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Gender Differences in Risk and Communication Behavior: Responses to the New Madrid Earthquake Prediction

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This study examines gender differences in communication behavior, risk perception, and preparedness in response to the highly publicized New Madrid earthquake prediction for a 6.5-7.5 Richter magnitude earthquake on December 2-3, 1990. A survey of 629 respondents in November and a follow-up survey of 496 respondents in February 1991 in the Cape Girardeau, Missouri, community provided the opportunity to assess public response to the false alarm. The analysis includes a panel survey of 290 respondents who agreed in November to a second interview. When compared with men, women were associated with higher levels of interpersonal discussion about the prediction and perceived higher levels of interpersonal and news media influence on their perceptions of the importance of the earthquake prediction. Contrary to previous studies reporting higher levels of news media use for men, no gender differences in news media use were found. A majority of studies of risk perception suggest higher levels of perceived risk for women than men. In this study, men were associated with higher levels of risk and lower levels of preparedness.

Within the social dimension of disaster, interpersonal and mass communication play a critical role in public response. Although the news media are a primary source of information about disasters (Drabek

and Boggs 1968; Turner et al. 1986; Perry and Lindell 1989; Burkhart 1991), rather than immediately responding to initial warnings, many people first talk with family members, friends, and neighbors to clarify the warning, to assess the potential risk, and to determine what action to take (Nigg 1982; Mileti and Fitzpatrick 1993). According to Mileti and Fitzpatrick (1993, p. 13): "[I]t is the risk people 'perceive' that determines what they and society do to get ready for future disasters," and clearly the communication process performs a critical role in that social construction of risk.

The purpose of this study is to examine gender differences in perceived risk and communication behavior in response to the highly publicized 1990 New Madrid prediction that specified the earthquake's time, location, and magnitude.[1] Opportunities to examine real-time earthquake predictions are unusual because of the complex process involving their issuance. Because the New Madrid prediction was issued one year in advance of its expected occurrence, preevent and postevent opinion surveys were collected from adult respondents in the area to analyze the relationships among gender, communication behavior, perceived risk, and preparedness.

The New Madrid Prediction

The New Madrid fault is the most seismically-active earthquake zone east of the Rocky Mountains and is the location of the 1811-1812 earthquakes, the most devastating that have occurred in the continental United States (Atkinson 1989). On December 12, 1989, at a meeting of the Missouri Governor's Conference on Agriculture,[2] a New Mexico business consultant and self-taught climatologist with a doctorate in physiology predicted that a "tidally triggered, magnitude 6.5-7.5 earthquake will occur in the New Madrid region of the Central United States on December 2-3, 1990, plus or minus 2 days" (Davis 1990, p. 1).

The news media in Missouri and Illinois publicized Browning's prediction even though it was not endorsed by the National Earthquake Prediction Evaluation Council (NEPEC). Between June 1 and December 3, 1990, 343 news stories appeared in the *St. Louis Post-Dispatch,* the *Memphis Commercial Appeal,* and the *Arkansas Gazette* (Shipman et al. 1993). In the community where the surveys were conducted for the study reported here, the local newspaper, the *Southeast Missourian*, published 89 news stories about the prediction between mid-October and December 5, 1990 (Gao 1991). The prediction also was publicized weekly on area television and radio stations from September through December.

In the news media coverage of the prediction, Browning was referred to as a "climatologist" despite the fact that he had no formal training in geology, seismology, or climatology (Shipman et al. 1993, p. 385). For area residents, four factors contributed to the prediction's credibility: (1) the director of the Center for Earthquake Studies at Southeast Missouri State University, Dr. David Stewart, supported the prediction and provided the news media with commentary about the prediction's validity[3]; (2) Browning was reported to have successfully predicted the October 17, 1989, Loma Prieta earthquake; (3) residents of the New Madrid area experienced a 4.6 Richter magnitude earthquake on September 26, 1990, that resulted in no serious damage but did reinforce the area's chronic earthquake threat; and (4) although the United States Geological Survey Ad Hoc Working Group issued a report on October 18, 1990, that there was no scientific basis for Browning's prediction, the area news media continued to publicize the prediction at a rate of two stories per day between mid-October and early December.

Gender and Communication Behavior

Communication is essential in disseminating disaster warnings and in educating publics at risk about earthquake response and preparedness. A number of studies have established a general pattern of gender differences in communication behavior. Turner (1994) reported that women communicated more frequently with members of their social networks than did men, confided in friends more frequently, reported higher empathy with friends and family, and reported greater emotional disclosure in social relationships than did men. Fischer (1982) and later Antonucci and Akiyama (1987) reported that women participated more frequently than men in discussions with friends and family members.

Interpersonal Sources

In research specific to earthquakes, women have been found to be

more likely to learn about a disaster warning before men do because of stronger and more complex social networks (Turner et al. 1979). Although women convey those warnings to family members, Drabek (1969) reported that husbands were skeptical of the disaster warnings that their wives had learned about through social networks. In addition to women's greater likelihood of talking about earthquakes with others (Turner et al. 1986), research indicates that women's social networks function as informal warning systems (Morrow and Enarson 1996) and that women seek advice from friends and relatives before making evacuation decisions (Drabek and Boggs 1968). O'Brien and Atchison (1998) reported that women were more likely than men to seek information about the 1989 Loma Prieta earthquake.

News Media Sources

The news media perform a critical role in disseminating information about disaster warnings. According to Turner et al. (1986, p. 72), who surveyed 1,450 respondents during the 1976 Palmdale bulge, the public's primary sources of information about earthquake predictions, forecasts, and cautions were television (55.1 percent), newspapers (19.5 percent), radio (12.1 percent), and social networks (9.7 percent). The important role of the news media in disaster warnings is supported by Burkhart's (1991, p. 61) findings that 29.9 percent of his 184 respondents initially heard about the Abilene, Texas, floods from official announcements, 47.8 percent from the news media, and 22.3 percent from social networks.

Several studies have reported gender differences in news media use. McGrath (1993) reported a readership gender gap with men more likely than women reporting reading newspapers everyday. In Briller's (1990) study, men were more likely than women to be heavy television news viewers. Kennamer (1986) reported greater attention levels to television and newspaper news reports for men than women. Clearly, the news media are an important source of information for publics at risk, and the research suggests that men are heavier consumers of news media than are women.

Official Sources

Besides interpersonal and mass media sources, the public has access to official sources of disaster warnings. In a comparative study of flood and chemical spill warnings, Burkhart (1991) found that official sources[4] were cited as the initial sources of the warning by 29.9 and 31.1 percent of the respondents, respectively. However, in the disaster literature the definition of official sources varies from the National Guard to police and fire departments, civil defense officials, emergency management officials, city officials, the Red Cross, and officials representing earthquake centers.

The research findings examining gender differences in information acquisition from official sources have been inconsistent, which in part may be a result of the variety of definitions of official sources employed in the studies. For example, one year after the 1994 Northridge earthquake, Blanchard-Boehm (1997, p. 6) found that women (40 percent) were more likely than men (27 percent) to seek information from the Red Cross and government agencies. Although O'Brien and Atchison (1998) found that women generally were more likely than men to seek information about earthquakes and aftershocks, they reported that men were more likely than women to receive aftershock information from official sources.[5]

Knowledge of the public's primary sources of disaster warning information is essential for planning programs, but equally important is an understanding of the trust that the public places in those sources. Two correlative factors affecting public response to sources of disaster warnings are: (1) the confidence attributed to the source of the information, and (2) how much that information influences the importance the individual attributes to the warning. Both factors have been found to impact whether or not preparatory activities are undertaken (Major 1998).

Gender and Confidence in Information Sources

Confidence, commonly referred to in the communication literature as trust, has been described as one of two underlying dimensions of friendship (Cushman et al. 1982). According to Giffin (1967, p. 105), trust in interpersonal relationships is the "reliance upon the communi-

cation behavior of another person in order to achieve a desired but uncertain objective in a risky situation." In a meta-analysis of gender differences in personality, Feingold (1994) found that women scored higher than men on all measures of trust. Carrocci's (1988) findings corroborate those of Feingold indicating that women are generally more trusting than men.

The level of confidence that individuals hold in information sources is especially important in situations of uncertainty like an earthquake prediction. In Burkhart's (1991, p. 75) study of flood warnings, the vast majority of respondents attributed medium to high levels of confidence to official (69.1 percent), news media (88.6 percent), and interpersonal (85.4 percent) information sources. For chemical spill warnings, 97.9 percent of respondents rated their confidence in official sources as either medium or high. The 29-point differential in confidence ratings in official sources in flood versus chemical warnings may result from the technological nature of the chemical warning where "citizens depend on people with access to technical information as most reliable" (Burkhart 1991, p. 74).

Predictions issued by scientists and government agencies disseminated through the news media are more likely to be believed by people than are predictions issued by non-scientific sources (Stallings 1995). However, confidence in disaster warnings is confounded by news media coverage of predictions issued by psychics, religious leaders, and pseudo-scientists. Although Browning was a pseudo-scientist, the news media promoted him as a credible scientific source.

Gender and Influence of Information Sources

There is controversy in the psychology literature about the findings of studies examining gender differences in susceptibility to influence. Maccoby and Jacklin (1974) reviewed 138 published studies and found that 84 of those studies provided no evidence of gender differences in influencability. Their study stands in contrast to Eagly and Carli's (1981) meta-analysis of 148 studies on gender differences wherein they did find evidence that women are more susceptible to influence than are men.

In a study specific to news media coverage, gender, and political issues, Wilkins (1995, p. 253) found that women "are less likely to be

susceptible to press coverage" than men. Despite the inconsistency regarding gender and influencability, the general pattern in the literature suggests greater influencability for women than for men. The New Madrid prediction provides an opportunity to examine gender differences in perceived influence of official, news media, and interpersonal information sources.

Gender Differences in Personalized Risk

Public response to hazard warnings has been linked to public perceptions of the risk associated with a hazard. According to Mileti and Fitzpatrick (1993), the concept of personalized risk is defined as the individual's belief about the likelihood of personal injury or property damage in the event of an earthquake and the individual's perception of control over the situation.

Gender differences in response to risk have been found in several studies. Women have been found to be less likely to take risks than men (Cutter et al. 1992), to perceive risks more seriously than do men (Cutter et al. 1992; Flynn et al. 1994), and to be more concerned about risks if those risks would impact their families (Bord and O'Connor 1990). However, the findings on gender and risk perception have not been consistent. Greenberg and Schneider (1995) point out that many risk studies assess college students' perceptions of contrived risks rather than adult respondents who live in areas where environmental hazards such as hazardous waste sites exist. In comparing the risk perceptions of residents of neighborhoods without hazardous sites with those where hazardous sites exist, Greenberg and Schneider (1995, p. 509) found that women living in non-stressed neighborhoods reported higher perceptions of risk than men, but that residents of hazardous neighborhoods "demonstrated no consistent difference in concern by gender." For earthquakes in particular, of 187 respondents in Pasadena, California, Blanchard-Boehm (1997, p. 6) found that more women (80 percent) than men (63 percent) believed their own home would sustain serious damage during a major earthquake in the next 10 years.

Gender and Earthquake Preparedness

An important factor in developing disaster preparedness programs

is to motivate citizens to respond to disaster warnings and to engage in preparations that will reduce the potential damage to human life and property. Preparatory actions provide individuals with a sense of control or mastery over a situation, which is comparable to Bandura's (1982) concept of self-efficacy, that is, the individual's estimate of his or her ability to take action to manage a situation.

In a review of the literature on gender, risk, and disasters, Fothergill (1996, p. 38) reported a pattern in the findings that women are more likely than men to participate in disaster preparations in residential areas, and that it is largely women's increased perception of risk that leads to preparations. In a study of Pasadena residents, Blanchard-Boehm (1997) found that a primary cause of fear was that respondents felt a lack of control over the situation. In her study, respondents reported that the information on preparations for an earthquake gave them a sense of control over the situation.

The New Madrid earthquake prediction provides an opportunity to examine gender differences in response to a "real-time" earthquake prediction where the news media continued to publicize the prediction even after it was discredited by the Ad Hoc Working Group (Davis 1990). In November 1990, 91.5 percent of the respondents (N = 629) held at least some or a strong belief in the New Madrid prediction.

To assess gender differences in response to the earthquake prediction, this study will address the following research questions:

1. Interpersonal Communication: The literature suggests that women in general engage more frequently than men in interpersonal discussions. Will this pattern of gender differences be supported in discussions of the New Madrid prediction with friends, family members, coworkers, and official sources?

2. News Media: Previous research has found men to be heavier consumers of news media content than women. Given the importance of the news media as a source of information for publics at risk, will these gender differences hold true in the use of news media for earthquake information?

3. Confidence in Information Sources: Confidence in disaster warning sources is a critical factor in response. Studies of confidence provide evidence that women are more likely to exhibit higher levels of confidence than men. Will women manifest higher levels of confidence in information sources than men about the New Madrid prediction?

4. Influence of Information Sources: The general pattern reported in the literature attributes higher levels of influenceability to women than men. Will this pattern of gender differences materialize for information sources about earthquake information?

5. Personalized Risk: The research examining perceived risk of earthquakes has shown that generally women exhibit higher levels of risk than men. Will this pattern of gender differences be supported in perceptions of risk about the New Madrid earthquake prediction?

6. Earthquake Preparedness: In a limited number of studies assessing gender differences in earthquake preparations, women have been found to engage in more preparations than men. Will this pattern of gender differences hold true for the New Madrid prediction?

Method

To assess gender differences in response to the 1990 New Madrid earthquake prediction, a discriminant analysis was undertaken of three surveys.[6] The first cross-section survey of 629 adults was conducted during the first five days of November 1990 in a community of 89,000 residents in the Cape Girardeau, Missouri, area. The follow-up cross-section survey of 496 adult respondents was conducted during the third week of February 1991 in the same community. A panel dataset was created from 290 adults who agreed in November to participate in the second interview. Analysis of the panel respondent characteristics shows that they did not differ substantially from the full November sample.[7]

A computer program generated telephone numbers that were proportional to those in each local exchange and proportional to the first digit in the final set of four digits. The final three digits were random numbers. Nearly sixty percent (59.3) of the incomplete calls were made to numbers no longer in service, a common problem encountered when using random-digit dialing in a small university community.[8] The telephone interviews were conducted by local university students in an undergraduate research methods class. The students were trained in interviewing techniques during the week prior to data collection and were supervised by faculty and graduate students who were present during the interview process.

A discriminant analysis procedure (Norusis 1994) was employed

to examine gender differences. This statistical technique is used to identify differences between two or more mutually exclusive categories or groups on the basis of a set of variables.[9] In this analysis, the maximum number of functions is one. Only associations of ± .30 with a discriminant function were considered for interpretation in the analysis because smaller associations would account for less that 9 percent of the variance.

Discriminant functions, otherwise referred to as linear combinations of variables, are calculated so that the scores contributing to a function are as similar as possible within a group but differ as much as possible between groups. In this analysis, gender is the group variable and the discriminating variables include interpersonal discussion,[10] news media use,[11] official sources,[12] influence of interpersonal sources,[13] influence of news media sources,[14] influence of official sources,[15] confidence in interpersonal sources,[16] confidence in news media sources,[17] confidence in official sources,[18] personalized risk,[19] and earthquake preparations.[20]

Because two discriminating variables may be correlated with a function in opposite directions and cancel each other out in terms of the magnitude of their discriminant function coefficients, the correlations of the these variables with the discriminant functions provide the best interpretation of a function's meaning (Klecka 1980). The structure matrix is used to derive the interpretation of the analysis. The sign of the correlation coefficient can be interpreted in terms of whether or not gender is negatively or positively associated with the function.[21] In the analyses that follow, a stepwise solution was employed to minimize Wilks' lambda. The lambda statistic provides a measure of the extent to which a function accounts for the differences between groups. As lambda increases, the remaining discriminating power decreases. Lambda is converted to chi-square to test the statistical significance of the function.

Findings

The impact of the continuous news coverage of the New Madrid prediction during the fall of 1990 is reflected by nearly nine of every ten respondents (90.8 percent of women and 88.4 percent of men) who had read about earthquakes in area newspapers or had heard about earthquakes on area television news programs (91.2 percent of the women and 87.7 percent of the men). Eight of every ten respondents reported talking with family members or friends about earthquakes. Table 1 presents the proportions of respondents by gender compared with news media use and interpersonal discussion about earthquakes and underscores the ubiquity of the earthquake problem among community residents.

Table 1.
Proportion of Respondents by Gender and Communication About the New Madrid Prediction

	November 1990 (N=629)		*February 1991* (N=488)		*Panel Survey* (N= 290)	
	Men	Women	Men	Women	Men	Women
Newspapers						
Percent	88.4	90.8	48.2	41.4	87.8	86.0
Frequency	267	289	106	111	116	142
Television						
Percent	87.7	91.2	45.6	44.9	84.1	87.7
Frequency	265	291	100	121	111	136
Radio						
Percent	56.7	56.6	35.9	29.1	50.4	49.3
Frequency	169	179	79	78	65	76
Family						
Percent	76.8	86.2	52.9	52.2	78.0	89.7
Frequency	232	275	116	140	103	140
Friends						
Percent	84.1	87.7	52.5	48.8	81.8	89.1
Frequency	254	279	115	130	108	139
Coworkers						
Percent	46.6	55.7	41.6	39.3	69.2	69.1
Frequency	137	170	90	103	90	105

The discriminant analysis employed in this study provided the multivariate means to ascertain gender differences in communication behavior, perceived risk, and preparedness in response to the highly publicized New Madrid prediction. Summary statistics for the canonical discriminant functions are presented in Table 2.

Table 2.
Summary Statistics for November 1990, February 1991, and Panel Respondents

Survey	Function	Eigenvalue	Variance	Canonical Correlation	Wilks' Lambda	Chi Square	df	P-value
1990[a]	1	.04	100.00	.21	.96	24.56	12	.0171
1991[b]	1	.12	100.00	.32	.89	43.05	12	.0001
Panel[c]	1	.10	100.00	.29	.91	22.42	11	.02

[a] Group centroids are comparable to group means. For the November survey, the group centroid for women = .21 (N=282) and for men = -.22 (N=273).

[b] For the February survey, the group centroid for women = .32 (N=212) and for men = -.36 (N=190).

[c] For the panel survey, the group centroid for women = -.29 (N=133) and for men = -.34 (N=113).

Gender and Interpersonal Communication

Previous studies underscoring that women engage more frequently in interpersonal discussions than men (Turner 1994) and have been found to be more likely to talk about earthquakes than men (Turner et al. 1986) lead to the first research question of whether gender differences would be found in discussions about the New Madrid prediction. In the November (.48) and panel (-.61) surveys, women were associated with higher levels of interpersonal discussion about earthquakes with family members, friends, and coworkers than were men.

The pattern of gender differences did not materialize in the February survey. Two months after the December 3 earthquake failed to occur, the proportion of male and female respondents who reported talking about earthquakes had declined by 30 percentage points (see Table 1). That gender differences did not occur following the failed prediction was likely the result of: (1) the fact that area news media coverage of the prediction had dramatically declined after the first week of December; (2) that the prediction was a false alarm; or (3) that the earthquake was no longer a salient topic on the public agenda. However, it

is important to emphasize that during the critical warning period prior to December 3, women did talk more about earthquakes than did men, which does provide support for Morrow and Enarson's (1996) findings that women's social networks function as informal warning systems.

Direct contact with official sources is limited to a minority of citizens in a community principally because of access. In the November survey, only one of five respondents reported talking with official sources about the prediction compared with fewer than one in ten respondents in the February survey (Table 1). In the few studies examining gender differences in information acquisition from official sources, the findings have been inconsistent (Blanchard-Boehm 1997; O'Brien and Atchison 1998). In this study, official sources are defined as officials or persons in government agencies. Only in the February analysis following the failed prediction were women (mean = 6.1) more likely than men (mean = 5.5) to have discussed earthquakes with official sources. This provides some support for Blanchard-Boehm's (1997) findings. In February, women who communicated with official sources may have been seeking clarification of why the earthquake had failed to occur.

Gender and News Media Use

In studies of news media use, men have been reported to be heavier consumers than women of the news media. For the most part, in previous studies news media use has been defined as attention to or time spent with a specific news media source such as television instead of attention to a specific topic or issue covered in the news media (i.e., news source versus news topic). In this study, where respondents were asked to recall news about earthquakes from specific sources, no differences in news media use were found between men and women. Although men generally may spend more time using news media than women, gender differences do not appear to surface when the definition of attention to news media is narrowed to recall of information about the earthquake prediction.

Gender and Confidence in Information Sources

Information sources are critical in communicating disaster pre-

Table 3.
Correlations Between Discriminating Variables and Functions, November 1990 and February 1991

Discriminating Variables and Indices	Function 1990	Function 1991
News media coverage of the earthquake problem influenced perception of the earthquake problem's importance (index)	.71*	.38*
Confidence in information about earthquakes from family, friends and coworkers (index)	.64*	.55*
Talked about earthquakes with family, friends, coworkers (index)	.48*	-.01
Confidence in information about earthquakes from newspapers, television and radio (index)	.33*	.22
Perceived preparedness for major earthquake (mastery index)	.31*	.55*
Evaluation of the amount of new media coverage of the earthquake	-.30*	-.42*
Confidence in information about earthquakes from official sources	.28	.45*
Discussions with friends, family and coworkers influenced perception of the earthquake's importance (index)	.27	.60*
Talked about earthquakes with official sources	.19	.31*
Knowledge of accuracy of earthquake prediction and meaning of small earthquakes (index)	.13	-.09
Amount of news heard recently about earthquakes in newspapers, and on television and radio (index)	.04	-.08
Discussion about earthquakes with official sources influenced perception of earthquake's importance	.03	-.41*

Note: Values marked with an asterisk are those that exceed .30 and are included in the intepretation. The 1990 function separates women (+) from men(-). The 1991 function separates women (+) from men (-).

Table 4.
Correlations Between Discriminating Variables and Functions: Panel Survey

Discriminating Variables and Indices	Function 1
Talked about earthquakes with family, friends, coworkers (index)	-.61*
Personalized risk (index)	.56*
Confidence in information about earthquakes from official sources	-.50*
Confidence in information about earthquakes from family, friends and coworkers (index)	-.45*
Knowledge of accuracy of earthquake prediction and meaning of small earthquakes (index)	.44*
Discussions with friends, family and coworkers influenced perception of the earthquake's importance (index)	-.41*
News media coverage of the earthquake problem influenced perception of the earthquake problem's importance (index)	-.40*
Confidence in information about earthquakes from newspapers, television and radio	-.29
Discussion about earthquakes with official sources influenced perception of earthquake's importance	-.21
Believability of the December 3 prediction	-.13
Talked about earthquakes with official sources	-.06

Note: Values marked with an asterisk are those that exceed .30 and are included in the interpretation. The 1991 function separates women (-) from men (+).

paredness information to publics, and a key factor affecting the reception of that information is the confidence that individuals attribute to it. Although studies of general measures of confidence and trust indicate that women tend to score higher than men (Carrocci 1988; Feingold 1994), no studies were found in the literature that examined gender differences in confidence attributed to disaster warning sources.

When compared with men, women were associated with higher lev-

els of confidence in the news media only in the November survey. This may reflect a general decline in public confidence in news media coverage of the New Madrid prediction. Following the failed prediction, public confidence in newspaper coverage of the prediction declined 10.8 percentage points, from 33 percent to 22.1 percent (Major and Atwood 1997).

For interpersonal information sources, women were associated with higher levels of confidence than were men in all three surveys. In contrast with the decline in respondent confidence in news media sources from November to February, the proportion of respondents reporting "some" or "a great deal" of confidence in interpersonal sources remained constant at 66.5 percent.

Women also were associated with higher levels of confidence in official information sources in the February (.45) and panel (-.50) surveys, which makes sense in view of the fact that women were more likely than men to talk with official sources in February. Women's discussions with official sources and higher confidence levels in the information from those discussions reinforces that "false alarms," if explained by authorities, do not necessarily lead to reductions in belief in future predictions (Mileti and Fitzpatrick 1993). The fact that confidence in official sources did not differentiate women from men in November may reflect the timing of the November survey, suggesting that the earthquake issue had not yet crystallized in the community.

Gender and Influence of Information Sources

In addition to exposure to earthquake information, what is equally important is the influence that information has on the public about the importance of the earthquake problem. Women were associated with higher levels of perceived news media influence on their perceptions of the importance of the earthquake problem in all three analyses (.71, .38, and -.40, respectively).

In the February and the panel surveys, women were more likely to perceive that interpersonal discussions had influenced their perception of the importance of the earthquake problem. However, contrary to the higher levels of perceived influence of information from the news media and interpersonal sources that characterized women's responses to the New Madrid prediction in the February analysis (-.41), men were more

likely than women to report being influenced by discussions about earthquakes with official sources.

Gender, Personalized Risk, and Preparedness

Although previous research has attributed higher levels of personalized risk to women than to men (Bord and O'Connor 1990; Cutter et al. 1992), in response to the New Madrid prediction men reported higher levels of risk about the predicted earthquake than did women. In the community, women's greater likelihood of talking about the earthquake issue, coupled with their confidence in those discussions and the influence of those discussions on their behavior, may have created a social safety net that resulted in lower perceptions of personalized risk from the chronic earthquake threat. Finally, women's lower levels of personalized risk may have contributed to their response to the earthquake warning by undertaking preparations to make their homes safer. In the November (.31) and February (.55) analyses, women were associated with higher levels of earthquake preparedness than were men, and these findings provide support for those of Morrow and Enarson (1996).

Discussion

The New Madrid earthquake prediction provided an opportunity to examine public response prior to and following a "real-time" disaster warning that was not endorsed by the scientific community but was legitimated by continuous news media coverage that resulted in 9 out of 10 (91.5 percent) area residents reporting some belief in the warning's validity. These findings support those of previous studies highlighting the function of women's social networks as information systems during disaster events (Drabek and Boggs 1968; Morrow and Enarson 1996) and the important role of communication in those networks (Turner et al. 1986; Antonucci and Akiyama 1987).

The findings also suggest general patterns of gender differences in response to disaster warnings. When compared with men, women talked more about earthquakes, were more confident in the information from those discussions, and perceived greater influence from those discussions on the importance that they attributed to the prediction. However, men perceived greater influence from their discussions with

official sources on the importance that they assigned to the prediction. For men, official sources may have been a more influential and as a result a more important source of disaster information than interpersonal sources. However, an alternative explanation for their attribution of influence of information from official sources is that it was a mechanism for externalizing responsibility for their belief in a prediction that did not materialize. Although these findings highlight a general pattern of stronger levels of influencability for women than for men, the pattern is clearly not cross-situational. The rationale underlying these gender differences in influencability in disaster response warrants further study.

Although the news media performed an important role in disseminating the earthquake warning, interpersonal discussions appear to have played a more important role in public response to the prediction, providing further evidence that people often seek information from the news media first and then seek out confirmation and reassurance from members of their social networks (Turner et al. 1986). Because interpersonal discussions appear to be more closely anchored to behavior than are the news media, efforts to educate publics about earthquake preparedness should place greater emphasis on interpersonal rather than news media sources. Women constitute a critical public for disaster preparation education because of the preparations they undertake in their homes and neighborhoods. Preparedness programs targeted at women's neighborhood, community, and civic organizations would reach effective and efficient social networks for disseminating critical messages to key opinion leaders in communities.

The risk that people perceive does appear to influence public response to disaster warnings (Mileti and Fitzpatrick 1993). Contrary to the findings of the majority of studies of gender differences and risk, in response to the New Madrid prediction, women were characterized by lower levels of perceived risk than men, which may have resulted from the fact that women spent more time discussing the prediction and undertook more preparations for potential disaster. Communication clearly had an impact on women's self-efficacy (Bandura 1982).

Communication did not have the same consequence for men. Because men were less likely than women to talk about the earthquake, the news media were most likely their primary source of information about preparations. In a study of the news coverage of the New Madrid

prediction, Gao (1991) found limited and contradictory information on preparations. The fact that men attributed higher levels of influence to official information sources suggests a need for education programs that can be delivered in work environments by emergency management officials. Efforts to educate men about earthquake risk and preparedness should emphasize specific actions that will enable them to reduce their risk of injury or property damage. Efforts also need to focus on improving community residents' access to official information sources to ensure the dissemination of accurate information. These findings underscore that, in disaster mitigation, gender differences do make a difference in response and preparation.

Notes

1. According to the Earthquake Hazards Reduction Act of 1977, an official earthquake prediction approved by the scientific committee of the National Earthquake Prediction Evaluation Council (NEPEC) must define the (1) time, (2) location, (3) magnitude, and (4) probability of the occurrence of the event. The United States Geological Survey (USGS) is circumspect in issuing official predictions because earthquake prediction is an inexact science and establishing the four criteria is extremely difficult to pinpoint (Mileti and Fitzpatrick 1993). This situation is further complicated by disagreements among members of the scientific community about earthquake prediction methods.
2. The meeting was held in Osage Beach, Missouri.
3. Stewart resigned from his position at the Center for Earthquake Studies following the controversy that developed over the failed prediction.
4. In Burkhart's (1991) study, official information sources included city officials, the police, and city planning offices.
5. Official information sources were not specifically defined.
6. Support for this research was provided by the Department of Mass Communications at Southeast Missouri State University and the School of Journalism at Southern Illinois University at Carbondale.
7. In the November survey, 51.4 percent of the respondents were female and 48.6 percent were male. For the panel survey, these percentages were 54.2 and 45.8 percent, respectively. For education, in the November survey 10.9 percent of the respondents had not completed

high school, 38.2 percent had graduated from high school, 30.0 percent had attended some college, 15.7 percent had graduated from college, and 5.2 percent had attended graduate school. For the panel survey, those figures were 8.3, 36.7, 32.5, 15.2, and 7.3 percent, respectively. In the November survey, 17.6 percent of the respondents were between the ages of 18 and 24, 21.7 percent were between 25 and 34, 32.8 percent were between 35 and 54, and 24.8 percent were 55 or older. For the panel survey, those percentages were 23.8, 23.5, 26.0, and 20.8, respectively. For belief in the New Madrid prediction, 91.5 percent of the November respondents held some belief in the prediction while 8.4 percent reported no belief in the prediction. Of the panel respondents, 93.9 percent believed the prediction while 6.1 percent did not.

8. In the November sample, 763 working contacts were generated. Of those, 629 interviews (82.5 percent) were completed. A subset of 480 respondents (76.3 percent of the 629) agreed to participate in a second interview. Second interviews were completed with 290 respondents (60 percent of the 480 respondents).

9. The number of constructs that differentiate between the group variable, that is, the number of discriminant functions, cannot exceed the number of groups minus one (i.e., 2-1), or the number of discriminating variables minus one (i.e., 12-1), whichever is smaller.

10. The interpersonal discussion index was created from the following three items: "How much have you talked with (members of your family/friends/people you work with) about earthquakes? Have you talked (4) a lot, (3) some, (2) not much, or (1) not at all?" For the November items, Cronbach's $\alpha = .66$ and for the February items, $\alpha = .87$.

11. The news media use index was created from three items: "How much have you recently read or heard about earthquakes? Would you say you've read and heard (4) a great deal, (3) some, (2) not very much, or (1) nothing at all?" Separate questions were asked for newspapers, television, and radio. Cronbach's $\alpha = .61$ and .91 for November and February respectively.

12. Discussion with official sources was measured by asking respondents: "How much have you talked with officials or persons in government agencies about earthquakes? Have you talked (4) a lot, (3) some, (2) not much, or (1) not at all."

13. The perceived influence of interpersonal communication was created from three items: "Do you think what you talked about with (members of your family/friends/coworkers) has had any influence on how important you think the earthquake problem is?" The response options included (4) a lot of influence, (3) some influence, (2) not much influence, or (1) no influence at all. For these three items, Cronbach's $\alpha = .81, .83$, and .79 for November, February, and panel surveys, respectively.

14. The perceived influence of news media index was created from three items: "How much do you think (the newspaper/television/radio) has influenced your opinion about how important the earthquake problem is?" Response options were identical to those for discussion. Cronbach's alpha equaled .79, .84, and .78 for the three surveys, respectively.

15. Perceived influence of information from earthquake officials was measured by asking: "Do you think what you talked about with officials or persons in government agencies who are concerned about earthquakes has had any influence on how important you think the earthquake problem is? Do you think those talks had (4) a lot of influence, (3) some influence, (2) not much influence, or (1) no influence at all?"

16. The confidence index for interpersonal discussion was measured by three items: "How much confidence do you have in the information you have been getting about earthquakes from (members of your family/friends/people you work with)? Do you have (4) a great deal of confidence, (3) some confidence, (2) not much confidence, or (1) no confidence at all?" For the three data sets, Cronbach's $\alpha = .80$, .80, and .78, respectively.

17. For news media sources, the confidence index was created from the following three items: "How much confidence do you have in the information you have been getting about earthquakes from (newspapers/television/radio)? Do you have (4) a great deal of confidence, (3) some confidence, (2) not much confidence, or (1) no confidence at all?" For the November, February, and panel surveys, Cronbach's $\alpha = .81$, .80, and .77, respectively.

18. A single item was used to measure confidence in information from official sources: "How much confidence do you have in the information you have been getting about earthquakes from officials or persons in government agencies? Do you have (4) a great deal of con-

fidence, (3) some confidence, (2) not much confidence, or (1) no confidence at all?"

19. Because the personalized risk index was included only in the November survey, only the panel survey is examined. Personalized risk was measured by an index of three items that were developed from those used by Turner et al. (1986, pp. 175-178): "I don't believe an earthquake would really hurt me (reverse coded). There is nothing I can do about earthquakes, so I don't try to prepare for that kind of emergency. The way I look at it, nothing is going to help if there were an earthquake." Response options were (4) strongly agree, (3) agree somewhat, (2) disagree somewhat, (1) strongly disagree. The higher the score, the greater the level of personalized risk. For the three items, Cronbach's $\alpha = .71$.

20. In the November data, preparedness was measured by an index created from the following three variables: "How prepared do you feel you are in the event of a major earthquake? Are you (4) very well prepared, (3) somewhat prepared, (2) not well prepared, or (1) not at all prepared?"; "If you personally tried to do something to help protect yourself and your family from a major earthquake, do you think your efforts would make (4) a lot of difference, (3) some difference, (2) not much difference, or (1) no difference at all?"; "Some people are trying to make their homes safer even if it might not make much difference. Have you done anything that might make your home safer if there were a major earthquake?" Response categories included (0) had not made preparations or (1) had made preparations. Cronbach's $\alpha = .57$. For the February survey, the first two variables of the preparedness index were identical to those in the November survey. The third variable was changed to reflect the February time period: "Some people are still doing things to make their homes safer in case there is an earthquake. Is there anything that you have done since last December to prepare for a major earthquake?" Response categories were identical to November. Cronbach's $\alpha = .58$.

21. It is important to note that if women are associated negatively with a function and the correlation coefficient for the discriminating variable or index is also negative, then women are associated positively with that variable or index. Refer to the signs of the centroids reported in Table 2. A positive correlation and a negative group centroid are interpreted as a negative association.

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