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FAMILY RECOVERY FROM NATURAL DISASTER: A PRELIMINARY MODEL

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INTRODUCTION

When families are stricken by natural disaster, complex processes occur that affect all aspects of family behavior from the receipt of warnings to recovery in the aftermath. The extent of sociological knowledge about family behavior in stress situations is varied, with the greatest paucity in findings occurring in the area of long-term recovery (e.g. Mileti et al., 1975). The current research reported here examines systematically the relationships between factors that affect how families readjust over the long term after a stress event.

Much of the literature on natural disasters focuses on the activities of various social units during the immediate pre- and postimpact periods. While a small part of this literature, insofar as it pertains to families, will be reviewed, more attention will be given to a recent study conducted by Drabek and others (1973, 1975, 1976) in Topeka, Kansas. Their research is one of the first rigorous studies to focus on the long-term impact of disasters on primary groups, and such is salient here.

Data for this analysis were gathered in Rapid City, South Dakota following a catastrophic flash flood. Analytically, two statistical techniques are used to develop a family recovery model from these data. Relationships between variables in the model are evaluated in light of other findings in the literature.

The descriptive model presented here is a step, limited both in scope and generalizability, toward developing a general, comprehensive theory of familial recovery from natural disaster. No overarching theoretical framework presently exists in disaster research (Mileti et al., 1975) for the integrating of findings. Consequently, the current analysis stands as an example of a "middle range" (Merton, 1968), theoretical model, inductively developed and grounded in general social systemic notions of the relationships of families to other locality-relevant social structures (Warren, 1963).

FAMILIES IN DISASTER: A REVIEW

The greater part of disaster research has focused on complex organizations, the community, or individuals with the family as a unit being given only cursory attention. More recent studies (e.g. Drabek and Boggs, 1968; Drabek and Stephenson, 1971), have concentrated on interactional processes in families, specifically in familial response to warnings and evacuations. Some of the literature on warnings and evacuations, insofar as it concerns families, is reviewed before considering research on long-term family response to stress.

Warnings and Evacuations

The primacy of family roles in natural disasters has been axiomatic to most disaster research (Hill and Hansen, 1962:88). Research findings coming out of the Holland floods of 1953 emphasized the importance of the family as a major evacuation unit (Instituut voor Sociaal Onderzoek van het Nederlandse Volk Amsterdam, 1955:165). When families are not allowed to remain together, as in the Canvey Island, Great Britain evacuation, intense anxiety emerges in the separated families (Young, 1954:383).

Clifford, in his cross-cultural comparison of two border communities and their response to a flood on the Rio Grande, illustrates the salience of kinship structures as a determining factor in a family's responses to warnings of of an impending disaster. In Piedras Negras, Mexico, in which extended kinship patterns were characteristic, evacuation decisions were made in consultation with relatives (Clifford, 1956:117). In Eagle Pass, Texas, families indicated that evacuation decisions were dependent on interaction with immediate friends and neighbors.

Other studies of family response to warning and evacuation (Bates, 1963; Moore et al., 1963) emphasize the primacy of the family unit as a locus for decision making regarding impending disasters. If possible, evacuees seek refuge with relatives whose homes are outside the area of imminent danger (Moore et al., 1963:57). This is mediated by an age factor. Families in later stages of the life cycle (Cavan, 1974) are less likely to evacuate as far from the threat area as younger couples are. Bates (1963:13) notes that of families who do not evacuate, many go to other relatives' homes within the impact area to weather out the storm in "the security of the kinship circle." Evacuating families, if they go to official evacuation sites, tend to recluster in patterns duplicative of their old neighborhoods (Bates, 1963) indicating an intention to restore the familiar in the midst of unfamiliar surroundings.

Restoration and Recovery

According to Mileti et al. (1975:108), research findings on families in the postdisaster rehabilitation stage are clustered around two general themes: family behavior in emergency quarters, and variations in family relief needs based on their demographic characteristics.

Stoddard (1961) found that females have a more difficult time readjusting roles in emergency quarters than do males. Black families are said to adjust better to the demands of living in "communal" shelters than do white families (Kutak, 1938:65).

In terms of family relief needs, black families (Moore, 1958) and families with aged members (Moore, 1958) tend to need greater extrafamilial recovery aid than younger or higher socioeconomic status families. Relief needs are generally proportional to the extent of the impact of the disaster agent on a family's resources. In Moore's (1958:96) study of a town lightly damaged by a tornado, 76% of the victims received *no* aid outside the kin network. Victims in a more severely damaged town required a far greater amount of extrafamilial aid (74% vs. 24%), than those in the lightly damaged town (Moore, 1958:96). In the same study it was found that white families were more likely to receive aid from multiple sources than were black or chicano families (Moore, 1958:150).

A related but limited set of findings deals with families in the recovery phase of a disaster. Recovery entails a process of reestablishing homes and readjusting intrafamilial roles to the new postdisaster social milieu. Several researchers have reported an increased level of familial or primary group solidarity as a result of a family's shared experiences in a disaster (Fritz, 1961; Bates, 1963; Crawford, 1957). These findings are of limited generalizability and it is likely that under many conditions disasters may have dysfunctional consequences for family solidarity.

The extent and success of family readjustment depends on such variables as the demo-

graphic characteristics of the victim family and the severity of the impact on the physical well-being of the family. Crawford (1957:290) has found that large families with a disproportionate number of females have the greatest difficulty readjusting after a disaster. The loss of life or physical handicapping of a family member can cause problems in the reallocation of roles in the stricken family as well as in the adaptive responses of families to increased financial demands.

The necessity for families to find new housing, particularly if they are forced to relocate outside their old neighborhoods, compounds readjustment and recovery troubles of victim families. Dacy and Kunreuther indicate (1969:42) that families try to relocate with family or friends and, if possible, to return ultimately to their own home. In fact, the desire for families to return to their old homes is a recurrent theme in disaster literature (Instituut voor Sociaal Onderzoek van het Nederlandse Volk Amsterdam, 1955; Bates, 1963; Barton, 1969). The family, as an intimate environment (Skolnick, 1974), requires the privacy of a home to confront the traumas and disruptive experiences precipitated by an extreme event. In contrast, we have found that in the case of catastrophic disasters, many families do not seek to return to a site they associate with a traumatic event.

To most accurately assess the processes by which a family recovers from a disaster and to determine the long-term impacts of a disaster on family and kin, a longitudinal research design is a necessity. Until very recently such a design has not been utilized. Drabek and others (Drabek and Key, 1975; Drabek et al., 1973, 1975) have recently analyzed longitudinal, including preimpact, data on victim and nonvictim families in Topeka, Kansas, in a quasi-experimental research design. Their primary concern was to assess the long-term consequences of a disaster on inter- and intrafamily functioning. Several of their conclusions are salient to this research and will be reviewed.

Drabek and Key (1975:20–22) found that among the most important linkages of the family with extrafamilial units are ties to kin. The link of the nuclear family to kin is strengthened over the long run in the post-disaster community. This particular primary group linkage is suggested (p. 22) to be a facilitator of family recovery. Further, the authors suggest that linkages between the victim family and other relevant social units that were extensive and active prior to the disaster tended to become more so while those that were weak "were weakened further" (P. 22).

Elsewhere (Drabek et al., 1975:491), the primacy of kin ties in both the immediate emergency period and in the long run has been affirmed. As Moore (1958), Drabek found a high incidence of kin-based aid in the recovery process. This was true even for families who had tenuous preimpact kin ties. Also, the importance of kin ties in the recovery process was found to hold across sex, age, ethnicity, education, income, and religious categories (Drabek et al., 1973:491).

The preceding review has raised several issues of general theoretical and empirical importance to the sociology of the family. These will be noted before considering a causal model of family recovery.

Disaster Research and the Sociology of the Family

There are two crosscutting themes emerging from disaster research as it pertains to the family: (1) the relative importance of kinship linkages, and (2) the loss of family functions.

That the importance of kin relationships has decreased in the postindustrial West has been established (Parsons, 1943; Stephens, 1963). However, due to a general misunderstanding of Parsons' formulation (1943; Parsons et al., 1955), the American nuclear family came to be thought of by some researchers as "isolated." While Parsons' con-

ceptualization entails familial isolation in space (Parsons et al., 1955: 11), and not socially, this distinction was ignored generally. The findings of various researchers in disaster-stricken communities have emphasized the importance and functional nature of kinship ties. While, in a cross-cultural sense, the American kinship system is less elaborate than many, in situations of collective stress (Barton, 1969), primary group linkages become increasingly important.

In the last twenty years the importance of kinship in the United States has become an object of research interest (cf. Sussman, 1953, 1959, 1962; Litwak, 1960; Adams, 1968; Babchuck, 1971). While these studies all point to the continuing importance of kin networks in the United States, their varied emphases have made integrating the findings difficult (Drabek et al., 1975: 481). Thus, while the data do indicate the salience of kin linkages to nuclear families, they are not conclusive.

Disasters represent a special case in which kin relations, whether "dormant" or active before the event, become activated or heightened afterwards (Drabek and Key, 1975). After a disaster, victim families tend not to be isolated either socially or physically. Implicit in this is the issue of the functions of the nuclear family. Families stricken by natural disasters become dependent not only on kin, but also on local, state, and federal agencies for financial aid, food, emergency shelter, and temporary housing. In this sense, disasters cause families to lose some of their functions to formal organizations in the community (Bates, 1963).

The theoretical underpinnings of the notion of the "defunctioning" of the family have been presented by Parsons et al. (1955: 9). As societies become complex and structurally differentiated, the component structures (including the family) become increasingly specialized. In this way the family has lost part of its socialization function, its production function, and others, to nonkinship institutions. That disasters precipitate further loss of function for the family is true in a limited sense. Disasters may also increase the importance of the family for the well-being of its individual members.

The protective or security function of the family becomes heightened during disasters and provides important contributions to the psychological well-being of victims. This contention is supported by the incidence of extreme anxiety in families that are separated during disasters (Young, 1954; Instituut voor Sociaal Onderzoek van het Nederlandse Volk Amsterdam, 1955; Dacy and Kunreuther, 1969). In disasters, families give up certain functions to community. This is apparently balanced by the heightened importance of the family as an environment for individual protection and security.

To summarize, several points should be reiterated. Disasters cause victim families to utilize extrafamilial linkages to augment their recovery capacities. The number of systemic linkages a family has in a postdisaster situation determines "in large part" the family's capacity to recover (Drabek and Key, 1975: 27). Families in disaster situations are neither isolated socially nor without important functions. While kinship and community aid is important in determining the speed and extent of familial recovery, the extent of their contributions has not been systematically assessed. The remainder of this paper will consider the 1972 flood in Rapid City and the nature of family recovery from that event.

THE RAPID FLOOD

Impact

On June 9, 1972, a flash flood of massive proportions swept through the community of Rapid City, South Dakota. Two hundred and thirty-eight persons were killed and 1,300 families left homeless, with property damage reaching $ 100 million. Mobile homes parked

along Rapid Creek were tossed around like match boxes. Sturdy brick homes were swept off their foundations and wood frame homes were splintered. Whole blocks of neighborhoods were eliminated and hundreds of houses received extreme mud and water damage, although they withstood the deluge. A housing shortage in Rapid City was exacerbated by the disaster. Shelter had to be found for the dispossessed as well as food and clothing. Massive federal intervention was forthcoming in the form of Small Business Administration (SBA) loans, a $ 48 million urban renewal project to clear a floodway, and mobile homes for temporary shelter. Also, organizations were formed to distribute donations to flood victims.

Many victim families were forced to relocate as a result of the floodway clearance project, while those who remained in their preflood homes often spent the following year cleaning up the detritus of the flood. Neighborhoods were disrupted as families moved to new and disparate areas in the town. The cataclysmic nature of the flood left many traumatized by the event, enough to spur the formation of a "mental health steering committee" to start an intervention program. Mobile home communities of a multiethnic nature were rapidly erected and became a source of not inconsiderable tension and violence. The situation in Rapid City constituted a logical site to examine family recovery processes. Here was a suitable population of victims from the mildy stricken to those who had lost homes and family. Many had to relocate to new areas in unfamiliar surroundings. The only aspects of victim family life that were not altered to any degree were jobs and work.

Methodology

A random sample of victim households was drawn in the context of another study [1] (Mileti, 1974). This sample was utilized in the current research, with victim families interviewed twice over a two-year period. The final adjusted sample size was 125 families [2]. A control group sample of 70 was also drawn to improve the internal validity of the design [3]. The control group was comprised of nonvictim families randomly selected. Families were interviewed in June, 1973, and May, 1974, by trained interviewers familiar with sociological interviewing techniques. Each interview was field-checked by telephoning the respondent to confirm selected answers.

The interview schedules, constructed after site visits and a review of relevant disaster literature, obtained information on major aspects of family life, including housing, employment, education, "life styles," attitudes, and demographics. Preimpact measures on certain items such as housing characteristics and employment histories were gathered. The use of such recall and self-reported behavior items is a possible source of error in survey research (Cook and Sellitz, 1964; Dohrenwend, 1966; Hyman, 1954; Phillips, 1971), and is recognized as such here. However, many schedule items were of the sort that social desirability responses and response-set biases (Babbie, 1973), were not likely to occur. It is felt that this factor further minimizes threats to internal validity through error.

Indicators of Family Recovery

Eight composite indicators thought to be important in understanding family recovery were constructed, based on the face validity of the items. Each index was a composite of several items thought to be good indicators of a given concept. After the indices were constructed, all variables contained in them were factor analyzed (Rummel, 1970), to see if underlying statistical dimensions upheld the original formulations. Some additional items not included in the original indices were added to see if they clustered on a given dimension. In this way indices were refined by the addition or deletion of items.

TABLE I

Factor Analysis of Index Components for Family Recovery

Factor	Variable	Factor Loading
Degree of impact	Percent of flood damage to residence	0.556
	Percent of furnishings lost	0.495
	Dollar loss of furnishings	0.566
	Percent of personal possessions lost	0.467
	Percent of damage to automobiles	0.475
Disruption	Number of moves made after flood	0.953
	Presence of friends in new neighborhood	0.689
	Visitation with preflood friends	–0.414
	Change of residence since July, 1973	–0.944
Institutional embeddedness	Receipt of disaster aid	0.722
	Organizations that gave aid	0.835
	Aid eligibility information	0.921
	Organizations applied to for aid	0.649
	Amount of housing aid received	0.585
	Amount of aid for furnishings	0.958
	Amount of aid for personal possessions	0.560
Kin embeddedness	Receipt of help from relatives	0.418
	Amount received	0.566
	Frequency of visitation with kin	0.711
	Postflood change in visitation with kin	0.423
	Feel could get aid from relatives	0.512
	Who to go to if had family problems	0.648
Family recovery	Comparison of current living situation to preflood one	0.445
	Comparison of standard of living to preflood one	0.428
	Is life happier now compared to preflood happiness	0.491
	Explanation of change in happiness	0.528
Socioeconomic status	Chief wage earner's education	0.593
	Chief wage earner's income	0.517
	Chief wage earner's occupation	0.446

Initial factors were extracted using principal component analysis from the Statistical Package for the Social Sciences program (Nie et al., 1975). The factor matrix output from this was then rotated to simplify the factor structure. The orthogonal VARIMAX technique was used in the rotation (Nie et al., 1975: 485). The resulting factors paralleled the indices constructed prior to analysis to a satisfactory degree. Table I presents the name of the extracted factor, the items in that factor and their loadings. The minimum acceptable loading of a variable on a factor was set at 0.400 (16% of the variance explained).

Two additional indices to be used below were not factor analyzed due to the nature of their construction. A family life cycle indicator was derived directly from the interview schedule. Families were assigned scores on the basis of marital status, age of husband, age of wife, age of children (if any), presence of children in the home, and presence of older parents in home with children (extended family), (e.g. Hunter, 1975). A housing recovery index was developed through computation of changes in housing characteristics using pre- and postflood housing measures, e.g. number of rooms, number of bedrooms, whether home was permanent, changes in tenure, etc.

Discussion of the Measures

The measures of impact and disruption will be used as necessary determinants of the family response indicators. That is, the severity of impact and amount of disruption will be considered prime determinants both of how much and the sources of aid for recovery a victim family seeks (Moore et al., 1963; Quarantelli, 1960). Two exogenous indicators that also affect recovery of victim families are their socioeconomic status and their position in the family life cycle (Cavan, 1974). Families in latter stages of the life cycle will tend to be less able to recover from stress than will younger families with concomitantly less attachment to place and more resources (Friedsam, 1962).

The two primary modes of family recovery have been labeled kin embeddedness and institutional embeddedness after Adams (1975: 92). In the sense used here kin embeddedness conceptualizes the degree of family dependence and interaction with extended kin groups in the recovery process. Departing from Adams' usage, institutional embeddedness here entails the degree to which families utilize community agencies in the recovery process. Thus, families with a high degree of institutional embeddedness used multiple sources of extrafamilial aid to recover and reconstruct after the disaster.

Family recovery as a dependent variable has been divided into two components, housing recovery and family recovery. Housing recovery simply refers to the extent to which a family reestablishes equivalent or "better" housing when compared to their preflood residence. Family recovery conceptualizes a more perceptual dimension of readjustment. Items in this index assess a family's perceptions of life satisfaction when compared to their preflood levels. What is concerned here then is how a family defines its situation and how it comes to redefine its situation as recovery progresses.

These indicators have been utilized in a causal model of family recovery, and it is this model which will now be examined.

TABLE II

Zero Order Correlation Coefficients* Among All Indices

	1.	2.	3.	4.	5.	6.	7.	8.
1. Impact	...	0.040	0.083	0.403	0.760	–0.157	0.298	–0.036
2. SES	...	...	–0.120	–0.121	0.056	0.106	0.172	0.174
3. Life Cycle	...	...	...	0.027	0.042	0.188	–0.176	–0.305
4. Disruption	...	...	...	...	0.291	0.062	0.110	0.054
5. Institutional Embeddedness	...	...	...	...	...	0.112	0.305	–0.011
6. Kin Embeddedness	...	...	...	...	...	...	–0.173	0.235
7. Housing Recovery	...	...	...	...	...	...	...	–0.031

*Coefficients greater than 0.135 $p<0.05$; 8 = Family Recovery

TABLE III

Standardized Regression Coefficients for Path Model

Dependent Variable	Independent Variable					
	X_1	X_2	X_3	X_4	X_5	X_6
	Standardized Regression Coefficients					
X_8 Family Recovery	–0.036	0.174*	–0.301	0.054	–0.011	0.234*
X_7 Housing Recovery	0.293*	0.172*	–0.174*	0.103	0.233*	–0.162*
X_6 Kin Embeddedness	–0.148*	0.102	0.180*	0.062	0.101	....
X_5 Institutional Embeddedness	0.760*	0.056	0.042	0.241*	....	....
X_4 Disruption	0.403*	–0.101	0.027	....	....	....

*$p<0.05$ and at least 2 times standard error.

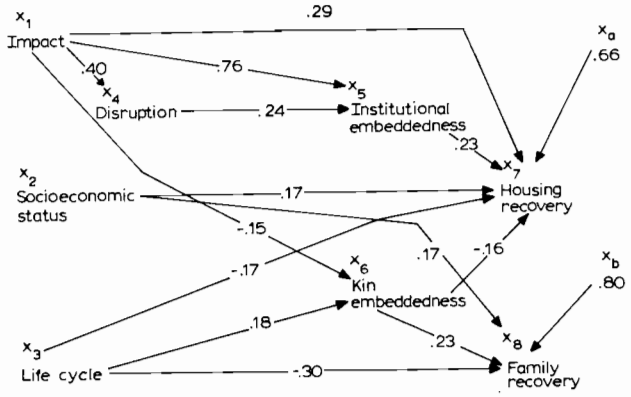
Family Recovery: A Causal Model [4]

In developing a recursive causal model of family recovery, a zero order correlation matrix of the major variables was run (Table II). The size and direction of the coefficients leant support to an implicit model of the indices. Based on the correlation matrix a preliminary causal model was constructed. Paths were drawn between variables that had relatively high covariate associations.

Regression analysis, using a subroutine of the Statistical Package for the Social Sciences (Nie et al., 1975), was performed to derive standardized regression coefficients (beta weights) for the specified relationships in the model. Table III presents the multiple regression analysis and Fig. 1 illustrates the model with all statistically significant direct effects noted.

Discussion

Examining total causal effects (Table IV) of the independent variables on the recovery measures, it can be seen that impact, position in the life cycle, and institutional embeddedness are the most important explanatory factors in regard to housing recovery. Life cycle, kin embeddedness and, to a lesser degree, socioeconomic status, have the greatest total causal effect on the family recovery index.



NOTE: x_a, x_b = residual effects

Fig. 1. Path diagram of family recovery showing statistically significant direct effects

TABLE IV

Decomposition of Effects of Independent Variables Specified in Path Model

Causal Variable	Total Causal Effect	Direct Causal Effects on X_7, Housing Recovery	Indirect Causal Effects on X_7, Housing Recovery
X_1 Impact	0.446	0.293	0.153
X_2 SES	0.172	0.172	–
X_3 Life cycle	–0.200	–0.174	–0.026
X_4 Disruption	0.055	–	0.055
X_5 Institutional Embeddedness	0.234	–	–
X_6 Kin Embeddedness	–0.162	–0.162	–

Causal Variable	Total Causal Effect	Direct Causal Effects on X_8, Family Recovery	Indirect Causal Effects on X_8, Family Recovery
X_1 Impact	–0.045	–	–0.045
X_2 SES	0.174	0.174	–
X_3 Life style	–0.266	–0.301	0.041
X_6 Kin Embeddedness	0.234	0.234	–

The indirect effect of impact on housing recovery is about one-half the direct effect (Table IV). This points to its importance both directly and through the mediating effects of other endogenous variables. It can also be seen that the severity of impact determines the degree a family becomes reliant on extra-familial aid sources (e.g. Moore et al., 1963). Although the coefficients are not large in absolute terms, at least part of the effect of disaster impacting on housing recovery is mediated by both disruption and institutional embeddedness factors.

The direct effect of socioeconomic status on housing recovery is moderate. Socioeconomic status affects family recovery positively. High SES families, in the current data, were

more likely to readjust successfully after the disaster than were lower income families. A family's SES does not have any indirect effects on either recovery measure.

A family's position in the life cycle has multiple effects on both dependent variables. The indirect effect of life cycle (Table IV), mediated by kin embeddedness on housing recovery is considerably smaller than its direct effect. The negative values are consistent with a logical interpretation. Older families are less likely to reestablish homes than are younger families. The direct effect of life cycle is also negative. Thus, older families are less likely to readjust, in a perceptual sense, than are younger families. The effects of life cycle, mediated by kin embeddedness are found to be positively associated. That is, families who utilized kin aid and support are more likely to recover (as it is defined here), than those who do not. While kin may not be able to give families the aid needed to reestablish a home, they can give them much needed comfort and emotional support. This reflects the importance of kinship linkages in the recovery process noted elsewhere (e.g. Drabek and Key, 1975).

CONCLUSIONS

The long-term effects of disaster on families have only recently come under the scrutiny of sociologists. A causal model has been developed here to explore relationships between major factors hypothesized to affect long-term family recovery. Family recovery has been conceptualized to have two dimensions: (1) a housing recovery dimension, and (2) a perceptual, life satisfaction dimension.

By way of summary, findings from this analysis may be stated in general propositional form.

1 The more severe the impact of the disaster on a family's resources and the more residential dislocation it experiences, the more likely will that family seek recovery aid from community agencies if it is available.

2 The more a family utilizes institutional aid sources, the more likely will that family recover or reestablish housing equivalent to that lost in the disaster.

3 The higher the socioeconomic status of a victim family, the more likely will that family reestablish housing equivalent to that lost in the disaster.

4 The later a victim family is in the life cycle, the less likely will that family reestablish housing equivalent to that lost in the disaster.

5 The more severe the impact of a disaster on a family, the less likely will that family rely solely on extended kin for recovery aid.

6 The later a victim family is in the life cycle, the less likely will it utilize kin-based aid for recovery.

7 Families that rely solely on aid from extended kin groups are less likely to reestablish housing equivalent to that lost in the disaster.

8 The higher a victim family's socioeconomic status, the more likely will that family recover in a perceptual and emotional sense from the disaster.

9 The later a victim family is in the life cycle, the less likely will it be able to recover in a perceptual and emotional sense from the disaster.

10 The more a victim family utilizes aid from extended kin, the more likely will that family recover from the disaster in a perceptual and emotional sense.

What this analysis has attempted to do is to present a systematic examination of long-term family recovery from disasters using rigorous statistical techniques. There is a need for further research in this area in order to elaborate the causal model and refine indicators contained in it.

NOTES

1 Mileti drew the sample by first establishing the parameters of the flood waters and then drawing a random sample of residents based on utilities records. Three sampling areas were established; a zone of heavy damage to residences; a zone of light damage to residences; a zone of no damage to residences. The damage zones were combined and those sampled from these zones constitute the victim sample in the current study.

2 The original sample size (Mileti, 1974) was 189. The sample size at the time of the first wave of the current interviewing was 147, due in large part to families moving out of town. The sample size at the time of the second wave of interviewing (May, 1974) was 125 families. The wave I sample is adjusted to this size to facilitate statistical analysis.

3 While the control group (sampled from the zone of no damage) is not used directly in the current research, those data have been used to compare responses of victims versus nonvictims to the event to better ascertain if changes in victims are the result of the disaster or confounding influences such as "history".

4 The statistical techniques used in the building of a causal model come under the rubric of multiple regression analysis. Briefly, multiple regression analysis is a method by which the effects of several independent variables are assessed for a single dependent variable. Path analysis is a specific form of multiple regression analysis in which the researcher imposes a set of causal assumptions. See Loether and McTavish (1975) for a good introduction to both topics and the requirements for using them.

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