receiving a warning message through a personal channel, increases the likelihood of a person believing the message.

Perry, Ronald W. and Michael K. Lindell. 1986. "Twentieth-Century Volcanicity at Mt. St. Helens: The Routinization of Life Near an Active Volcano." Tempe, AZ: School of Public Affairs, Arizona State University.

Abstract

This report describes a systematic attempt to study citizen adaptation to volcano hazard in the communities of Toutle and Lexington, Washington. The type of information collected during the research included threat awareness by perceived risk to personal safety and property, the threat awareness of school-aged children, perceived vulnerability by the children in a household, the reasons for various hazard adjustments, and the degree of disruption of household routine attributed to the volcano's proximity. Among the findings it is suggested that a higher level of perceived risk exists when there is 1) less confidence in the efficacy of protective measures, and 2) a heightened feeling of the probability of future disaster impacts. Other findings indicate that employment in a hazard-related occupation is associated with a greater level of threat knowledge, and that the greater the proportion of protective information received from friends and relatives, the greater the degree of hazard adjustment.

Causal Findings

The public is more likely to hear a warning message if they have personal contact with the messenger. The more community involvement a person has, the more likely they are to hear a warning message. People who have had previous experience with disasters, are more likely to hear warning messages. The more hazard knowledge a person has, the more likely they are to understand a warning message. If a person has had hazard related employment, they are more likely to understand a warning message. The greater a persons' perceived personal and/or property risk, the more likely they are to understand a warning message. If the receiver a warning message has school-aged children, they are more likely to understand a warning message. The more a person has thought about a hazard/disaster, the more likely they are to understand a warning message. The closer in geographical proximity a person is to disaster/hazard, the more likely they are to personalize a warning message about that disaster. The more hazards knowledge a person has, the more likely they are to personalize a warning message. The greater a persons' perceived personal risk, the more likely they are to personalize a warning message. People are more likely to respond to a warning message when that message comes from a familiar source. A person is more likely to respond to a warning message if they have had prior hazards experience and/or hazards knowledge. The more a person personalizes a warning message, the more likely they are to respond to it.

Perry, Ronald W. and Michael K. Lindell. 1991. "The Effects of Ethnicity on Evacuation Decision Making." *International Journal of Mass Emergencies and Disasters* 9(1):47-68.

Abstract

Many gaps still remain in the empirical record of behavioral response to evacuation warnings, particularly in the area of warning compliance among ethnic groups. This study employs a single stage theoretical model to examine how three ethnic groups--blacks, whites, and Mexican-Americans--respond to warnings, perceive risk, and view the credibility of warning sources. Other independent variables evaluated in the model include warning content, warning confirmation, income level, and whether the groups possess an adaptive plan for evacuating a threatened area. While it is possible to conclude that ethnic variations do exist on variables related to evacuation compliance, the model basically found that ethnicity and income had statistically nonsignificant effects upon warning compliance. The study also indicated that the best predictor of compliance in each of the data sets was the level of perceived risk. The model was tested using data gathered from a flood in Abilene, Texas and a hazardous substance spill in Mt. Vernon, Washington.

Causal Findings

There is no relationship between a persons' income and their likelihood of responding to a warning message. There is no relationship between race/ethnicity and a persons' likelihood of responding to warning message.

Perry, Ronald W. and Michael K. Lindell. 1997. "Aged Citizens in the Warning Phase of Disasters: Re-Examining the Evidence." *International Journal of Aging and Human Development* 44 (4):257-267.

Abstract

While there is a strong consistent empirical literature on older citizens in the recovery period of disasters, there is much less research on how the elderly respond to disaster warnings. Furthermore, there are conflicting findings among these studies, some characterizing the elderly as noncompliant and less likely to cooperate with authorities, while others find the elderly no less responsive than other age groups. The current article reviews the literature in this area and tires to sort out conflicting findings in terms of the timing of the research and methodological considerations. Data are analyzed from nine disasters-representing flood events, volcanic eruptions, and hazardous materials emergencies-which show citizens over sixty-five years old no less likely to comply with disaster warnings.

Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1980. "The Implications of Natural Hazard Evacuation Warning Studies for Crisis Relocation Planning." Seattle, WA: Battelle Human Affairs Research Center.

Abstract

Human response to evacuation warnings is reviewed in light of existing social science knowledge and the implications of this research are examined as it concerns citizen response to relocate under Crisis Relocation Planning (CRP). Funded by the Defense Civil Preparedness Agency (now part of FEMA) in 1978, the study demonstrates that it is appropriate to examine nuclear attack within the same conceptual and analytic framework as any other type of disaster agent, whether natural or man-made. Earlier research on behavior in natural disasters was consulted for significant factors in evacuation response, such as perceived threat and personal risk. To be effective, a CRP program needs 1) a well-defined structure which has been disseminated to, and understood by the general public, 2) a high degree of visibility, 3) to be recognized as an effective means of coping with the crisis, and 4) a provision for adequate training of pivotal management personnel. In addition, the public must be educated to recognize and interpret the warning message that is meant to signal the start of the evacuation process.

Causal Findings

The more specific a warning message is, the more likely a person is to personalize it. If a person has knowledge about a protective response, they are more likely to respond to a warning message. If a family is together in the same place at the same time, they are more likely to respond to a warning message.

Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1981. *Evacuation Planning in Emergency Management*. Lexington, MA: Lexington Books.

Abstract

This publication basically is a reprint of a report prepared by the authors for the Battelle Human Affairs Research Center in Seattle that was entailed "Evacuation Decision-Making and Emergency Planning." The study focuses on the problem of evacuation as a protective mechanism for coping with riverine flooding in four western U.S. communities. Flood hazard was specifically chosen for examination because of its potential threat to virtually every community in the U.S. Objectives of the study were 1) to empirically develop an integrated framework which utilizes factors important in citizens' decisions to evacuate an area following a flood warning, and 2) to suggest methods in which existing evacuation plans can be improved or new plans developed that will increase the likelihood of compliance to such a warning. Features include: A brief description of evacuation history together with an evacuation typology; aspects of the structure and delivery of warnings are examined; and the role of social networks in the determination of warning response is discussed.

Causal Findings

People with membership in a subculture and/or a voluntary association are more likely to hear a warning message. The older a person is, the less likely they are to hear a warning message. The more certainty with which a warning message is delivered, the more likely the receiver is to believe it. The more frequently a warning message is delivered, the more likely the public is to believe it. The more specific the warning message is, the more likely the receiver is to believe, understand, and/or personalize it. If confirmation of the disaster/hazard happens, people are more likely to believe and/or personalize a warning message. If a person has had hazard experience in the past, they are more likely to understand a warning message. A person is more likely to personalize a message if it comes from an official source and/or they are familiar with the source. The more hazards experience a person has had, the more likely they are to personalize a warning message. The more time until a disasters' impact, the more likely a person is to confirm that message. A person is more likely to respond to a warning message if they receive that message from a face-to-face channel. The more frequently a warning message is delivered, the more likely the public is to respond to it. The public is more likely to respond to a warning message if it comes from an official source. The public is more likely to respond to a warning message if the message comes from a credible source. People are more likely to respond to a warning message when that message comes from a familiar source. The more specific a warning message is, the more likely the public is to respond to it. The older a person is, the less likely they are to respond to a warning message. The older a person is, the more likely they are to respond to a warning message. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person is more likely to respond to a warning message if they have had prior hazards experience. If a person has knowledge about a protective response, they are more likely to respond to a warning message. A person with membership in social networks is more likely to respond to a warning message. A

person with membership in a minority group is less likely to respond to a warning message. If a person has had a recent experience with a hazard/disaster, they are more likely to respond to a warning message. If a family is together in the same place at the same time, they are more likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it. If a family experiences frequent kinship interaction, they are more likely to hear a warning message.

Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1982a. "Crisis Communications: Ethnic Differentials in Interpreting and Acting on Disaster Warnings." *Social Behavior and Personality* 10 (1):97-104.

Abstract

This report examines the problem of communicating emergency information to communities that are multi-ethnic. A probability sample of flood evacuation warning recipients (n=200) was taken from a small Western United States town with a large segment of Mexican-American citizens. Analyses of these data revealed three primary differentials by ethnicity: (1) Mexican-Americans were more skeptical than whites about believing warning messages, no matter how specific the message; (2) Mexican-Americans interpreted the same warning messages as indicating lower levels of personal danger; and (3) Mexican-Americans were less likely to undertake a protective action (that is, evacuate) than whites. These findings suggest that there is a need for studies which explore the warning response decision making process used by minorities, examine the criteria on which minorities interpret warning message content, and review the ways in which minorities evaluate the validity and accuracy of any given message.

Causal Findings

The more specific the warning message is, the more likely the receiver is to believe it and/or personalize it. Members of minority groups are less likely to believe a warning message. Members of disenfranchised ethnic groups are less likely to personalize warning messages. A person with membership in a minority group is less likely to respond to a warning message. Believing a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it.

Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1982b. "Threat Perception and Public Response to Volcano Hazard." *Journal of Social Psychology* 16:119-204.

Abstract

This paper examines perceptions of the threat posed by a volcano in Washington State. In particular, interest is focused upon the level of perceive risk, the source and frequency of information receipt and the level of confidence of the affected population in the adequacy of the information received. A probability sample of 230 citizens was taken from seven communities near Mt. St. Helens, Washington, which resumed volcanic activity in March 1980 after a 123-year dormant period. The data analyses indicate that intensive dissemination of hazard information during a short period of imminent threat of disaster sensitized people to the pending event.

Causal Findings

The public is more likely to hear a warning message that is delivered via the mass media. A person is more likely to personalize a message if it is delivered frequently. A person with membership in a minority group is less likely to respond to a warning message.

Perry, Ronald W. and Lisa S. Nelson. 1991. "Ethnicity and Hazard Information Dissemination." *Environmental Management* 15(4):581-587.

Abstracts

Citizens from two communities were questioned regarding the sources from which they have previously obtained information abut environmental hazards and their preferences for different communication channels. Three ethnic groups - whites, blacks, and Mexican-Americans - were represented among those questioned. While all three ethnic groups described similar patterns of past information receipt, it was found that Mexican-Americans obtained more information through social network contacts than whites or blacks. Ethnic differentials emerged when citizens were asked about preferred sources for information receipt. While radio was identified as desirable by all three groups, only minority citizens expressed a preference for local television as a dissemination mode and only Mexican-Americans favored neighborhood meetings. Mailed dissemination and newspapers were preferred primarily by whites and blacks. The implications of the results for the conduct of hazard information dissemination are examined.

Causal Findings

The public is more likely to hear a warning message that is delivered via the mass media.

Peters, Richard G., Vincent T. Covello, and David B. McCallum. 1997. "The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study." *Risk Analysis* 17(1):43-54.

Abstract

This study examines a key component of environmental risk communication; trust and credibility. The study was conducted in two parts. In the first part, six hypotheses regarding the perceptions and determinants of trust and credibility were tested against survey data. The hypotheses were supported by the data. The most important hypothesis was that perceptions of trust and credibility are dependent on three factors: perceptions of knowledge and expertise; perceptions of openness and honesty; and perceptions of concern and care. In the second part, models were constructed with perceptions of trust and credibility as the dependent variable. The goal was to examine the data for findings with direct policy implications. One such finding was that defying a negative stereotype is key to improving perceptions of trust and credibility.

Causal Findings

People are more likely to trust risk communications and believe they are credible when they perceive the source to be knowledgeable and expert, open and honest, and concerned and caring.

Pfister, Neil. 2002. "Community Response to Flood Warnings: The Case of an Evacuation from Grafton, March 2001." *Australian Journal of Emergency Management* 17:19-29.

Abstract

During the Grafton floods in March 2001, a decision to evacuate 12,000 residents resulted in fewer than ten percent of Grafton's population evacuating the city during the nine hours that the evacuation was in effect. This article explores why the flood warnings issued during the Grafton Floods in March 2001 were ignored by ninety percent of the community. More specifically, the article looks at data collected through a telephone survey and face-to-face interviews to determine the extent to the evacuation form Grafton, to investigate the reasons why people chose to evacuate or to not evacuate and the assess the impact of an evacuation warning that proves to be unnecessary. The author concludes that the residents did not evacuate because they were not prepared to do so. In such, the article recommends community education programs, more informative evacuation warnings and that emergency operations serve to reinforce the authority of emergency services.

Causal Findings

The public is more likely to hear a warning message that is delivered via multiple channels. A person is more likely to respond to a warning message if they receive that message from a face-to-face channel. There is no relationship between receiving a warning message from an official source and the publics' likelihood of responding to that message. The more disbelief a person has about an impending disaster/hazard, the less likely they are to respond to a warning message. There is no relationship between false alarms and responding to a warning message. There is no relationship between people having pets and their likelihood for responding to a warning message. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it.

Ponting, J.R. 1974. "It Can't Happen Here: A Pedagogical Look at Community Coordination in Response to a Toxic Gas Leak." *Emergency Planning Digest* 1:8-13.

Abstract

This paper focuses on the October 2, 1973 explosion of a gas well near Camrose, Albert, Canada to identify some of the more salient sociological problems encountered by disaster response organizations. Problems highlighted include: the 'it-can't-happen-here' syndrome, a clear definition of this specific situation and disaster situations in general, unclear lines of authority and roles, as well as gaps in the response organizations' communication network. Suggested recommendations include: regular practice with as authentic as possible situations, establishing pre-existing evacuation plan, and that the police department assign and integrate an officer into the communications network.

Causal Findings

If a person has had previous hazards experience, they are more likely to believe a warning message.

Punongbayan, Raymundo S., Christopher G. Newhall, Leonila P. Bautista, Delfin Garcia, David H. Harlow, Richard P. Hoblitt, Julio P. Sabit, and Renato U. Solidum. 1996. "Eruption Hazard Assessments and Warnings." Pp. 67-85 in *Fire and Mud: Eruptions and Lahars of Mount Pinatubo, Philippines*, edited by C. G. Newhall and R. S. Punongbayan. Seattle, WA: University of Washington Press.

Abstract

An urgent program to monitor unrest and to interpret the record of past eruptions at Mount Pinatubo led to remarkably accurate warnings of one of the largest eruption of this century. Three cornerstones of the warnings were an interpretation of the origin of the unrest, a simple five-level warning scheme and a hazards map based upon a composite 'worst-case' of prehistoric eruptions. Warnings were coupled with an intensive educational campaign to ensure that they were not only received but also understood. The authors conclude that in hindsight stronger warnings could have been given and a modification of the numerical alert scheme to be less specific about time windows and more specific about distinctions between small and large eruptions. Furthermore, it is suggested that credibility in these sorts of situations will always be an issue: credibility is gained only when an eruption is correctly predicted, at which point it is too late. The authors suggest in-person or videotaped accounts by officials who averted or failed to avert volcanic disasters elsewhere to mitigate these limitations.

Qijia, Zou and Zhang Shaoquan. 1990. "Social and Economic Responses to Earthquake Prediction and Countermeasures Against the Prediction Issuance." *Acta Seismologica Sinica* 3:223-231.

Abstract

With the theoretical and technological aspects of earthquake prediction still in their infancy, the most pressing problem is how to maximize social and economic benefits from existing knowledge about predictive methods. Based on economic loss data from several major Chinese earthquakes, the authors present a curve that relates earthquake magnitudes to economic losses caused 1) by actual quakes and 2) by false earthquake predictions. The study finds that it is unnecessary to issue a prediction to the public if the magnitude is anticipated to be equal or less than M6.0; issuing the prediction possibly could cause more casualties and economic loss. Although it is felt that local officials and the general public cannot comprehend how much damage might occur due to a predicted earthquake of any given magnitude, it is maintained that earthquake mitigation and preparedness measures still need to be implemented regardless of the anticipated magnitude associated with a given prediction.

Quarantelli, E. L.1980. "Evacuation Behavior and Problems: Findings and Implications from the Research Literature." Columbus, OH: Disaster Research Center, Ohio State University.

Abstract

The study attempts to isolate what is known and not known about peacetime evacuation procedures; to systematically organize the literature and other research data; and to present recommendations resulting from the investigation. Findings suggest that the evacuation process usually goes relatively well and is effective in removing people from danger. The problems occur before and after the flight process itself. In addition, evacuation seldom proceeds in a linear path, but is subject to multiple and disjunctive influences. Knowledge about the evacuation process, particularly as it pertains to natural hazards, rests on a rather weak research base. Descriptive studies are few and far between, and theoretical treatments are even more rare. The study finds that in America there exists a poor organizational basis for initiating and conducting a mass evacuation effort resulting from a natural or technological disaster Planning for evacuation often takes an unrealistic approach by assuming that evacuees have to be controlled. A further preparedness shortcoming is the failure to realize that evacuation also involves arriving at a given destination and a return to the place of origin.

Causal Findings

The public is more likely to hear a warning message that is delivered via the mass media. The public is more likely to believe a warning from an official source. A person is more likely to believe a warning message if they observe cues that support the message. If a person has had previous hazards experience, they are more likely to believe a warning message. The more stress a person feels, the less likely they are to believe a warning message. A person is more likely to understand a warning message if it comes from an official source. Contradictory findings indicate that prior hazards experience may or may not be related to the propensity to understand a warning message. The clearer the warning message is, the more likely the public is to respond to the warning. The more consist a warning message is, the more likely the public is to respond to it. The more frequently a warning message is delivered, the more likely the public is to respond to it. The public is more likely to respond to a warning message if it comes from an official source. The public is more likely to respond to a warning message if the message comes from a credible source. The more specific a warning message is, the more likely the public is to respond to it. A person with children is more likely to respond to a warning message than someone without children. The more time there is to impact of a disaster, the less likely a person is to respond.

Quarantelli, E. L. 1984. "Perceptions and Reactions to Emergency Warnings of Sudden Hazards." *Ekistics* 309:511-515.

Abstract

This paper summarizes the major findings regarding reactions of humans to disaster warnings of an immediate event, including how the might affect evacuation. The paper focuses on individual reactions to relatively short-term warnings. The reaction of individuals to longer-term warnings is not explored. More specifically, this article addresses factors affecting the definition of the situation, factors affecting evacuation as well as provides implications for disaster planning and operations.

Causal Findings

The more specific the warning message is, the more likely the receiver is to believe it and/or understand it. If confirmation of the disaster/hazard happens, people are more likely to believe a warning message. A person is less likely to respond to a warning message if they have a fear of looting. If a person feels some personal efficacy, they are more likely to respond to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Quarantelli, E. L. 1990. "The Warning Process and Evacuation Behavior: The Research Evidence." Newark, DE: Disaster Research Center, University of Delaware.

Abstract

This paper summarizes and highlights the major findings regarding reactions of human beings to disaster warnings of an immediate treat. Response in this approach is viewed more narrowly as the adjustive behavioral outcome of the reaction pattern. Reaction is the broader set of activities involving in exposure to and use of disseminated warning messages as well as other observations regarding a dangerous situation. The paper focuses on the reaction of individuals to relatively short-term warnings as might be issued in a sudden crisis, rather than longer term threats such as might be involved in famines, droughts most epidemics and even long range earthquake predictions. In general, the research empirically shows that there are qualitative differences in reactions to warnings in the two kinds of situations; warnings are less recognized, believed and responded to in the longer run crises. Applications of research findings are provided.

Quarantelli, E. L. and Dennis Wenger. 1992." A Study of Local Mass Media Coverage of Two Disasters in the United States." *The Bulletin of Faculty of Sociology Tokyo University* 29:77-138.

Abstract

This reports the findings of a comparative study of local mass media response to two disasters, Hurricane Alicia that struck the area around Houston, Texas in August of 1983 and a major flashflood that inundated Tulsa, Oklahoma in May of 1984. More specifically, the study examines the operation of local mass media organization in the immediate pre-impact, impact and immediate post-impact periods of disasters and to compares these observations with routine operations. Data was obtained from a variety of quick-response field techniques that included interview schedules, observational guidelines and document collection checklist; in all, 71 interviews were conducted. Findings and conclusions are presented in terms of community profiles of media involvement in disaster reporting, in-depth case studies of the media operations with a particular focus on changes due to the disaster and a content analysis of newspaper coverage.

Reser, Joseph P. and Shirley A. Morrissey. "Coping with Natural Disaster Warnings: A Need for Pre-Impact Psycho-Educational Intervention." Unpublished report.

Abstract

Warning communication and natural disaster preparedness literatures are reviewed in a quest for meaningful psychological interventions and/or content. Notwithstanding cogent arguments for the dissemination of psychological information to individuals in the context of natural disaster preparedness mitigation, there is a remarkable absence of any pre-impact psycho-educational content or focus. Relevant psychological processes (e.g., anticipatory stress, protection motivation, event appraisal and coping, social comparison and support) are reviewed in the context of tropical cyclone (hurricane) warning communications in Northern Australia. It is argued that providing psychological information which allows individuals to anticipate and identify particular emotional states in themselves and others, and access coping options and suggestions, facilitates psychological and situational preparedness and moderates pre and post-impact distress and trauma. A psycho-educational intervention based on a modified stress inoculation procedure is suggested and professional ethical and social relevance issues are canvassed.

Riad, Jasmin K. and Fran H. Norris. 1998. "Hurricane Threat and Evacuation Intentions: An Analysis of Risk Perception, Preparedness, Social Influence and Resources." Newark, DE: Disaster Research Center, University of Delaware.

Abstract

The goal of this study was to test a model in which the decision to evacuate is a function of four processes (risk perception, preparedness, social influence, and economic resources). Participants were interviewed by telephone both while they were under a hurricane warning and after the threat had disappeared (pre-post sample). Because all respondents had been participants in an earlier panel study, pre-threat data were also available. Because all respondents had been participants in an earlier panel study, pre-threat data were also available. The pre-post sample of 95 panelists was older than the non-respondent sample of 54 panelists who could not be reached b phone during the warning period but was otherwise comparable. The results indicated that higher risk perception and the belief that one is influenced by others are the strongest predictors of intentions to evacuate. Furthermore, risk perception was shown to mediate the influences of many background variables (e.g., experiences, demographics) on evacuation intentions. Post-event comparisons between the pre-post group and a reactivity control group of 66 panelists suggested that the wring period interview did not increase anxiety by mat have influenced reactive preparedness.

Causal Findings

The more anxiety a person feels about an impending disaster/hazard, the more likely they are to believe a warning message. The greater the social influence, the more likely a person is to believe a warning message. Women are more likely than men to respond to a warning message. Black people are more likely to respond to a warning message than are non-blacks. There is no relationship between having children and responding to a warning message. A person is less likely to respond to a warning message if they have had prior hazards experience. If a person owns a home, they are less likely to respond to a warning message. If a person perceives an increased risk or loss, they are more likely to respond to a warning message. Someone who is experiencing low social embeddedness is more likely to respond to a warning. There is no relationship between a persons resources and their likelihood for responding to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. If a person feels some personal efficacy, they are more likely to respond to a warning message.

Riad, Jasmin K., Fran H. Norris, and R. Barry Ruback. 1999. "Predicting Evacuation in Two Major Disasters: Risk Perception, Social Influence, and Access to Resources." *Journal of Applied Social Psychology* 29 (5):918-934.

Abstract

The complex and somewhat bewildering phenomenon of why people sometimes decide not to evacuate from a dangerous situation is influenced by a combination of individual characteristics and 3 basic social psychological processes: (a) risk perception, (b) social influence, and (c) access to resources. This study used a combined sample of 777 adults interviewed after Hurricanes Hugo and Andrew. Although numerous variables significantly predicted evacuation, much variance in this behavior still remained unexplained. Different population subgroups gave different reasons for not evacuating (e.g., severeness of storm, territoriality). A multifaceted and tailored approach to both individuals and communities is needed; a simple warning is often not enough.

Causal Findings

Reasons for non-evacuation vary by population subgroup and are based on individual characteristics, risk perception, social influence, and access to resources.

Rich, Richard C. and W. David Conn. 1995. "Using Automated Emergency Notification Systems to Inform the Public: A Field Experiment." *Risk Analysis* 15:23-28.

Abstract

Research and experience have shown that it can be difficult to get citizens to pay attention to risk messages and preparedness information in the absence of an actual emergency. As the use of computerized systems that alert the public to hazards by automatically ringing their home phones increases, the authors thought it important to ask if tests of these "call down" systems can also be used to convey pre-emergency information. They worked with local government to add instructions on how to shelter-in-place to the message on a routine test of a call down system. They then surveyed a test group and a control group before and after the test call and a second control group only after the call. The results indicate that the test call raised awareness of the emergency notification system without generating undue concern about the possibility of a chemical accident. Those who received the test call demonstrated significant improvements in their knowledge of how to shelter-in-place while no such improvement was observed in those who did not get the call. While the nature of the sample used in this study limits generalizability, they feel this outcome is positive enough to warrant further exploration of this method of disseminating risk information and preparedness instructions.

Rincon, Elizabeth, Marc Y-R Linares, and Barry Greenberg. 2001. "Effect of Previous Experience of a Hurricane on Preparedness for Future Hurricanes." *American Journal of Emergency Medicine* 19 (4):276-279.

Abstract

The purpose of this study was to examine the hypothesis that having experienced a major hurricane will promote better preparedness for future ones. A survey was conducted in November 1999 at Miami children's Hospital. No statistical differences were found between the population that was present in Dade County during hurricane Andrew and the one that was not; in regard of the possession of a generator at home, the obtaining of material to secure their home, the presence of hurricane shutters, the willingness to evacuate their home in case of advise. Only 37% of the families that experienced hurricane Andrew would go to a shelter versus 49% for the families that did not (P< .05). It was concluded that we can safely reject the hypothesis that having experienced a major hurricane will promote better preparedness for future ones. Those who experienced hurricane Andrew were less willing to go to a shelter compared with the group that did not.

Rogers, George O. 1985. "Some Policy Implications of Human Components of Emergency Warning." Pittsburgh, PA: Center for Social and Urban Research, University of Pittsburgh.

Abstract

This paper examines the human component of the warning process in terms of potential obstacles to warning dissemination. On the basis of a detailed analysis of the existing research pertaining to emergency warnings, twelve policy implications are highlighted.

Causal Findings

The older a person is, the less likely they are to hear a warning message. The public is more likely to believe a warning from an official source. The greater a persons perceived risk, the more likely they are to believe a warning message. The more consistency with which a warning message is delivered, the more likely the receiver is to understand it. The more frequently a warning message is delivered, the more likely the receiver is to understand it. A person is more likely to understand a warning message if it is sent via multiple channels. A person is more likely to confirm a warning message if they have hazards knowledge. A person is more likely to confirm a warning message if they have heard it. The public is more likely to respond to a warning message if it comes from an official source. The more specific a warning message is, the more likely the public is to respond to it. If a person has knowledge about a protective response, they are more likely to respond to a warning message. A person with membership in social networks is more likely to respond to a warning message.   Having confirmation of the disaster/hazard increases the likelihood of a person responding to it.

Rogers, George O. 1989. "Communication of Emergency Warning: A Cyclical Process." *Disaster Management* 1:23-32.

Abstract

In this article, the author asserts that conceptually emergency warnings are cyclical and composed of a four interdependent phases: 1) hazard detection; 2) hazard assessment; 3) warning transmission; and 4) response. People and organizations face potential obstacles to effective communication as they enter the waning process. Because people are integral links in the warning process, technological warning systems alone are unlikely to disseminate warning effectively. For communication of emergency warning to be effective, people have to be integrated into the process.

Rogers, George O. 1992. "Aspects of Risk Communication in Two Cultures." *International Journal of Mass Emergencies and Disasters* 10:437-464.

Abstract

When people from two distinct cultures attempt to communicate, they often fail to share the fundamental foundation upon which to establish meaningful two-way communication (e.g. language and belief). Risk communication under such circumstances demands special attention; extra effort on the part of people from both cultures to understand and appreciate the risks from a comprehensive perspective that accommodates both sets of interests. This paper examines the communication about risk between the U.S. Army and the native Polynesian cultures in the Pacific Ocean. Specifically, the article analyzes the written record of the proceedings to comply with the National Environmental Policy Act of 1969 that led up to the shipment of the European Stockpile of unitary chemical weapons to Johnston Atoll that was completed November 1990. The analysis indicates that while both the native cultures and the Army spoke the same language, the U.S. Army and the native cultures failed to communicate about the risks associated with the movement and destruction of weapons. They failed to establish risk communication dialogue, and never established a common framework for effective risk communication. The people involved from all groups did not establish a shared meaning, and no dialogue was established to clarify meaning as misunderstandings occurred. This condition contributed to increased distrust, and undermined the credibility of both perspectives.

Rogers, George O. 1994. "The Timing of Emergency Decisions: Modeling Decisions by Community Officials during Chemical Accidents." *Journal of Hazardous Materials* 37:353-373.

Abstract

Protecting the public from airborne chemical releases is limited by the timing of the implementation of actions taken and the capacity of those actions to avoid or reduce exposure. This paper examines the community decision processes during emergencies to identify critical factors associated with the timing of emergency warning, and protective action recommendations. This research examines the decision process by tracing emergency response form the outset of the community decision process, through the decision to warn the public, including the communication of hazard to the public, and the all clear at the end of the emergency period. Both community authorities and the public cycle through hazard detection, assessment, communication and behavioral response as they become aware of the hazard. A sample of emergency decisions during chemical emergencies was examined via post-emergency interviews with key community officials. Emergency responders in a systematic sample of events after 1984, but period to 1990, were interviewed in the fall of 1989. Finding that decisions in more recent events were more easily reconstructed, a randomly selected half of the significant chemical emergencies occurring during 1990 were interviewed within weeks of the chemical events. Previous work shows that community decision processes are seldom immediate and often involve information seeking. T his descriptive work is expanded herein to provide better models of the key factors effecting decision processes in chemical emergencies. Regression models of these data indicate that protective action and warning decisions occur more rapidly than all clear decisions, and that each decision is influenced by different factors in the decision process. Moreover, these data indicate that the role of experts changes throughout the emergency response. When decisions lead to the active avoidance of exposure, officials seem to take evasive action more quickly, but when failure to decide results in passive avoidance of exposure and continued inconvenience of the public, the decision process is often protracted.

Causal Findings

The public is more likely to respond to a warning message if existing leadership conflicts have been resolved. When standard operating procedures are followed for issuing a warning message, the public is more likely to respond to the message.

Rogers, George O. and Jiri Nehnevajsa. 1984. "Crisis Conditions." Pittsburgh, PA: Center for Social and Urban Research, University of Pittsburgh.

Abstract

Attempting to locate document.

Causal Findings

The closer in proximity to the impact of the disaster/hazard, the more likely a person is to hear a warning message. The public is more likely to believe a warning from an official source. A person is more likely to personalize a message if it comes from a credible source.

Rogers, George O. and Jiri Nehnevajsa. 1987. "Warning Human Populations of Technological Hazards." Pp. 357-362 in *Radiological Accidents: Perspectives and Emergency*, edited by C. Chester and K. S. Grant. Washington, D.C.: American Nuclear Society.

Abstract

Warning people of an impending hazard seeks to make the aware of the threat and to elicit actions that would minimize the danger to life and property. Because technological and natural hazards differ in important ways, the alerting and notification process for technological and natural hazards is also different. One of the differences rest in the ability of people to detect many natural hazards in a direct sensory manner; technological hazards often make such detection difficult. For example, detection of radiological releases without instrumentation is nearly impossible, but even with tornadoes where warning is notoriously difficult, people are at least able to use their senses to detect the potential for hazard. Hence, warning for technological hazards is in some ways more problematic, generally representing a rather rapid shift from normalcy to emergency. This paper builds on the significant foundation natural hazard waning research in developing a model of waning suitable for technological hazards. This model specifically examines immediate cascading, or networking, of the warning signal and message, so often reported in the natural hazard literature. The implications for technological and natural hazard warning systems are examined.

Causal Findings

People with network memberships are more likely to hear a warning message. The closer in geographical proximity a person is to disaster/hazard, the more likely they are to personalize a warning message about that disaster. The more hazards experience a person has had, the more likely they are to personalize a warning message. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person is more likely to respond to a warning message if they have had prior hazards experience. If a person receives social cues about a disaster, they are more likely to respond to a warning message.

Rogers, George O. and John H. Sorensen. 1988. "Diffusion of Emergency Warnings." *The Environmental Professional* 10:281-294.

Abstract

An important part of emergency response involves warning the public of an imminent disaster. This paper proposes a general model for the diffusion of emergency warnings, with particular regard to its potential application to Title 3 of the Superfund Amendments and Reauthorization Act (SARA). Six different types of warning systems are examined: 1) sirens and alarms that prompt people to obtain additional information from the media; 2) tone-alert radios, which are centrally activated and broadcast a warning message; 3) automatic-dialing telephone systems; 4) a system consisting of the emergency broadcast system and officials going through areas at risk to disseminate the warning; 5) a combination of siren and tone-alert radio systems; and 6) a combination of automatic-dialing telephone and siren systems. The systems are then analyzed to determine their effectiveness under various hazard-onset conditions. A combination of sirens with automatic-dial telephones or tone-alert radios was determined to provide the most rapid dissemination of warnings.

Causal Findings

The public is more likely to hear a warning message that is delivered via multiple channels. People are less likely to hear a warning message if they are at home and asleep. A person is more likely to hear a warning message if it addresses contagion.

Rogers, George O. and John H. Sorensen. 1989. "Warning and Response in Two Hazardous Materials Transportation Accidents in the U.S." *Journal of Hazardous Materials* 22:57-74.

Abstract

Warning system effectiveness is critically important in selecting an appropriate emergency warning system to alert the public to potential danger. This paper examines warning system effectiveness in terms of the timing of warning receipt and response. Warning receipt involves the analysis of when warning system information is received, which includes alerting the public and delivering a warning massage. Response involves what people decide to do on the basis of the information provided in the warning message. Data from post-event surveys conducted in communities affected by two U.S. train derailments in western Pennsylvania, on in Pittsburgh and the other in Confluence, in the spring of 1987 are analyzed. The general logistical model of the diffusion of emergency warning specified in earlier works 1) is examined and found to fit the data from these events quite well. Warning penetration in these two events can be estimated as a function of the simulated models. While response can lag behind warning as much as six hours, the response occurs within an hour after warning receipt on average. Response time is found to be a function of when the warning is received, the warning message and the source of the information.

Causal Findings

The public is more likely to hear a warning message if they have personal contact with the messenger. The public is more likely to hear a warning message if it is delivered via route alerts. The public is more likely to respond to a warning message if it contains simply defined response options and a simply defined risk area. If a person disregards a warning message, they are less likely to respond to that warning. A person is more likely to hear a warning message if it addresses contagion.

Rogers, George O. and John H. Sorensen. 1991. "Diffusion of Emergency Warning: Comparing Empirical and Simulation Results." *Risk Analysis* 11:117-134.

Abstract

As officials consider emergency warning systems to alert the public to potential danger in surrounding areas hazardous facilities, the issue of warning system effectiveness is of critical importance. The purpose of this paper is to present the results of an analysis on the timing of warning system information dissemination including the alert of the public and delivery of a warning message. A general model of the diffusion of emergency warning is specified as a logistic function. Alternative warning systems are characterized in terms of the parameters of the model, which generally constrain the diffusion process to account for judged maximum penetration of each system for various locations and likelihood of the public's being in those places by time of day. The results indicate that either telephone ring-down warning systems or tone-alert radio systems combined with sirens provide the most effective warning system under conditions of either very rapid onset, close proximity or both. These results indicate that single technology systems provide adequate waning effectiveness when available warning time (after detection and decision to warn) extends to as much as an hour. Moreover, telephone ring-down systems provide similar coverage at approximately 30 minutes of available public warning time.

Causal Findings

The public is more likely to hear a warning message that is delivered via multiple channels. The public is more likely to hear a warning message if they have personal contact with the messenger. The public is more likely to hear a warning message if it is delivered via route alerts. People are less likely to hear a warning message if they are at home and asleep. People with memberships in social networks are more likely to hear warning messages. People who observe cues of the impending disaster/hazard are more likely to hear a warning message. A person is more likely to hear a warning message if it addresses contagion. If a person is seeking out information, they are more likely to believe a warning message.

Rohrmann, Bernd. 1995. "Effective Risk Communication for Fire Preparedness: A Conceptual Framework." *The Australian Journal of Emergency Management* 10:42-46.

Abstract

This article presents a comprehensive conceptual framework for effective risk communication for fire preparedness. Based upon a review of the current fire risk communication practices, theoretical input from social-scientific literature and exploratory interviews with experts from fire-fighting organizations, the framework specifies the factors that determine the outcomes of fire risk communication efforts, referring to message, source audience and process attributes. The author focuses on comprehension, acceptance of messages and the link between knowledge and actual behavior in emergencies. The problem analysis concludes with suggestions for and distributing fire hazard information to the public and enhancing commitment and preparedness. Also, integrated evaluation research is strongly recommended.

Rosenthal, Uriel. 1988. "Studies in Holland Flood Disaster 1953: An Essay on the Proto-Sociology of Disaster." *International Journal of Mass Emergencies and Disasters* 6 (3):233-251.

Abstract

In this essay, the author provides some facts and figures pertaining to the Holland flood disaster, and the subsequent four-volume study entitled *Studies in Holland Flood Disaster 1953* (SHFD). These volumes are considered the most important Dutch contribution to the international disaster literature, despite handicaps it faced coming to the public's attention such as its military funding and, therefore, confidentiality.

Causal Findings

If a person has had personal experience with a hazard/disaster in the past, they are more likely to believe and respond to a warning message.

Rothermel, Richard C. 1993. "Mann Gulch Fire: A Race That Couldn't Be Won." Ogden, UT: Intermountain Research Station, Forest Service, U.S. Department of Agriculture.

Abstract

The Mann Gulch fire, which overran 16 firefighters in 1949, is analyzed to show its probable movement with respect to the crew. The firefighters were smoke-jumpers who had parachuted near the fire on August 5, 1949. While they were moving to a safer location, the fire blocked their route. Three survived, the foreman who ignited an escape fire into which he tried to move his crew, wand two firefighters who found a route to safety. Considerable controversy has centered on the probable behavior of the fire and the actions of the crewmembers and their foreman. Modern safety techniques used by 73 firefighters who escaped injury after being trapped on the Butte Fire in 1985 are described for comparison.

Russell, L A, L B Bourque, and J D Goltz. Aug. 1994. "Media Use and the Loma Prieta Earthquake of October 17, 1989." Paper read at The Annual Meeting of the American Sociological Association.

Abstract

Modified random digit dialing (rdd) procedures were used to obtain a representative sample of 656 residents of Santa Cruz, Santa Clara, San Francisco, Alameda and San Mateo counties. Intentional oversampling was conducted in two high-impact areas: northeast edge of the San Francisco Peninsula and Oakland, and the Boulder Creek-Santa Cruz-Watsonville area. Response rates were between 70.3% and 80.6%. Data were collected between April 29 and August 1, 1990, in either English or Spanish. Hypotheses examined relationships between demographic characteristics and electronic media demand, radio use and epicenter proximity, and exposure to media and maladaptive behaviors.

Causal Findings

Exposure to electronic media did not differ with gender, age, ethnicity/race, education, or income. People who were at work or school were not using media; persons at home were exposed to television and those in transit had radios on. Proximity to the epicenter was associated with increased use of radios.

Media exposure was not associated with knowledge about what people should do during an earthquake, perceived earthquake preparedness, or hearing a prediction about a potentially damaging future earthquake.

Exposure to electronic media immediately after the earthquake was associated with increased preparedness planning (family instruction, neighborhood planning, purchase of earthquake insurance, contacting officials, preparedness at work) done after the earthquake. Persons who actively sought exposure with electronic media at the time of the earthquake and who reported that newspapers and interpersonal sources were the preferred sources of information in the days after the main shock were more likely to engage in hazard mitigation after the earthquake (rearrangement of cupboard contents, securing furniture, latching cupboard doors, reinforcing structures).

The 115 persons who cited newspapers as the best source of information after the earthquake and the 28 persons who preferred non-traditional sources of information after the earthquake had more knowledge about disaster recovery agencies than did persons who cited television and radio as best sources.

Saarinen, Thomas F., Victor R. Baker, Robert Durrenberger and Thomas Maddock. 1984. "The Tucson, Arizona Flood of October 1983." Washington, D.C: National Academy Press.

Abstract

Severe flooding occurred in parts of Arizona early in October, 1983. In some circles, the floods were so widespread and severe that they were regarded as the worst disaster since Arizona became a state. NAS/NRC flood disaster reports often concentrate on the meteorological aspects of the event, but this report devotes considerable space to analyses of the damage and its causes, bank erosion, pre-disaster planning, emergency response, the characteristics of desert flooding, and the haphazard history of floodplain planning in areas hit by the storm. Other items worthy of mention are discussions about public perception of the flood hazard, community attitudes towards long-term floodplain planning, future prospects for improving the flood problems in Tucson, and the effect of sand and gravel operations on desert river flood flow. A major conclusion suggests that the nature and pattern of damages and channel change during the 1983 flood demonstrate the profound geomorphic and hydrologic complexity of stream systems in the semiarid West. Nationally standardized procedures for flood-hazard evaluation proved inadequate for anticipating the damages. An area for future social research revolves around the sociological effects of the flood on the tension-ridden community of Clifton.

Causal Findings

The more hazards experience a person has had, the more likely they are to personalize a warning message.

Saarinen, Thomas F. and James L. Sell. 1985. *Warning and Response to the Mount St. Helens Eruption*. Albany, NY: State University of New York Press.

Abstract

The amount of warning for the Mount St. Helens volcanic eruption was probably greater than for any previous geologic hazard in U.S. history. This book gives an overview of the information provided by the U.S. Geological Survey, other public agencies, and the media as a response to the heightened volcanic activity; describes in some detail the physical event, its social and economic impacts; and concludes with a statement of the major benefits of the warning. One hundred and thirty of the main participants in the warning process were surveyed by questionnaire to determine what they did. Findings from the study suggest that 1) the failure to close state and federal lands in the hazard area led to the mistaken belief by the public that those areas were safe; 2) the FEMA response to the disaster was an excellent example of a public information operation in a hazard situation; 3) hazard monitoring, hazard assessment, and hazard warning are equivalent functions; 4) the experience offers a wealth of material for improving emergency service systems and their connections with scientific agencies; and 5) not enough can be said about the importance of planning for disaster response.

Causal Findings

A person is more likely to believe a warning message if they observe cues that support the message. The public is more likely to respond to a warning message if it comes from an official source. Hearing a warning message increases the likelihood of responding to it.

Salter, John, John Bally, Jim Elliott, and David Packham. 1993. "Vulnerability and Warnings." *Macedon Digest* 8:1-6.

Abstract

This paper considers severe weather related warning systems in Australia and proposes some vulnerability related lessons that may have appropriate transfer potential to merit consideration in relations to other hazards and locations. Six issues surrounding the warning messages and their effectiveness are explored, and include: 1) message structure, 2) clarity, 3) consistency and frequency, 4) dissemination channels and credibility, 5) personalization and public participation and 6) boundaries, roles and responsibilities. The author concludes that risk affirms itself as a social construct rather than an objective scientific phenomenon.

Scanlon, Joseph. 1993. "Leaving, Waiting and Coming Back: Evacuation as a Strategy in Emergency Management." Paper presented at the *Conference on Evacuation, Emergency Planning College, Easingwold*. The Emergency Planning College, Easingwold, Carleton University.

Abstract

This report summarizes much of the literature on evacuations and presents it as sequential or chronological considerations with which emergency managers may deal. The author starts by defining and contextualizing evacuations as only one of may hazard mitigation strategies. The report then addresses the decision to call for an evacuation, the warning process and components of effective warnings. It goes on to discuss the role of law enforcement agencies, the need for and workings of pubic accommodations as well as a more general view of evacuation management including traffic and the process of ending an evacuation.

Scanlon, Joseph and Alan Frizzell. 1979. "Old Theories Don't Apply: Implications of Communication in Crisis." *Disasters* 3(3):315-319.

Abstract

The authors assert that the current general theories that attempt to explain how people acquire and disseminate information are outdated and insufficient for the unconventional situations that emergencies and disaster often are. Rather that the common linear model of information dissemination the authors' present research finding that suggest a more phenomenistic model may be more appropriate. Specific recommendations are included.

Causal Findings

The more community involvement a person has, the more likely they are to hear a warning message.

Scawthorn, Charles R., Frank Blackburn, and Laurie Friedman. 1991. "Fire in the East Bay Hills." *EQE Review* Fall:13-20.

Abstract

In order to comprehend more thoroughly the significance of the October 1991 Oakland Hills fire, this article examines several important aspects of the event. The author reviews 1) the natural and human environment that was the setting for the fire; 2) the course of the fire and emergency response; and 3) lifelines and disaster relief aspects of the fire. Conclusions and implications for potentially larger fires are provided.

Schmidlin, Thomas W. and Paul S. King. 1997. "Risk Factors for Death in the March 1, 1997 Arkansas Tornadoes." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado.

Abstract

Field surveys were made two weeks after tornadoes killed 26 personas in Arkansas, USA on 1 March 1997. Surveys were completed for samples of persons killed (n=25) and persons in the paths of the tornadoes but survived (n=73) to determine whether there were differences in personal characteristics, behavior or location between the two groups. Fourteen of the 25 deaths were in mobile homes, four in frame homes, two each in commercial buildings, vehicles, and outdoors, and one in a garage. Risk factors for death included being in an above ground room with windows, being in a room where the roof, wall or floor was blown away, and being hit by debris. Divorced persons formed a larger portion of deaths (22%) than of those who survived (1%). There was no significant difference between deaths and survivors in age, gender, race, education, disability or time between first becoming aware of the tornado and the tornado striking.

Causal Findings

The public is more likely to hear a warning message if it is delivered via the television. People who observe cues of the impending disaster/hazard are more likely to hear a warning message. The greater the time until impact of the disaster, the less likely a person is to believe a warning message.

Schmidlin, Thomas W., Paul S. King, Barbara O. Hummer, and Yuichi Ono. 1998. "Risk Factors for Death in the 22-23 February 1998 Florida Tornadoes." Natural Hazards Research Applications and Information Center, Institute for Behavioral Science, University of Colorado, Boulder, CO.

Abstract

Field surveys were made in the week after tornadoes killed 42 persons in central Florida, USA, on 22-23 February 1998. Surveys were completed for persons killed (n=42) and a sample of persons in the paths of tornadoes but who survived (n=86) to determine whether there were differences in personal characteristics, behavior or location between the two groups. All but one of the deaths were in mobile homes or parked recreational vehicles. Risk factors for death included advanced age, being in an above-ground room with windows, being in a room where the roof, wall or floor was blown away, being hit by debris and being unmarried. The well-known vulnerability of mobile homes is emphasized in these results. A lack of underground shelters or sturdy aboveground shelters for mobile home residents contributed to the high death toll. In addition, the midnight occurrence and lack of community sirens meant few people received warning of the approaching tornado, in spite of 10 to 24 minutes of warning from the National Weather Service.

Causal Findings

The public is less likely to hear a warning message if no NOAA tone alerts or sirens are used. The later in the evening a warning is delivered, the less likely it is to be heard. People who observe cues of the impending disaster/hazard are more likely to hear a warning message.

Schumacher, Joe and Holly Stone. 2002. "Use the Phone for Urgent Warnings." *Public Management* 84:21-24.

Abstract

In this article, the author argues that the use of Targeted Telephone notification (TTN), either as a stand-alone tool or in conjunction with other notification tools significantly improves the chances of a successful notification. The three essential components of a TTN are a database management system, a mapped or predefined geographical area and a detailed reporting capability of post-incident analysis.

Seydlitz, Ruth, J. William Spencer, and George Lundskow. 1994. "Media Presentations of a Hazard Event and the Public's Response: An Empirical Examination." *International Journal of Mass Emergencies and Disasters* 12:279-301.

Abstract

Very few studies in the area of media reports of hazards and disasters empirically examine the effect of specific characteristics of media portrayals of these situations on responses by the public and even fewer compare these effects across medium. Based on the literature, we derive hypotheses concerning the effect of degree of threat and personal relevance on response to a hazard event that threatened the water supply of the Greater New Orleans area in the summer of 1988. Using time series analysis to examine all phases of the hazard event, we find that degree of threat significantly influences only one type of response-purchasing bottled water-and only when the threatening information comes from television reports. Personal relevance impacts both purchasing bottled water and calling a bottled water company, regardless of medium (television or newspaper). We discuss the conceptual and methodological implications of these results for future research.

Causal Findings

The public is more likely to respond to a warning message if it receives that message from the mass media. The greater the severity of the threat, the more likely the public is to respond to a warning message about that threat.

Shoaf, K I, L B Bourque, and L V Smith. September 21, 1988. The Impact of the Northridge Earthquake on Los Angeles County, Health Effects and Responses. Los Angeles, CA: Prepared for Los Angeles County Department of Health Services, UCLA Center for Public Health and Disaster Relief.

Abstract

Data were collected in telephone interviews from 1830 residents of Los Angeles County selected by random digit dialing. A 48-minute interview was conducted in either English or Spanish between August 1994 and May 1996. Information was collected about where a respondent was at the time of the earthquake, what they did during and immediately after the earthquake, damage to their home/property, physical and emotional injuries sustained by the respondent and their family members, preparedness activities undertaken before and after the earthquake, utility outages, utilization of electronic media, knowledge of and contact with agencies, psychological distress, and social and demographic characteristics of the respondent and household.

Causal Findings

Whites with more income who lived in areas of high shaking intensity and who made at least two attempts were most successful in accessing electronic media after the earthquake.

Latinos, African Americans, and Spanish-speakers whose homes were damaged and who eventually evacuated were most likely to hear and remember such information about what to do after the earthquake.

Less than 3% of the sample remembered hearing information about what to expect beyond their immediate neighborhoods regarding available transportation routes, areas to avoid because of damage or fires, etc. Those that heard information were younger, Latinos who spoke Spanish and lived in areas of higher shaking.

Spanish speakers and African Americans were most likely to select radio and television news as their best sources of information. White respondents selected newspapers as their best source. Females and African Americans with higher income selected work sites as a best source. Schools were a good source of information for younger persons with children in the household who lived in undamaged areas.

Showalter, Pamela Sands. 1991. "Small Community Response to the New Madrid Earthquake Prediction: Preliminary Survey Results." Boulder, CO: Natural Hazards Research and Applications Information Center, Institute for Behavior Sciences, University of Colorado.

Abstract

The opportunity to study the phenomenon of what much of the mid-South's public regarded as a prediction of rare, devastating earthquake in an area vulnerable to seismic activity and facing a real threat rarely presents itself. This report is the account of research regarding the response of the residents in four small communities to predictions of an impending earthquake. To ascertain the project's effects away from urban centers, a questionnaire was mailed to 1000 residents of the communities all within or near the New Madrid Seismic Zone. The questionnaire is included as appendix A. The preliminary results of the survey indicate that public is receptive to messages about risk as long as the source appears to be qualified, regardless of established scientific opinion. The key element behind generating response to a warning of risk lies in establishing the credibility of both the warning and the predictor.

Causal Findings

The more credibility the sender of a warning message has, the more likely the receiver is to believe it.

Showalter, Pamela Sands. 1993. "Prognostications of Doom: Exploring Response to Predictions of Impending Earthquakes." Boulder, CO: Department of Geography, University of Colorado.

Abstract

This dissertation explores the responses of the residents of four small communities near or within the New Madrid seismic zone to the prediction of an earthquake. The research reveals that the public does not simply rely on conventional science when dealing with a threat that is spatially diffuse, of unknown dimensions and shrouded in speculation. Similarly, official response to unconventional predictions has been characterized by confusion regarding when or who to respond, the release of differently worded messages at different time intervals form different sources and inability to track escalating public apprehension due to inexperience with such situations. Consequently, unbudgeted funds are expended to provide the pubic with the materials and presentation they demand and personnel charged the duty of responding to the demand for information and clarification become exhausted. The research yields recommendations that will help officials in different parts of the nation monitor and respond to future unconventional earthquake prediction.

Siegel, J M, K I Shoaf, A A Afifi, and L B Bourque. 2003. "Surviving Two Disasters: Does Reaction to the First Predict Response to the Second?" *Environment and Behavior* 35:637-654.

Abstract

Respondents (N = 414) studied after a California earthquake were recontacted 4 years later to determine if their prior experience with a disaster impaired or enhanced their ability to deal with a second natural disaster – a slow-onset El Niño weather pattern. Analyses addressed whether being emotionally injured in one disaster influences the extent to which one prepares for a future disaster, whether emotional injuries experienced in one disaster predispose individuals to emotional injury in a subsequent disaster, and whether other disaster-related parameters (physical injury and property damage) are similarly associated across two disasters. Emotional injury both facilitated preparedness, in terms of number of hazard-mitigation activities performed, and predisposed to a subsequent emotional injury. An unexpected finding emerged showing that emotional injury increased the chance of reporting damage in a second disaster – a relationship that was maintained after controlling for emotional injury in the second disaster. The impact of self-reported emotional injury in two sequential disasters on what might be considered a more objective outcome – property damage in the second disaster – underscores the need for a comprehensive assessment of disaster reactions in postdisaster research and across disasters, when possible.

Causal Findings

After controlling for both demographic characteristics and exposure to the Northridge earthquake, persons who said they were emotionally injured in the Northridge earthquake were more likely to make preparations for the El Niño winter.

Sime, Jonathan D. 1997. "Informative Flood Warnings: Occupant Response to Risk, Threat, and Loss of Place." Pp. 155-175 in *Flood Warning: Issues and Practice in Total System Design*, edited by J. Handmer. Enfield, Middlesex, UK: Flood Hazard Research Centre, Middlesex University.

Abstract

This paper explores the nature of the response to floods in terms of the psychological and social science principles derived from people-environment research. Touching upon aspects of risk denial, ambiguity of a threat in its early stages and the reality of the threat as a physical, economic, social and psychological phenomenon in terms of the potential damage and destruction it causes, while focusing on warning and response in the context of house and home. This paper affirms the argument that a 'total flood warning system' needs to draw upon the human resources of a community at a local level, notably existing personal, social and community networks.

Sime, Jonathan D. 1999. "Crowd Facilities, Management and Communications in Disasters." *Facilities* 17:313-324.

Abstract

This paper reviews the human behavior and risk communications that occurred during a number of major fires (Beverly Hills Supper Club, Summerland, Woolworth's, Bradford, King's Cross) and a crowd crush (Hillsborough). The paper draws on official inquiry reports and related research, including a series of five underground station evacuation studies modeled on the King's Cross scenario. The pattern of delay in warning the public is considered in terms of misconceptions about "panic" and the performance of public facilities as a communication system consisting of design, technology, management and occupancy (setting in use). The paper advocates performance-based design, warning system technology and facilities management (organizational and occupant response) criteria, allied to minimally sufficient early warning of the public on a risk communication timeline. The latter needs to address and accommodate the timing and duration of occupant response, shelter, and escape behavior from different locations as an emergency unfolds.

Simpson, Robert H. and Herbert Riehl. 1981. *The Hurricane and Its Impact*. Baton Rouge, LA: Louisiana State University Press.

Abstract

This book is a compendium of hurricane meteorological phenomena, the book includes five chapters under the heading "Planning Coexistence with the Hurricane Hazard." Topics discussed in the chapters include prediction and warning, scenarios, awareness, and threat assessment and risk reduction. Sections dealing with the technical side of hurricane research also contain additional information about the social impacts that these storms generate. Overall, the book is a well-written overview of what is currently known about hurricanes from both the meteorological and socioeconomic perspectives.

Causal Findings

The public is more likely to believe a warning message if it comes from a familiar source. The public is more likely to respond to a warning message if the message comes from a credible source. The more specific a warning message is, the more likely the public is to respond to it.

Sims, John H. and Duane D. Baumann. 1972. "The Tornado Threat: Coping Styles of the North and South." *Science* 176:1386-1392.

Abstract

Noting that US figures for 'potential' or predicted deaths by tornado do not coincide with actual deaths by tornado, particularly in the southern region of the nation, this article explores four hypotheses that seek to explain the discrepancy. Two hypotheses focus on the characteristics of the storm: 1) The South experiences more tornadoes at night, and thus the public is less frequently prepared; 2) the South has more severe and deadly storms. The other set of hypotheses focus on differences in the human environment: 1) the construction of the buildings in the South is less durable than in the North; and 2) there are significant differences in the warning systems of the North and the South and/or response behavior of Northerners and Southerners. Data was obtained from 57 white, female residents of four Illinois counties and four Alabama counties. The data was collected by way of a sentence completion test of 15 stems that sought to assess individuals' response behavior to tornadoes as well as a measure of internal or external locus of control. After briefly exploring and rejecting the alternate explanations of the disproportionately high tornado death rate in the South, the authors present findings which suggest that discrepancies in tornado death rates are related to the generalized psychological dispositions associated to locus of control. The authors conclude that southerners are more fatalistic, have less faith in the efficacy of their own actions and have less trust in society's warning system and that psychological factors resulting in failure to take effective action cause higher tornado death rates in the South.

Causal Findings

If a person feels some personal efficacy, they are more likely to respond to a warning message.

Slovic, Paul. 1987. "Perception of Risk." *Science* 236:280-5.

Abstract

Studies of risk perception examine the judgments people make when they are asked to characterize and evaluate hazardous activities and technologies. This research aims to aid risk analysis and policy-making by providing a basis for understanding and anticipating public responses to hazards and improving the communication of risk information among lay people, technical experts, and decision-makers. This work assumes that those who promote and regulate health and safety need to understand how people think about and respond to risk. Without such understanding, well-intended policies may be ineffective.

Causal Findings

Prior research has shown that extensive negative media coverage has led to the strong association in people's minds between nuclear power and nuclear proliferation. Educating and reassuring the public to be more in line with opinions of industry experts seems impossible given the low probability of a serious accident makes it hard to demonstrate safety.

Starr's prior work showed that in general, people are more willing to tolerate risk when the activity is viewed as highly beneficial. In particular: (1) "the acceptability of risk from an activity is roughly proportional to the third power of the benefits for that activity" (p. 282), and (2) the public will accept risks from voluntary activities, such as skydiving, that are roughly 1000 times as great as from involuntary events, such as food preservative consumption, given the same level of benefits.

Slovic, Paul. 1992. "Perception of Risk: Reflections on the Psychometric Paradigm." In S. Krimsky and D. Golding (Eds.) *Social Theories of Risk* (pp. 117-152). Westport: Praeger.

Abstract

This chapter provides a brief overview of the psychometric paradigm and early results from psychometric studies of perceived risk. The remainder of the chapter discusses more recent developments in psychometric studies of perceived risk, including new hazard domains, new analytical methods, new theories and conceptual frameworks, including the social amplification of risk framework, and new forms of risk impact (i.e., stigma).

Smith, Keith and Graham Tobin. 1979. *Human Adjustment to the Flood Hazard*. New York, NY: Longman.

Abstract

Despite a growing understanding of flood hydrology, the application of an ever more complex technology, and the expenditure of progressively larger amounts of capital, losses due to riverine flooding continue to rise. This book overviews this paradoxical situation, reviewing both structural and non-structural measures instituted in past years. Specifically, it attempts to demonstrate, on an introductory level, the practical significance of developing and implementing an informed approach towards efficiently alleviating flood hazard. A comprehensive examination is made of flood plain management strategies, after which, a case study of the Cumbrian Eden is used to demonstrate the complexities associated with riverine management. The authors contend that responsible authorities have failed to contain flood hazard because of inadequate planning and partial mitigative strategies. The mistakes previously made with structural adjustments have been repeated with non-structural measures in that such schemes have been implemented with comparatively little regard for social feasibility or acceptance. To improve adjustment, authorities need a broader perspective of the problem, they should plan more comprehensively, and they should consider the desires and capabilities of each individual community.

Causal Findings

If a person has had hazard experience in the past, they are more likely to understand a warning message. A person is more likely to respond to a warning message if they have had prior hazards experience.

Sorensen, John H. 1982. "Evaluation of Emergency Warning System at Ft. St. Vrain Nuclear Power Plant." Oak Ridge, TN: Oak Ridge National Laboratory.

Abstract

The Fort St. Vrain nuclear power plant is the only high-temperature gas-cooled reactor in commercial operation in the U.S. The operator of the plant, the Public Service Company of Colorado (PSC), must conform to Nuclear Regulatory Commission planning regulations pertaining to commercial reactors. The company has challenged the applicability of certain requirements, which, therefore, have not been included in their Radiological Emergency Response Plan. This report examines three of these areas: 1) requirements for an early warning capability, 2) responsibility for the warning system, and 3) public information programs. Study findings include: although the PSC has compiled with NRC/FEMA requirements for public information, the impact of PSC's program on the preparedness capabilities of the public is unknown; a legal analysis of the issue to assess liability for the warning system's operation would be prudent; and more specific warning procedures would improve the original PSC system. These improvements would include a more suitable warning messages, establishing a rumor-control mechanism, and a better risk information and graphic displays.

Causal Findings

The more consistency with which a warning message is delivered, the more likely the receiver is to believe it. The more frequently a warning message is delivered, the more likely the public is to believe it. The public is more likely to believe a warning from an official source. The more specific the warning message is, the more likely the receiver is to believe it. A person is more likely to believe a warning message if they observe cues that support the message. A person is more likely to believe a warning if they are in close geographical proximity to the disaster/hazard. If a person has had previous hazards experience, they are more likely to believe a warning message. The greater the time until impact of the disaster, the less likely a person is to believe a warning message. Receiving a warning message through a personal channel, increases the likelihood of a person believing the message. A person with a high socio-economic status is more likely to believe a warning message.

Sorensen, John H. 1984. "Evaluating the Effectiveness of Warning Systems for Nuclear Power Plant Emergencies: Criteria and Application." Pp. 259-277 in *Nuclear Power: Assessing and Managing Hazardous Technologies*, edited by M. Pasqualietti and K. Pijawka. Boulder, CO: Westview Press.

Abstract

Chief among the problems with the handling of the accident at Three Mile Island in 1979 was ineffective public warning and communication. The boondoggle led to significant changes in the regulatory specifications for public warning and notification. This article reviews the regulations and suggests an alternative set of criteria to use in evaluating warning systems. The criteria are used to assess the warning system at the Fort St. Vrain nuclear power plant in Colorado. A discussion of lessons learned from TMI applicable to all nuclear generating stations concludes the articles. One of the more interesting and important findings is that despite the nature of the warning system or the contents of the message, people will hear a variety of different instructions because of their selective perceptions, biases, and inexperience; planning and public education are the only ways to correct some of this dissonance.

Causal Findings

A person is more likely to hear a warning message if they are at home at the time of delivery. A person is more likely to respond to a warning message if that message comes from a scientific source.

Sorensen, J. 1986. "Evacuations due to Chemical Accidents: Experience from 1980 to 1984. Washington, D.C.: Oak Ridge National Laboratory, U.S. Department of Energy.

Abstract

A profile of evacuation trends is developed from a database compiled from wire service accounts of nearly 300 evacuations prompted by chemical accidents. Findings from an analysis of the database indicate that the average size of an evacuation was 1000 people and that the most frequent cause of evacuations was industrial accidents followed by train derailments. While injuries occurred in 25 percent of the evacuations, only eight people were injured by chemical exposure per 1000 evacuees. No injuries were reported that occurred during the other acts of evacuating. The report contends that evacuations due to toxic chemical mishaps happen on the average of once every six days somewhere in the nation. This event frequency justifies further improvement of warning and response capabilities at the state and local levels. All of the events are listed in an appendix and suggestions are offered for maintaining and improving the database.

Causal Findings

Having hazards knowledge increases a persons' likelihood of responding to a warning message.

Sorensen, John H. 1987. "Warning Systems in the Cheyenne Flash Flood." Pp. 174-183 in *What We Learned Since the Big Thompson Flood,* edited by E. Gruntfest. Boulder, CO: Institute for Behavioral Science, University of Colorado.

Abstract

This publication is the proceedings volume from a symposium held July 17-19, 1986, in Boulder, Colorado on the tenth anniversary of the flash flood that killed 139 people and destroyed about 500 homes and businesses. The twenty-nine papers in the volume are organized under six categories: the flood in an historical context, mitigation problems and opportunities at various levels of government, flash flood forecasting innovations, warning and response systems, hydrology and geomorphology, and policy and research recommendations. The papers deal with a variety of topics, such as the operation of a temporary morgue, the effect of the Big Thompson flood on local flood prevention efforts, the future of the National Weather Service's flash flood program, the effectiveness of flash flood warnings, and the operation of flash flood warning systems in the 1985 Cheyenne, Wyoming flood. Symposium participants suggested that there is a pressing need for heightened public awareness about flash floods, and that officials at different levels of government, as well as private consultants, need to clarify their legal and ethical responsibility to protect the public.

Causal Findings

The more consistency with which a warning message is delivered, the more likely the receiver is to understand it.

Sorensen, John H. 1991. "When Shall We Leave? Factors Affecting the Timing of Evacuation Departures." *International Journal of Mass Emergencies and Disasters* 9 (2):153-165.

Abstract

Very little work on been conducted on the dynamics of human behavior in evacuations. This paper documents what is known about the timing of departures in different emergency events. This is followed by an effort to model individual variations in warning receipt and evacuation departures in the Nanticoke, PA hazardous materials fire. Among the factors that are significantly related to the time of warning receipt are the mode of the first warning, the proximity to the site of the emergency and the type of structure inhabited. The only significant variable related to mobilization time is the personalization of the warning. Perceived threat, age and family size were not related to mobilization time. The analysis points to the need for additional research to help understand the variability of human behavior in evacuations.

Causal Findings

There is no relationship between age or a person being older in age and the likelihood of a person responding to a warning message. There is no relationship between a persons' geographical proximity to a disaster and their likelihood for responding to a disaster. There is no relationship between the size of a persons' family and their likelihood for responding to a warning message. The less time there is to impact of a disaster, the less likely a person is to respond.

Sorensen, John H. 1992. "Assessment of the Need for Dual Indoor/Outdoor Warning Systems and Enhanced Technologies in the Chemical Stockpile Emergency Preparedness Program." Washington, D.C.: Oak Ridge National Laboratory, U.S. Department of Energy.

Abstract

The need for a dual indoor/outdoor warning system as recommended by the program guidance and Alert Notification (A&N) standard for the Chemical Stockpile Emergency Preparedness Program is analyzed in this report. Under the current program standards, the outdoor warning system consists of omnidirectional sirens and the new indoor system would be an enhanced tone alert (TA) radio system. This analysis identifies various tone-alert technologies, distribution options, and alternative siren configurations. It also assesses the costs and benefits of the options and analyzes what appears to best meet program needs.

Given the current evidence, it is recommended that a 10-dB siren system and the special or enhanced TA radio be distributed to each residence and special institution in the immediate response zone as preferred the A&N standard. This approach minimizes the cost of maintenance and cost of the TA radio system while providing a high degree of reliability for indoor alerting. Furthermore, it reaches the population (residential and institutional) in the greatest need of indoor alerting.

Sorensen, John H. 2000. "Hazard Warning Systems: Review of 20 Years of Progress." *Natural Hazards Review* 1:119-125.

Abstract

The United States has no comprehensive national warning strategy that covers all hazards in all places. Instead, public warning practices are decentralized across different governments and the private sector. Uneven preparedness to issue warnings exists across local communities; hence, people are unevenly protected from the surprise onset of natural disasters. Without changes in this situation, inequalities will grow larger, and the gains made in saving lives over the past decades may well be reversed. Since the first assessment of research on natural hazards was completed in 1975, there have been significant improvements in forecasts and warnings for some hazards but only marginal improvements for others. Forecasts for floods, hurricanes and volcanic eruptions have improved most significantly, and public dissemination of warnings has improved the most for hurricanes. However, a 100% reliable warning system does not exist for any hazard.

Sorensen, John H. and Philip J. Gersmehl. 1980. "Volcanic Hazard Warning System: Persistence and Transferability." *Environmental Management* 4:125-136.

Abstract

This study examines the functioning of the volcano warning system on Hawaii and seeks to identify the factors that allow the system to operate with success. The warning system under examination is distinctive for 3 reasons: Kilauea eruptions occur in a non-explosive manner, the threat is narrow and localized, and the volcanic eruptions occur frequently enough (16 times in a 20-year period) to warrant the installation of a complex system. Topics discussed include both the public official and citizen decision making subsystems, informal warning networks, the role played by key individuals, and the warning system in a changing environment. Although the participants in the Kilauea warning networks, the role played by key individuals, and the warning system in a changing environment. Some problems found of the system are: 1) new subdivisions are being planned for the hazard region, increasing the potential for damage and compounding the magnitude   of the warning procedure; 2) population growth will increase the complexity of the social structure, replacing face-to-face contacts with formal channels of communication; 3) establishing the credibility of the hazard may become particularly difficult since the incoming population has already been subjected to a barrage of risk-denial; and 4) most interviewees felt that people of the district now perceive that the state and federal governments are willing to step in with the financial assistance in the event of catastrophic damage.

Causal Findings

The more community involvement a person has, the more likely they are to hear a warning message.

Sorensen, John H. and Dennis S. Mileti. 1987. "Decision-Making Uncertainties in Emergency Warning System Organizations." *International Journal of Mass Emergencies and Disasters* 5:33-61.

Abstract

The record of organizational decision making in warning systems is systematically reviewed. A descriptive model of organizational decision making points and linkages is proposed. The review of 39 historical accounts included in this work led to the identification of four broad classes, comprised of 19 specific categories, of uncertainties in organizational decision-making in organizations with warning system tasks. The major decision making uncertainty classes identified in this review were: (1) ability to interpret the impending event; (2) communications; (3) perceived impacts of the warning and (4) exogenous influences. Primary problems have been recognition of the hazardous event and physical ability to communicate information with others in the chain of warning dissemination. It is concluded that decision making uncertainty, at all levels of stages of warning systems, has been a major constraint to warning effectiveness and would well be a prime object to be mitigated by future warning system preparedness activities.

Sorensen, John H. and Dennis S. Mileti. 1988. "Warning and Evacuation: Answering Some Basic Questions." *Industrial Crisis Quarterly* 2:195-209.

Abstract

In this paper the authors address five question that are frequently asked in the context of emergency planning for various accidents and disasters. These questions are commonly voiced by emergency managers or planners wanting a better basis for developing emergency response plans. The questions are frequently answered by people who have an image of how people behave in an emergency; often, however, their observations are inaccurate and misleading. The questions are as follows. First, how long does it take to warn a population about a crisis? Second, how many people evacuate in an emergency situation? Third, when do people evacuate? Fourth, do people evacuate unnecessarily? Fifth, where do people go when they evacuate? The major findings are as follows. First, most emergency response systems which typically consist of law enforcement, fire fighting and other civic employees, and sometimes volunteers, coupled with emergency use of available electronic media can issue an effective warning given three or four hours of lead time. In some situations, when the threat is urgent, a warning can be disseminated in a much more rapid fashion. In situations with less than one hour of available warning time, some, and perhaps a substantial portion of the population will not receive a warning. Second, the speed of warning dissemination, particularly in urgent situations, is increased by informal warning processes. People seek information following the receipt of the warning and one common way to do so is to contact friends, relatives or neighbors. In some of the situations studied, 50% of the initial warning was attributable to informal notification processes.   Third, when advised or ordered to take a protective action such as evacuation, few people respond instantaneously except when there is a recognized and immediate threat. The length of time it takes for people to respond is variable among events, depending on the available time to impact and the severity of the threat. In any event, people are unlikely to take action simultaneously; rather it will be spread out over time.

Sorensen, J. H. and D. S. Mileti. 1989. "Warning Systems for Nuclear Power Plant Emergencies." *Nuclear Safety* 30(3):358-370.

Abstract

Over 200 studies of warning systems and warning response were reviewed. The major findings are as follows: First, variations in the nature and content of warnings have a large impact on whether or not the warning is heeded by the public. Relevant factors include the warning source; warning channel; the consistency, credibility, accuracy, and understandability of the message; and the warning frequency. Second, characteristics of the population receiving the warning affect warning response. These include social characteristics, such as gender, ethnicity, and age; social setting characteristics, such as stage of life or family context; psychological characteristics, such as fatalism or risk perception; and knowledge characteristics, such as experience or training. Third, many myths about public response to emergency warning now exist and are at odds with knowledge derived from field investigations. Some of these myths include the "keep it simple" notion, the "cry wolf" syndrome, public panic and hysteria, and public willingness to respond to warnings. Finally, different methods of warning the public are not equally effective at providing an alert and notification in different physical and social settings. Most systems can provide a warning given three or more hours of available warning time. Special systems, such as tone-alert radios, are needed to provide rapid warning.

Sorensen, John and Dennis Mileti. 1991. "Risk Communication in Emergencies." Pp. 367-392 in *Communicating Risks to the Public: International Perspectives,* edited by R. E. Kasperson and J. M. Stallen. Boston, MA: Kluwer Academic Publishers.

Abstract

Despite the obvious linkages between pre-emergency risk communication and emergency risk communication, little has been done to compare the two or to examine how lessons learned about one activity can improve the other. Furthermore, risk communications research has done little to tap these bodies of knowledge. This chapter attempts a more systematic approach to examining risk communication as related to emergencies and disasters. This chapter defines each communication activity, reviews alternative modes of communicating risk information, and their strengths and weaknesses, reviews major research findings on each process, and summarizes the implications for improving risk communications in general.

Sorensen, John H. and Dennis S. Mileti. 1995. "Pre-Emergency Information Programs for Accidents at Nuclear Power Plants." Pp. 311-336 in *Preparing for Nuclear Power Plant Accidents,* edited by D. Golding, J. X. Kasperson, and R. E. Kasperson. Boulder, CO: Westview Press.

Abstract

Although it cannot be demonstrated that educational pre-emergency information programs are critical to achieving good emergency response, collective experience in the social sciences supports the general thesis that such programs help "prime" the public to react appropriately to emergency warnings. Furthermore, qualitative differences, attributable mainly to style and content, distinguish good informational programs from poor ones. To illustrate this thesis, the authors first review the goals of pre-emergency information programs. Second, the empirical literature on hazard-awareness programs is reviewed. Third, what is known about where people acquire information about what to do in an emergency is discussed. Fourth, a conceptualization of the various styles and formats that a program can adopt are offered. Fifth, a framework is developed for assessing pre-emergency information programs. Finally, the authors use that framework to assess pre-emergency information programs at nuclear power plants.

Sorensen, John H., Dennis S. Mileti, and Emily Copenhaver. 1985. "Inter and Intraorganizational Cohesion in Emergencies." *International Journal of Mass Emergencies and Disasters* 3 (3):27-52.

Abstract

The purpose of this paper is to pose and test a means to facilitate the comparative examination of inter-organizational relations and behavior in emergency planning and response. Additionally we sought to define and operationalize the concept of inter- and intra-organizational cohesion in emergencies. The paper, following a review of literature on organizational behavior in disasters, describes an effort to define, and develop measures for twenty indicators of inter- and intra-organizational cohesion. Data on these indicators are collected for organizations in an emergency response network at a nuclear power plant. This is done for relationships in both pre-emergency planning and for an exercise of an emergency plan. Findings regarding cohesion are presented and the implications for refining emergency organizational theory are discussed. Overall, it was found that internally organizations are fairly cohesive but that cohesiveness diminishes between organizations. Communications and lack of interaction clarity appear to be the chief reasons for decreases in cohesion. In order to understand why this occurs, it is necessary to investigate the antecedents of organizational behavior that lead to cohesion breakdowns.

Sorensen, John H. and George O. Rogers. 1988. "Local Preparedness for Chemical Accidents: A Survey of U.S. Communities." *Industrial Crisis Quarterly* 2:89-108.

Abstract

The preliminary results of a survey designed to assess the state of emergency preparedness in communities across the United States aid in the development of a conceptual approach to emergency management. The approach identifies the relationships among existing emergency management systems and practices and assesses their effectiveness in alerting and notifying the public. A comparison of data gleaned from a survey of emergency preparedness officials permits comparison of existing public alert and notification systems with state of the art technology, procedures and management systems. The study also addresses the potential problems and constraints likely to thwart timely effective warning in the advent of an emergency. Finally, the authors make recommendations or improving public alert and notification systems in chemical emergencies.

Sorensen, John H. and Barbara M. Vogt. 1988. "Emergency Planning for Nuclear Accidents: Contentions and Issues." *Journal of the Washington Academy of Sciences* 78:210-225.

Abstract

The purpose of this paper is to identify and discuss issues that have been raised concerning emergency planning for nuclear power plants. The extent to which these issues can be eliminated or dismissed on the basis of current physical and social science knowledge is important for assessing the viability of emergency planning as a form of human protection. Where an issue is valid, it is important that emergency planning incorporate knowledge concerning those issues. The results of the analysis indicate that the critical point for changes made in planning requirements was the TMI accident. Current plans, as the result of these changes are far too complex, bureaucratic and rigid to permit flexibility in managing emergencies. Having an adaptive and flexible organization is a key factor in having effective emergency management response. Many of the issues in nuclear power plant emergency planning are derived from behavioral intent surveys. Research based on these methods that concludes people will behave in certain ways in a future emergency is largely invalid and should not be the basis for developing emergency plans. The basis for plans must be developed on existing knowledge, not on speculative or inaccurate assumptions. Based on the analysis three recommended actions are proposed: 1) Revise radiological emergency planning frameworks in a manner which promotes m ore flexibility in response procedures and which is more responsive to local factors such as unique topography and population distributions. 2) Develop policy positions on various issues including the validity of various contentions and the conditions under which the contention are or are not valid. 3) Give local and state governments more legal responsibility for developing emergency plans for nuclear power plants while placing the burden of proof on all parties.

Spencer, J. William, Robert B. Herrmann, Arch C. Johnston, and Glen Reagor. 1993. "Responses to Iben Browning's Prediction of a 1990 New Madrid, Missouri Earthquake." Washington, D.C.: U.S. Government Printing Office.

Abstract

This study of seismological and sociological elements of the Browning prediction is intended as both a research tool and an informational publication for the general public. It explains how Browning's prediction of a major central U.S. earthquake became credible to many members of the media, many emergency preparedness personnel, and a broad segment of the general public, even though it was never accepted by the scientific community. The results were enormous public concern and expense that, the authors maintains, could have been avoided. A unique aspect of this report is that it contains much of its own source material--some 200-press reports and other documentation--for the casual reader to investigator to explore. Appendices contain many examples of preparedness literature distributed during the course of the prediction, a section on humor generated by the false alert, official statements on the prediction, and some of the writings and speeches of Browning and David Stewart.

Stallings, Robert A. 1984. "Evacuation Behavior at Three Mile Island." *International Journal of Mass Emergencies and Disasters* 2:11-26.

Abstract

Evacuation behavior associated with the accident at Three Mile Island is described based upon data from field surveys. The question addressed is whether this evacuation was unique or whether it conformed to the pattern normally found in natural disasters. Demographic and social aspects of the evacuation are compared with those in the disaster literature. The conclusion is that the voluntary evacuation at Thee Mile Island did not differ significantly from those taking place in natural disasters. Therefore, no special plans, policies, or procedures seem needed over and above those in places for other kinds of disaster evacuations. But in emergencies that are unusual and infrequent, where public officials must rely exclusively on experts who themselves disagree, and where the incident is part of an existing public controversy, forced evacuation may be a difficult action to take. This should not prevent officials from taking steps to make voluntary evacuation available to all citizens who choose to take such protective actions.

Causal Findings

The public is more likely to respond to a warning message if the message comes from a credible source. If a person has freedom to leave their place of employment, they are more likely to respond to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message.

Stallings, Robert A. 1991. "Ending Evacuations." *International Journal of Mass Emergencies and Disasters* 9:183-200.

Abstract

There is little research describing the process by which organizations decide to issue the "all-clear" to terminate an evacuation and of the process by which evacuated families decide to return to their homes. These processes are inherently more problematic in evacuations triggered by chemical or radioactive agents than is usually the case in evacuations occasioned by natural disasters. This paper presents some examples of toxic chemical evacuations as background for an examination of the process of terminating evacuations. The "all-clear" message and the pre-disaster warning message are taken as analogous, as are the decisions to evacuate and to return. Variables that research has shown explain warning and evacuation behavior are evaluated in relation to the all clear and return. Ending evacuations where toxic agents are concerned are more problematic because there is greater conflict that in turn lessens the credibility of all clear messages. Both the sources of these differences and their consequences are explored.

Stallings, Robert A. and Wolf R. Dombrowsky. 1991. "A Topical Issue on Evacuation Research: Theory and Applications*." International Journal of Mass Emergencies and Disasters* 9 (2):1-100.

Abstract

This dedicated journal issue contains 10 articles that explore both theoretical and applied topics associated with evacuation behavior. The papers address subjects such as motivating the public to evacuate; delineating the factors that affect the timing of evacuation departures; ending evacuations; setting boundaries for research on the organizational capability to evacuate; planning the evacuation of tourist-oriented private businesses; and planning, nursing home evacuations. Other essays report on evacuation behavior during hurricanes, international trends in evacuations from chemical accidents, and social system redundancy as a factor in warning and evacuation planning.

Abstract

This paper provides a basic introduction to the concepts and theory of redundancy in social systems. It examines the implications of redundancy as a design method in planning disaster response systems, with special attention given to warning and evacuation. It also examines some of the criticisms of redundancy and examines several problems associated with transferring the concepts of redundancy to social systems. Examples are used to illustrate the benefits of planned redundancy in the design of warning and evacuation systems.

Sylves, R T. 2006. "President Bush and Hurricane Katrina: A Presidential Leadership Study." *ANNALS, The American Academy of Political and Social Science* 604:26-56.

Abstract

Hurricane Katrina raised many concerns about presidential management of megadisasters. President George W. Bush has been criticized, and has personally accepted blame, for the failures and shortcomings of governmental response to this disaster. This work draws from government documents and public affairs information to analyze the facts of the event, the policies and organizational alignments in place before the disaster, and the president's performance. This study concludes that how presidents lead, manage federal officials, cope with the news media, address federal-state relations, set the boundaries of civil-military relations, define their policy agenda, and choose political appointees for responsible posts all contribute to their ability, or inability, to address the demands imposed by disasters and catastrophes. In some respects, political, policy and managerial decisions made by the president and his administration before the disaster seriously impeded the federal government's ability to mitigate, prepare for, and respond to the catastrophe.

Tierney, Kathleen. 1987. "Chemical Emergencies, Offsite Exposures and Organizational Response." Boulder, CO: Natural Hazards Research and Applications Center, Institute of Behavioral Science, University of Colorado.

Abstract

This paper focuses upon the topic of community response to sudden, large-scale releases of hazardous chemicals. It is asserted that insomuch as chemical plant safety system failures are inevitable and hazards cannot be eliminated, the alternative is the effective management of chemical accidents. The paper first reviews the findings of surveys and case studies on chemical emergency preparedness and response, after which several factors that have impeded attempts to manage theses kinds of incidents are discussed. These factors relate to culture, social organization, and societal and community resources. Recommendations for further research are included.

Causal Findings

People who observe cues of the impending disaster/hazard are more likely to hear a warning message. A person is more likely to believe a warning message if they observe cues that support the message. A person is less likely to understand a warning message if sirens alone are used to relay the message.

Tierney, Kathleen J, Michael K Lindell, and Ronald W Perry. 2001. *Facing the Unexpected, Disaster Preparedness and Response in the United States*. Washington, D.C.: Joseph Henry Press.

Abstract

Facing the Unexpected presents the wealth of information derived from disasters around the world over the past 25 years. The authors explore how these findings can improve disaster programs, identify remaining research needs, and discuss disaster within the broader context of sustainable development. How do different people think about disaster? Are we more likely to panic or to respond with altruism? Why are 110 people killed in a Valujet crash considered disaster victims while the 50,000 killed annually in traffic accidents in the U.S. are not? At the crossroads of social, cultural, and economic factors, this book examines these and other compelling questions.

The authors review the influences that shape the U.S. governmental system for disaster planning and response, the effectiveness of local emergency agencies, and the level of professionalism in the field. They also compare technological versus natural disaster and examine the impact of technology on disaster programs.

Treadwell, Mattie E. 1962. "Hurricane Carla: September 3-14, 1961." Denton, TX: Office of Civil Defense Region 5, U.S. Government Printing Office.

Abstract

This report summarizes the emergency response process of several counties and municipalities in Louisiana and Texas as related to the events associated Hurricane Carla, September 3rd – 14th, 1961. The report gives a detailed account of the events in a systematic description of the warning, various evacuations, the reception and sheltering of evacuees, the emergency organizations responses and equipment, evacuee reentry and the rehabilitation of and recuperative abilities of the effected areas.

Causal Findings

The public is more likely to respond to a warning message if it comes from an official source. A person is more likely to respond to a warning message if they have had prior hazards experience. If a person receives social cues about a disaster, they are more likely to respond to a warning message.

Trumbo, Craig W., and Katherine A. McComas. 2003. "The Function of Credibility in Information Processing for Risk Perception." *Risk Analysis* 23 (2):343-353.

Abstract

This study examines how credibility affects the way people process information and how they subsequently perceive risk. Three conceptual areas are brought together in this analysis: the psychometric model of risk perception, Eagly and Chaiken's heuristic-systematic information processing model, and Meyer's credibility index. Data come from a study of risk communication in the circumstance of state health department investigations of suspected cancer clusters (five cases, N= 696). Credibility is assessed for three information sources: state health departments, citizen groups, and industries involved in each case. Higher credibility for industry and the state directly predicts lower risk perception, whereas high credibility for citizen groups predicts greater risk perception. A path model shows that perceiving high credibility for industry and state-and perceiving low credibility for citizen groups-promotes heuristic processing, which in turn is a strong predictor of lower risk perception. Alternately, perceiving industry and the state to have low credibility also promotes greater systematic processing, which consistently leads to perception of greater risk. Between a one-fifth and one-third of the effect of credibility on risk perception is shown to be indirectly transmitted through information processing.

Causal Findings

Higher credibility for industry and the state directly predicts lower risk perception, whereas high credibility for citizen groups predicts greater risk perception. A path model shows that perceiving high credibility for industry and state-and perceiving low credibility for citizen groups-promotes heuristic processing, which in turn is a strong predictor of lower risk perception. Alternately, perceiving industry and the state to have low credibility also promotes greater systematic processing, which consistently leads to perception of greater risk. Between a one-fifth and one-third of the effect of credibility on risk perception is shown to be indirectly transmitted through information processing.

Turner, Ralph H. 1976. "Earthquake Prediction and Public Policy: Distillations from a National Academy of Sciences Report." *Mass Emergencies* 1:179-202.

Abstract

In April of 1974, the Panel on Public Policy Implications of Earthquake Prediction was established to formulate pubic policy relating to an expected earthquake prediction capability. This article summarizes the panel's report by answering four broad sets of questions: what are the policy-relevant characteristics of earthquakes and the subsequent consequences? What is already known that might be of help in planning for the constructive release of predictions? And, what complications should be anticipated? Additionally, numerous recommendations are presented along with brief statements of the associated conclusions.

Causal Findings

The older a person is, the less likely they are to hear a warning message. If a person has had previous hazards experience, they are more likely to believe a warning message. A member of a minority group is less likely to believe a warning message. The public is more likely to respond to a warning message if the message comes from a credible source. A person is more likely to respond to a warning message if they have had prior hazards experience.

Turner, Ralph H. 1983. "Waiting for Disaster: Changing Reactions to Earthquake Forecasts in Southern California." *International Journal of Mass Emergencies and Disasters* 1 (2):307-334.

Abstract

Several earthquake near predictions in 1976 initiated a period of waiting in Los Angeles County of a great and destructive earthquake. Hypothesized negative effects of an extended period of waiting under an open-ended threat of disaster include 1) declining sense of urgency and vigilance, 2) disillusionment and disbelief, 3) accumulation anxiety and defensive denial of danger, and 4) resentment and scapegoating. Hypothesized positive effects include 5) familiarization, appreciation, and sensitization, and 6) symbolic and active rehearsal of responses. Interviews with five waves of adult County residents over a period of nearly two years, followed bay sixth wave immediately after a moderate but nondestructive earthquake, provided measures of change and stability of response to earthquake threat. Measures of fear, imminent expectation for a damaging earthquake, household preparedness, confidence in scientific earthquake prediction capability, suspicion that information was being withheld, attitude toward releasing uncertain predictions, focus on scientific as compared with unscientific forecasts, and preferred media source of information on forecasts tend to disconfirm the disillusionment, denial, and scapegoating hypotheses, to support reduced urgency and familiarization hypotheses, and to provide weak support for the rehearsal hypothesis.

Causal Findings

The public is more likely to hear a warning message that is delivered via broadcast media. The more frequent a warning message is delivered, the more likely the public is to believe it. The more frequently a warning message is delivered, the more likely the receiver is to understand it. Hearing, and understanding a warning message increases the likelihood of responding to it.

Turner, Ralph H. 1993. "Reflections on the Past and Future of Social Research on Earthquake Warnings." *International Journal of Mass Emergencies and Disasters* 11:453-468.

Abstract

This special essay is a review and summary of research on earthquake prediction and warning. After a historical account of the research, the author addresses several issues. What do people attend to? What does the public understand? How do people cope with ambiguous communications? How can concern be converted into action? Lastly, the author asserts that a historical, cultural, situational and individual variability of interpretation and response is necessary to keep prediction research in context.

Turner, Ralph H., Joanne M. Nigg, Denise H. Paz, and Barbara S. Young. 1979. "Earthquake Threat: The Human Response in Southern California." Los Angeles, CA: Institute for Social Science Research, University of California, Los Angeles.

Abstract

This interim report describes the public state of mind one year after announcement of the southern California Uplift. It attempts to supply an accurate statistical account of the diversity of human response to earthquake threat in Los Angeles County. A few of the questions that the report tries to answer are: 1) are southern Californians aware of the Uplift? 2) What earthquake predictions, forecasts and cautions do people remember? 3) How fearful and concerned are people over the earthquake threat? 4) Do Southern Californians want to hear about earthquakes? 5) What should government be doing? And 6) where do people hear about earthquake danger and earthquake safety? Findings indicate that scientists must be prepared to deal constructively with a public that puts its faith overwhelmingly in science, but is not ready to pledge exclusive allegiance to scientific earthquake prediction. Believers in science should be expected to turn occasionally to other realms for whatever help they can get in foretelling earthquakes. No evidence was found to suggest that religion plays a part in resistance to the acceptance of scientific earthquake prediction. Recommendations for constructive action will appear in a later report.

Causal Findings

The public is more likely to hear a warning message if it is delivered via the television. Women are more likely to hear warning messages. The more community involvement a person has, the more likely they are to hear a warning message. People with children are more likely to hear warning messages. People with high socio-economic status are more likely to hear a warning message. The older a person is, the less likely they are to hear a warning message. The more certainty with which a warning message is delivered, the more likely the receiver is to believe it. The more credibility the sender of a warning message has, the more likely the receiver is to believe it. The public is more likely to believe a warning when the warning is in the form of printed materials. A person is more likely to believe a warning message if they believe the scientific ability to predict disasters. The more frequently a warning message is delivered, the more likely the receiver is to understand it. The older a person is, the more likely they are to understand a warning message. The more education a person has, the more likely they are to understand a warning message. The greater community attachment a person has, the more likely they are to understand a warning message. The more hazards knowledge a person has, the more likely they are to personalize a warning message. The more frequently a warning message is delivered, the more likely the public is to respond to it. A person with membership in social networks is more likely to respond to a warning message. Hearing and understanding a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it.

Turner, Ralph H., Joanne M. Nigg, Denise H. Paz, and Barbara S. Young. 1981. "Community Response to Earthquake Threat in Southern California, Part 10, Summary and Recommendations." Los Angeles, CA: Institute for Social Science Research, University of California, Los Angeles.

Abstract

This is a first of kind report of the opportunity to observe the actual response behavior people in response to the potentially disturbing prediction of an earthquake made on February 13, 1976 in Southern California. Specific research objectives include the description and assessment of 1) popular reception and understanding of reports; 2) what people believe about safety and danger in earthquakes; 3) the extent of altruistic concern for victims; 4) what people believe public officials are doing in preparation; 5) the steps by which people might make decisions regarding the foregoing matters. More so, the authors sought to 6) identify relationships between each of the foregoing considerations and proximately to prior earthquake disaster areas as well as 7) trends in popular reception and understanding of the foregoing issues. Report objects also include 8) the noting of unusual economic activity, along with 9) the recording and interpretation of sequence and decisions and steps taken by public and private agencies, and 10) the treatment of the earthquake threat in the mass media. Lastly, the authors sought to examine the relationship to individual response of such items as past experience with earthquakes, commitment to neighborhood, time perspective, personal responsibility to family and degree of social integration. The research design used includes four types of investigation, namely: a record and analysis of media coverage from 1976-1978; a record of key governmental and organizational responses; a series of surveys of Los Angeles County residents; and focused field research into grassroots responses.

Causal Findings

The public is more likely to hear a warning message that is delivered via multiple channels. The public is more likely to hear a warning message if it is delivered via the television. Women are more likely to hear and believe warning messages, than are men. The more community involvement a person has, the more likely they are to hear a warning message. People with children are more likely to hear warning messages. People with high socio-economic status are more likely to hear a warning message. People with knowledge of the disaster agent and/or who have had prior experience with a disaster are more likely to hear a warning message. If a person feels some personal efficacy, they are more likely to hear a warning message. The more consistency with which a warning message is delivered, the more likely the receiver is to believe it. The more credibility the sender of a warning message has, the more likely the receiver is to believe it. The more frequently a warning message is delivered, and/or the more channels on which it is broadcast, the more likely the public is to believe it. The older a person is the less likely they are to believe a warning message. A person is more likely to believe a warning if they are in close geographical proximity to the disaster/hazard, and/or if they have had previous experience with a hazard/disaster. The greater a persons' perceived risk, the more likely they are to believe a warning message. The more personal efficacy a person feels, the more likely they

are to believe and/or personalize a warning message. A person is more likely to understand a warning message from a media source with adequate information. A person is more likely to understand a warning message if it is sent via multiple channels. The older a person is, the more likely they are to understand a warning message. The more education a person has, the more likely they are to understand a warning message. A person is more likely to understand a warning message if they discuss the message with others. A person is more likely to personalize a message if it is delivered frequently. The more hazards experience and/or knowledge a person has, the more likely they are to personalize a warning message. The greater a persons' perceived personal risk, the more likely they are to personalize a warning message. A person with children is more likely to respond to a warning message than someone without children. A person is more likely to respond to a warning message if they have had prior hazards experience. A person with membership in a minority group is less likely to respond to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. If a person feels some personal efficacy, they are more likely to respond to a warning message. Hearing and personalizing a warning message increases the likelihood of responding to it. A person with a high socio-economic status is more likely to believe a warning message.

Turner, Ralph H., Joanne M. Nigg, Denise H. Paz, and Barbara S. Young. 1986. *Waiting for Disaster*. Berkeley, CA: University of California Press.

Abstract

This book examines the public response to this threat of impending earthquake. The guiding questions structure the text: how did the media convey the news? How did the public interpret the threat? And, what did people do about it? A three-year analysis of media coverage and six population surveys were undertaken to determine individual and community response to events as they developed after the initial discovery of the bulge. Results highlight the problems of the media in relaying the news of the earthquake threat and the difficulties experienced by the public in assessing the threat.

Vaughan, Elaine. 1995. "The Significance of Socioeconomic and Ethnic Diversity for the Risk Communication Process." *Risk Analysis* 15:169-180.

Abstract

Risk communication is being characterized as one way of facilitating more effective, democratic and participatory risk management strategies. An emphasis on formal communication approaches as a means to improve decisions and decrease conflict with highlight the challenge of managing hazards within a culturally heterogeneous society. Communication and participatory strategies will be considered successful only if diverse communities can be engaged as partners in the policy process. Because responses to risk are embedded and evolve within broader social environments, achieving the promise of risk communication across a diverse society may not be possible absent an understanding of how socio-cultural variables and past experiences shape the exchange of ideas or information in any particular situation. This paper considers the implications of ethnic and socioeconomic variability for the risk communication process, summarizing theoretical perspectives and empirical evidence on the link between socio-cultural features and risk responses. Specifically, the factors that define the context of communication may influence: the initial framing of a risk issue, particularly, the adoption of an environmental justice vs. scientific/economic perspective; the perceived importance of various aspects of the decision problem; and prior beliefs about environmental hazards and agencies involved in risk management. Two examples of situations requiring communications about risk are presented and illustrate how these principles could operate in minority or lower income communities. A significant challenge for health and regulatory officials will be to engage in an interactive process of information and opinion exchanges that is reasonable and effective within vastly different socioeconomic and cultural contexts.

Vogt, Barbara M. 1990. "Evacuation of Institutionalized and Specialized Populations." Oak Ridge, TN: Oak Ridge National Laboratory, U.S. Department of Energy.

Abstract

This volume assesses the needs of institutions caring for people who require special consideration during evacuations. Over a four-year period, media accounts identified 1024 events where such evacuations occurred. The evacuations were grouped under four types of institutions: hospitals, educational facilities, correctional facilities, and nursing homes and related care facilities. A fifth category was identified for future study that includes miscellaneous facilities, such as workplaces, apartments, and places occupied by transient populations. Following introductory chapters that discuss the theoretical and practical considerations involving institutional evacuation, the author describes the data collection method and then presents findings and conclusions from the study. These findings include 1) the effectiveness of an evacuation (as measured by time to evacuate) appears limited by inter-organizational constraints; 2) the issues surrounding role abandonment among health care providers is largely dispelled by the continuity of care for clients; and 3) it appears that institutional populations are protected in emergencies by the adaptiveness of their organizations and not by formal planning nor by efforts of local communities.

Causal Findings

A person is more likely to believe to a warning message if they are involved with a care-giving organization.

Vogt, Barbara M. 1991. "Issues in Nursing Home Evacuations." *International Journal of Mass Emergencies and Disasters* 9 2):247-265.

Abstract

Both emergency planners and disaster researchers cite the lack of empirical data on the problems and needs of special populations during emergency evacuations. Although most evacuations of nursing homes and related care facilities are carried out successfully, the effectiveness of an evacuation (as measured by time to evacuate) appears limited by certain constraints. Among the factors affecting such evacuations are resources (such as the number of staff available at the time of the evacuation), type and number of clients, and community characteristics such as population density. This study describes selected organizational characteristics of nursing homes and related care facilities that have recently experienced either a partial or complete evacuation of their facilities. After discussing the theoretical aspects of organizations in evacuations and the methodology used for the study, the study discusses both the quantitative and qualitative factors affecting organizational behavior during evacuation. It is evident from the findings that the continuity of responsible care for clients is of critical concern to both management and staff during an evacuation. The findings suggest that individuals within specialized populations are unlike other disaster victims and may require different management strategies on the part of agencies assisting in the evacuation.

Causal Findings

A person is more likely to believe to a warning message if they are involved with a care-giving organization.

Vogt, Barbara M. and John H. Sorensen. 1992. "Evacuation Research: A Reassessment." Oak Ridge, TN: Oak Ridge National Laboratory, U.S. Department of Energy.

Abstract

The purpose of this study is to examine the literature on evacuation and update a previously published annotated bibliography on evacuation issues (Vogt & Sorensen 1987) and research assessment (Sorensen et. al. 1987). In doing so, the authors sought to determine if concerns raised in the previous analysis of evacuation research were still valid in light of subsequent empirical research and theoretical findings and to determine the trends and needs within the field. The report focuses on emergencies generated by technological, chemical and hazardous materials incidents. Empirical research is based on data gained from surveys, questionnaires, interviews or a combination thereof and the use of secondary sources. Theoretical work summarizes past research or involves the development of conceptual models.

Vogt, Barbara Muller and John H. Sorensen. 1999. "Description of Survey Data Regarding the Chemical Repackaging Plant Accident West Helena, Arkansas." Oak Ridge, TN: Oak Ridge National Laboratory, U.S. Department of Energy.

Abstract

Shortly after 1 p.m. on Thursday, May 8, 1997, clouds of foul smelling smoke began pouring from an herbicide and pesticide packaging plant in West Helena, Arkansas. An alert was sounded, employees evacuated, and the West Helena fire department was called. As three firefighters prepared to enter the plant, the chemical compounds exploded, collapsing a solid concrete block wall, and killing all three fire fighters. As the odorous smoky cloud drifted away from the plant, authorities ordered residents in a 2-mile area downwind of the plant to evacuate and those in the 2-3 mile zone to shelter in place. This study examines and compares the responses to a mail survey of those ordered to evacuate and those told to shelter in place. Among the variables examined are compliance with official orders and perceived warnings, threat perception, time and source of first warning, response times, and behavior characteristics for both populations. The findings indicate that 90% of those that were told to evacuate did so but only 27% of those told to shelter in place did so, with 68% opting to evacuate instead. The implications of these findings for emergency managers is that people will likely choose to evacuate when both warnings to evacuate and warnings to shelter are issued to residents in close proximity to each other. The findings on warning times closely resemble other findings from evacuations when chemical accidents occur and route notification is used for warning residents.

Causal Findings

The public is more likely to hear a warning message if they have personal contact with the messenger. The public is more likely to hear a warning message if it is delivered via route alerts. If a person has access to a shelter or another sanctuary, they are more likely to respond to a warning message. The greater the contagion, the more likely the public is to respond to a warning message. The more environmental cues the public receives, the more likely they are to respond to a warning message. A person living in low quality housing is more likely to respond to a warning message.

Wallace, Anthony F. C. 1956. "Tornado in Worcester." Washington, D.C.: National Research Council, National Academy of Sciences.

Abstract

An analysis of human behavior during the Worcester tornado in terms of a spatial model centering around the impact area and a time oriented model containing the categories of steady state, warning, impact, isolation, rescue, rehabilitation, and irreversible change. Response to the disaster was also discussed in terms of four other theoretical frameworks: the disaster syndrome, the counter disaster syndrome, the length of the isolation period, and the cornucopia theory. This report contains extensive quotations from interviews with disaster victims.

Warrick, Richard A., Jeremy Anderson, Thomas Downing, James Lyons, John Ressler, Mary Warrick, and Theodore Warrick. 1981. "Four Communities Under Ash: After Mount St. Helens." Boulder, CO: Institute of Behavioral Science, University of Colorado.

Abstract

A week after the ash fall from Mount St. Helens settled, three communities in Washington (Ellenburg, Ritzville, Cheney) and Missoula, Montana were studied in order to ascertain the range of immediate effects and actions precipitated by this rare but devastating event. A comparative examination of the four sites revealed a number of findings. For example, the initial warning about the ash fall issued by the Washington State Department of Emergency Services had absolutely no utility at any of the community study sites. The warning message was not specific about the areas to be affected by ash fall, no precautionary actions were prescribed, and the message lacked a sense of urgency. Agriculture suffered variable impacts but the total amount turned out to be much less than was initially anticipated. Had the mountain blown one month later, however, the area's economic disruption would have occurred. It was also found that ash depth had little early impact on transportation, but it did exert considerable influence on the amount of recovery time needed to get the system back in order.

Causal Findings

The more certainty and/or specificity with which a warning message is delivered, the more likely the receiver is to understand it. If a person has knowledge about a protective response, they are more likely to respond to a warning message.

Wenger, Dennis, Benigno E. Aguirre, and Gabriela Vigo. 1994. "Evacuation Behavior Among Tenants of the World Trade Center Following the Bombing of February 26, 1993." College Station, TX: Hazard Reduction & Recovery Center, Texas A&M University.

Abstract

As a part of an in-depth analysis of the rescue and emergency medical response to the February 26, 1993 explosion in the World Trade Center, this report focuses on the survey that was employed to collect data on the evacuation behavior of the tenants in light of collective behavior theories and the panic literature. This paper presents some of the preliminary findings regarding risk perception and evacuation behavior. Specifically, the report presents findings regarding the initial definition of the crisis situation on the part of those who were in the towers, the degree of danger that was perceived by the tenants immediately after the explosion and at later points in time during the evacuation, the tenants' perceptions of the behavior and activities of the people in the building, the conditions that influenced the likelihood of panic behavior and factors associated with the development of emergent norms regarding the evacuation of the building.

Causal Findings

There is no relationship between having had prior experience with a hazard and a persons' likelihood for responding to a warning message. If a person perceives an increased risk or loss, they are more likely to respond to a warning message. A person with membership in social networks is less likely to respond to a warning message.

Westgate, Kenneth. 1978. "Hurricane Response and Hurricane Perception in the Commonwealth of the Bahamas." *Mass Emergencies* 3:251-265.

Abstract

Set against a background of social response and perception of the persistent threat of hurricanes, this analysis of individual hurricane perception and awareness in the Bahamas means to test responses to potential hurricane watch/warnings, hurricane strikes and accompanying injury and damage, by testing previous experience together with any personal projections of attitudes to future events. Additionally, the efficiency of current public information services and the suitability of this information of each personal situation are examined. Data is collected with a questionnaire structured to collect information in four primary areas: socioeconomic, previous hurricane experience, potential future response behavior and perception of the hurricane phenomenon and the damage it may cause. The authors conclude that each of these areas of information are important considerations in understanding hurricane response.

Causal Findings

A person is more likely to respond to a warning message if they have had prior hazards experience.

Whitney, David J., Michael K. Lindell, and Hannah-Hanh D. Nguyen. 2004. "Earthquake Beliefs and Adoption of Seismic Hazard Adjustments." *Risk Analysis* 24 (1):87-102.

Abstract

This study investigated the prevalence of both accurate and erroneous earthquake-related beliefs among a sample of Southern California college students and the relationship between their endorsement of earthquake beliefs and adoption of seismic hazard adjustments. In addition, the study examined the effects of an experimental earthquake education program and the impact of need for cognition on this program. The data revealed a significant degree of agreement with earthquake myths, a generally low level of correlation between earthquake beliefs and the level of hazard adjustments, and a significant effect of hazard information on the endorsement of accurate earthquake beliefs and increases in hazard adjustment. Compared with the "Earthquake Facts (Only)" format, an "Earthquake Myths versus Facts" format was slightly more useful for dispelling erroneous beliefs. Further, there was a tendency for those who were high in need for cognition to have higher levels of hazard adjustment. Finally, there was weak support for the hypothesis that those who were low in need for cognition would develop more accurate earthquake beliefs and higher levels of hazard adjustment in the "Earthquake Myths versus Facts" information condition.

Causal Findings

- Beliefs regarding the probability of earthquake occurrence, its potential severity and the efficacy of preparedness are *not* associated with the adoption of seismic hazard adjustments.
- The accuracy of people's earthquake-related beliefs and their adoption of seismic adjustments increase as a result of exposure to earthquake information pamphlets.

Wiegman, Oene, Egli Komilis, Bernard Cadet, Henk Boer, and Jan M. Gutteling. 1992. "The Response of Local Residents to a Chemical Hazard Warning: Prediction of Behavioral Intentions in Greece, France and the Netherlands." *International Journal of Mass Emergencies and Disasters* 10:499-515.

Abstract

In this study Greek, French and Dutch residents of a hazardous chemical complex were confronted with a simulated warning scenario for an industrial accident and intended functional and dysfunctional behaviors were measured. Intended functional behaviors were poorly predicted by our model, while dysfunctional behavioral intentions could be predicted rather well. Consequences for hazard communication in the European Community are discussed.

Causal Findings

The more a person believes a warning message, the more likely they are to personalize it. The closer in geographical proximity a person is to the impending disaster/hazard, the more likely they are to respond to a warning message. A person is more likely to respond to a warning message if they have had prior hazards experience.

Wilkinson, Kenneth P. and Perry J. Ross. 1970. "Citizen Response to Warnings of Hurricane Camille." Starkville, MS: Social Science Research Center, Mississippi State University.

Abstract

This study looks at the response of citizens to the warnings of Hurricane Camille that reached the Mississippi coastline on August 17 1969. It is likely that most residents of the highly vulnerable area reacted to the extensive warnings by evacuating their homes. This study is primarily concerned with factors that influenced the decisions to leave or to stay in the face of the widespread and generally accurate official warnings of the storm's approach and strength. As such, this is a study of the thoughts and behaviors of individuals under conditions of collective stress. Women are more likely than men to respond to a warning message.

Causal Findings

The older a person is, the less likely they are to respond to a warning message. The more experience a person has with disasters/hazards, the less likely they are to respond to a warning message. A person with children is more likely to respond to a warning message than someone without children. A person with membership in a minority group is less likely to respond to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. Understanding a warning message increases the likelihood of responding to it.

Williams, Harry B. 1957. "Some Functions of Communication in Crisis Behavior." *Human Organization* 16:15-19.

Abstract

This article examines human behavior in one type of crisis – sudden community disaster – using the feedback control system in hope of generating some insights on the subject; a full examination of human behavior in disaster requires other points of views and models. The general function of communication in crisis to provide the actor with information that will enable him to make choices and avoid, minimize or remedy the consequences of the crisis. Eight hypotheses are advanced: 1) Information about a future possible threat, which has not been previously experienced, tends to have relatively low value. 2) Recognition of the existence of crisis tends to follow an emergent or non-linear pattern. 3) Information about survival choices is a major determinant of survival behavior. 4) Compelling pressure to act and a compressed time perspective lead to error. 5) Sudden crisis creates great disparity between input from the environment and reference input, cutting down output. 6) The sector of life subject to reference input through institutionalized channels and sources is radically reduced. 7) There is great need for assistance in the communication and decision-making process, and 8) crisis events need to be interpreted and re-integrated with the actor's value system.

Causal Findings

If a person has had previous hazards experience, they are more likely to believe a warning message.

Windham, Gerald O., Ellen I. Posey, Peggy J. Ross, and Barbara Spencer. 1977. "Reaction to Storm Threat During Hurricane Eloise." Starkville, MS: Social Science Research Center, Mississippi State University.

Abstract

The purpose of this study is to provide information that can assist in improving the effectiveness of the National Weather Service's hurricane warning and preparedness programs. A major goal of the projects was to learn more about the perceptions and reactions of persons to a hurricane threat and warning messages. This study is unique in many ways. First, the preparation of the instrument and training of interviews were done in advance and data collect could begin almost immediately. Thus, the influenced of rationalization, discussion, and published accounts on individual opinion and recall were minimized. Finds reconfirm an early hypothesis that states that new residents are more likely to evacuate that those emerged in the culture of the area.

Causal Findings

The public is more likely to respond to a warning message if it receives that message from the mass media. The public is more likely to respond to a warning message if it comes from an official source. The more experience a person has with disasters/hazards, the less likely they are to respond to a warning message. If a person has knowledge about a protective response, they are more likely to respond to a warning message. A person with membership in social networks is more likely to respond to a warning message. The greater a persons' perceived risk or loss, the more likely that person is to respond to a warning message. The greater the social influence, the greater the likelihood of a person responding to a warning message. Understanding a warning message increases the likelihood of responding to it. The more a person personalizes a warning message, the more likely they are to respond to it.

Withey, Stephen B. 1962. "Reaction to Uncertain Threat." Pp. 93-123 in *Man and Society in Disaster*, edited by G. W. Baker and D. W. Chapman. New York, NY: Basis Books.

Abstract

In this chapter, the author develops a framework of predicting several psychological behaviors and explaining much of the available research on people in situations of threatening disaster. This examination of the literature points readers into the vast and detailed research on stress, defense mechanisms, perception, decision making, learning theory and systems theory each with relevant links to field data collected from various discipline's inquiries into reactions to impending disaster, increasing deprivations, aggression against minority groups and reactions to individual situations of interpersonal and intra-personal threat.

Causal Findings

The more consistency with which a warning message is delivered, the more likely the receiver is to believe it. If confirmation of the disaster/hazard happens, people are more likely to believe a warning message.

Withey, Stephen B. 1976. "Accommodation to Threat." *Mass Emergencies* 1:125-130.

Abstract

In this essay, the author analyzes the concept of 'accommodation to threat', one of the central concepts in disaster research. The paper explores the conceptualization of accommodation to threat, differential reactions by individuals, factors that contribute to positive adaptive behavior as well as those factors that contribute to ill-adaptive behaviors. Lastly, the author suggests that only through the careful analysis of the concept can it serve as a springboard for the derivation of more practical ends.

Causal Findings

If a person has knowledge about a protective response, they are more likely to respond to a warning message. The more a person personalizes a warning message, the more likely they are to respond to it.

Wolfe, Amy K. 1993. "Risk Communication in Social Context: Improving Effective Communication." *The Environmental Professional* 15:248-255.

Abstract

In the realm of complex and controversial technologies, professional risk communicators typically attempt to educate the affected public about the safety of technologies, emphasizing very low probabilities of events that may harm human health and safety. When the often one-way transmission of such information fails to lead to pubic acceptance of the technology in question, there may be much frustration and heightened tensions on all sides. This article argues that the process of communication may be more effective when 1) topics of communication are expanded to include many socially relevant aspects of a technology and its effects, not just probabilities of morbidity and mortality; 2) communication truly is interactive not unidirectional; and 3) there is recognition that information about a technology is communicated nearly continually through both formal and informal channels. To illustrate these points, an example of technology communication involving military low-altitude training flight is presented. The article concludes by discussing why the linkage between risk communication and technology acceptance should promote and interactive, socially relevant communication process.

Workshop on Effective Hazards Warnings. 2002. "Developing a Unified All-Hazard Public Warning System." Pp. 39 in *The Workshop on Effective Hazards Warnings*. Emmitsburg, MD: Partnership for Public Warning.

Abstract

The purpose of this report is to propose a national all-hazards public warning architecture and to outline some of the issues that will need to be addressed in creating such architecture. It is asserted that bringing diverse warning resources together and focusing on a unified all-hazards warning system will improve the effectiveness of all warnings. More so it is felt that such can be done so at cost less than the cost of improving the existing diffuse system. The warning process itself and the need for uniform terminology, protocol and warning content are also discussed. More specifically, it is recommended that an all-hazards public warning system 1) is reflects the social science findings on the matter; 2) incorporates training for populations at risk and their emergency managers; 3) is based upon a standard terminology; and 4) utilizes a standard protocol.

Worth, Marti, F. and Benjamin F. McLuckie. 1977. "Get to High Ground! The Warning Process in the Colorado Floods, June 1965." Columbus, OH: Disaster Research Center, Ohio State University.

Abstract

The authors of this repot use the Colorado floods of June 1965 to draw more general conclusions regarding disasters and the warning process. The report includes and overview of the flood situation and warning systems, descriptions of several of the effected communities, a discussion of the findings as well as conclusions. The discussion categorizes communities on the dimension of how much time elapsed between the initial warning and the onslaught of the flood. The communities are further into 'no warning', 'moderate warning' and extended warning communities as well as community population. In the conclusion, the authors assert that an integrated warning system performs three basic functions: evaluation of the threat, dissemination of the warnings and response to those warnings. Such is accomplished in three stages: forecast, alert and confirmation. Implications are provided.

Causal Findings

A person with membership in social networks is more likely to respond to a warning message.

Yoshii, Hiroaki. 1990a. "Responses to a Japanese Tsunami Warning and Lessons for Planning Countermeasures." *Disaster Management* 3:90-93.

Abstract

At 3:25 A.M. on November 2, 1989, a magnitude 7.1 earthquake struck 105 km off the northeastern Japan coast, precipitating a tsunami warning nine minutes later. Research carried out by the author after the event revealed that only 23% of the municipalities in the warning (high risk) and advisory (lesser risk) target areas called out their emergency response officers just after the quake took place, that only 15% of the seaside municipalities warned residents to evacuate, and that 54% of the municipalities received their first tsunami warning through the prefectural emergency radio network 15 to 24 minutes after the earthquake. Other findings from the survey of 2098 residents in the Sanriku region: 1) the alerting of residents of a possible tsunami was carried out by 80% of municipalities in the warning area, but only 14% in the advisory areas; 2) nearly all the residents obtained the tsunami warning through television news and the municipal radio communication network; and 3) considerable confusion accompanied the evacuation orders that were issued.

Causal Findings

A person is more likely to respond to a warning message if they are experiencing damage during the disaster/hazard. A person is less likely to respond to a warning message if environmental cues are lacking.

Yoshii, Hiroaki. 1990b. "Social Impacts of Earthquake Prediction in Greece." *Disaster Management* 3:3-7.

Abstract

Using a technique that detects seismically generated electrical signals, three Greek physicists--the VAN group--were able to predict several large Greek earthquakes with a moderate degree of accuracy. This article traces the social implications of a prediction that involved the destructive Killini-Valtholomio quake that occurred in 1988. Controversy arose when French scientists publicly announced the prediction over strong opposition by the Greek government and its own seismological advisers. After chronicling the evolution of the prediction, the author discusses how residents in the threatened area became aware of the prediction, presents data on the mitigation actions taken by the residents, and reviews policy issues that became focused during the episode. Findings include 1) only 6% of the threatened populace evacuated the vicinity; 2) after the earthquake, there was widespread acknowledgement in the mass media that the prediction had been valid; and 3) nearly 80% of the residents sampled indicated that they would react more positively to a VAN prediction in future.

Yoshii, Hiroaki. 1992. "Disaster Warnings and Social Response: The Eruption of Mt. Unzen in Japan." *Disaster Management* 4:207-214.

Abstract

One of 77 active volcanoes in Japan, Mt. Unzen erupted in November 1990 after nearly 200 years of dormancy. Initial hazards were mostly limited to mud and debris flows, but a more serious threat appeared on May 15, 1991 when the first pyroclastic activity started. Despite evacuation advisories issued by local authorities, a major eruption on June 3 killed 43 persons and injured 11 others. This article reports the findings of a survey conducted by the author to ascertain 1) why so many people ignored the warnings, and 2) how authorities can force people to take evacuation warnings seriously. Findings indicate that many evacuees had no perception of the risks associated with pyroclastic flows or misunderstood their effects; that others felt a pyroclastic flow would not reach their homes; and that hazards associated with earlier debris flows had diminished the perception of the threat posed by pyroclastic flows. The author also discusses the social and economic consequences of a mass evacuation forced upon residents after the June 3 eruption. More than 10,000 people had to evacuate the at-risk area, and as of June 1992, still had not been allowed to return due to continued volcanic activity.

Causal Findings

When technical information is used in a warning message, the public is less likely to respond to the warning. A person is less likely to respond to a warning message if they have false optimism. If there is a focus on an incorrect hazard, the public is less likely to respond to a warning message. A person is less likely to respond to a warning message if they have had prior hazards experience.

Zeigler, Donald J. and Jr. James M. Johnson. 1984. "Evacuation Behavior in Response to Nuclear Power Plant Accidents." *Professional Geographer* 36 (2):207-215.

Abstract

A telephone survey of 2,595 households on Long Island provided a database for analyzing potential spatial behaviors in response to an accident at the Shoreham Nuclear Power Station. Study conclusions include 1) the intended behavior of Long Island residents in response to a general emergency at Shoreham is likely to parallel the actual behavior of TMI area residents during the 1979 accident; 2) the behavioral response to nuclear accidents appears to be quite different from responses to other emergencies, particularly in terms of the spatial dimensions of the evacuation process; 3) in its geographic manifestation, spontaneous evacuation seems to place nuclear power plant accidents in a class by themselves; and 4) unlike pre-impact evacuations in response to natural disasters, during which it is often difficult to get people to move at all, evacuations in response to nuclear power accidents are likely to be characterized by an extreme over-response to limited protective action advisories.

Causal Findings

The more a person personalizes a warning message, the more likely they are to respond to it.

Zhang, Y, C S Prater, and M K Lindell. 2004. "Risk Area Accuracy and Evacuation from Hurricane Bret." *Natural Hazards Review* 5:115-20.

Abstract

This study evaluated the accuracy with which those at risk from Hurricane Bret were able to identify their hurricane risk areas. Overall, one-third of the respondents incorrectly reported their risk area and slightly more than half of these overestimated their risk. There was no systematic geographic pattern in the level of accuracy, but respondents with higher incomes and longer tenure on the coast were more likely to correctly report their risk areas. However, risk area accuracy was unrelated to the respondents' evacuation from the hurricane and length of coastal residence and hazard education were negatively related to evacuation. Implications for emergency managers are discussed.

Causal Findings

People with higher incomes and longer tenure on the coast are more likely to correctly report their risk areas. However, risk area accuracy is unrelated to people's evacuation from the hurricane. Length of coastal residence and hazard education are negatively related to evacuation.