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ABSTRACT

Technological accidents such as the Exxon Valdez oil spill in 1989 create man-made disaster situations that threaten community survival and the well-being and quality of life of community residents. This paper focuses on the social and psychological impact of the 1989 oil spill on Cordova, an isolated Alaskan community with high economic dependence on commercial fishing and a native Alaskan cultural heritage of subsistence practices. Random samples of 118 households and 32 Native Alaskans in Cordova and a matched control community were surveyed 5 months after the spill to assess patterns of social disruption and post-traumatic stress. Data analysis revealed that Cordova experienced significantly more social disruption than the control community, particularly in the areas of work activities and future plans. Cordova residents also displayed significantly higher post-traumatic stress on 15 of 16 indicators; they had more intrusive recollections of the spill, more behaviors reflecting avoidance of stimuli associated with the spill, and a general diminished responsiveness or "numbness" to activities associated with the spill. Post-traumatic stress was most acute for persons experiencing disruption of family cohesion and uncertainty about future plans. This report contains 41 references and includes tabulations of responses to survey questions. (SV)

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SOCIAL DISRUPTION AND PSYCHOLOGICAL STRESS IN AN ALASKAN FISHING COMMUNITY: THE IMPACT OF THE EXXON VALDEZ OIL SPILL*

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Social Disruption and Psychological Stress in an Alaskan Fishing Community: The Impact of the Exxon Valdez Oil Spill

J.S. Picou, D. Gill, C.L. Dyer, E.W. Curry

ABSTRACT

The study of the social impacts of technological accidents is fast becoming an area of interdisciplinary research for both basic and applied social scientists. Technological accidents such as the Exxon Valdez spill create man-made disaster situations which threaten community survival and the well-being and quality of life of community residents. The most severe social impacts of man-made disasters occur in communities which not only depend upon the integrity and safety of their local environment for existence, but also follow a life-style which is directly supported by the use of renewable resources from the ecosystem.

The broad concept of "social impact" is conceptualized in this research in terms of three components - 1) economic impacts; 2) psychosocial impacts and; 3) cultural impacts. More specifically, this research report focuses on cultural and psychological impacts identified through comparisons of "control" and "impact community" data. Two general post-traumatic stress areas are contrasted for sixteen separate indicators - 1) intrusive recollections; and 2) avoidance behavior (Diagnostic and Statistical manual of Mental Disorders, 1987). In addition, patterns of social disruption were contrasted for both communities. A disaster impact assessment design was developed which included: 1) a random sample of Cordova households (impact community, n=118); 2) an ethnographic network sample of Native Alaskans, (n=32) and; 3) a random sample of Petersburg residents (control community, n=73).

The data analysis revealed that significantly more social disruption was experienced in the impact community from comparisons to the control community. Specifically, social disruption of future plans and work activities were more pronounced in the impact community. In terms of patterns of post-traumatic stress, impact community residents experienced more trauma in terms of having more recollections of the spill, behaviors that reflected the avoidance of stimuli associated with the spill and a general diminished responsiveness or "numbness" to activities associated with the spill. Only one out of sixteen comparisons was found not to be statistically significant in the analysis. These findings suggest a maximum amount of social disruption resulted from the Exxon Valdez oil spill in the impact community. This disruption and continuing observance of extreme ecosystem stress produced high-levels of post-traumatic stress existing five to eight months after the spill. Given that previous research indicates that man-made disasters manifest long-term social psychological impacts on communities, continued monitoring and programmatic responses to these findings are needed.

Social Disruption and Psychological Stress in an Alaskan Fishing Community: The Impact of the Exxon Valdez Oil Spill

Introduction

The primary objective of this research is an analysis of social disruption and post-traumatic stress experienced in an Alaskan fishing community five months following the largest oil spill in United States history. Conceptually, the Exxon Valdez oil spill is defined as a technological disaster (Baum, et al, 1982; 1983; Omohundro, 1982; Gill and Picou, 1989) and our research design includes data collected in both a "control community" and the "impact community". The analysis contrasts differences in our indicators in both "item-by-item" iterations, as well as for aggregate indicators of types of post-traumatic stress disorder (Diagnostic and Statistical Manual of Mental Disorders, 1987).

Disasters and Social Disruption

Disasters are situations which are socially defined in the context of human communities and their physical environment. An occasion is typically defined as a disaster if the social system's ability to reasonable ensure biological survival, social order, social meanings and social interaction are disrupted (Fritz, 1961; Barton, 1969; Dynes, 1970; Quarantelli and Dynes, 1970). Disasters possess a variety of characteristics, e.g., source, speed of onset, scope of impact, duration of impact, etc., which identify unique structural components (Dynes, 1970; Barton, 1969). Disasters also have direct consequences for the disruption of a wide variety of community activities (Dynes, 1970; Erickson, et al, 1976; Drabek and Key, 1976; Mileti, et al, 1975). Most recently in the disaster literature, increased attention has been accorded to "man-made", or "technological disasters" in terms of their possessing both unique characteristics and consequences for human communities (Turner, 1978; Baum, et al, 1983; Omohundro, 1982; Gill and Picou, 1989; Bogard, 1989). A brief discussion of this literature will be presented below.

Technological Disasters

The twentieth century has been the setting for the emergence of technological disasters. Massive disasters at Bhopal (India, 1986), Chernobyl (USSR, 1986), Three Mile Island (USA, 1979), Love Canal (USA, 1978-1980) and Buffalo Creek (USA, 1972) were unique because a technological malfunction, not nature, was defined as the cause. This qualitative distinction calls into question accepted notions of liability and responsibility for social, economic and political costs associated with technological accidents and forces a reevaluation of applied disaster research (Shirvastava, 1987; Bogard, 1989; Edelstein, 1989).

Technological disasters are abrupt disturbances to both the ecosystem and social system, which result in high degrees of uncertainty and stress at all levels of effected communities. The "increasing hazardousness of our everyday environment" has resulted in increased "rates" and "vulnerability" to technological accidents (Bogard, 1989). Research had documented a variety of consequences which are characteristic of technological disasters.

First, technological disasters have the potential to permanently eliminate communities. Although one could argue that the same potential consequence could result from a natural disaster, evidence from Love Canal and Chernoybal point to this realistic possibility in terms of toxic and technological malfunctions (Brown and Harris, 1979). Furthermore, community survival can be directly threatened by severe pollution to the environment in areas where ecosystem resources are utilized to support both physical and cultural structures (Robbins and McNabb, 1987). In short, technological disasters may permanently eliminate communities through contamination (Oliver-Smith, 1986). In some cases, especially in oil spills, no initial loss of life or physical destruction need take place (Omohundro, 1987). Nonetheless the threat posed by technological disasters often directly challenges community survival.

Secondly, technological accidents result in a "...loss of control over something that was once perceived as controllable, while... natural disasters highlights a perceived lack of control over something that either never was perceived as controllable or for which controllability was not particularly salient" (Baum, et al., 1983:120). This concept of loss of control is directly linked to the issue of liability, which, in turn, directly involves litigation. Class-action lawsuits and out-of-court settlements between communities and liable organizations have become an increasing long-term characteristic of technological accidents (Gleser, et al., 1978; Edelstein, 1989; Rosebrook and Picou, 1990). The litigation process may have a variety of secondary impacts on a community which prolong long-term, negative consequences stemming from the original technological malfunction (Erikson, 1976). In sum, technological disasters are more likely to spawn a number of "secondary disasters" which prolong community impacts.

Finally, technological accidents produce survivors who exhibit more "...anger, hostility, and rage than...victims of natural disasters" (Ahearn, 1981; Baum, et al., 1983). In addition, long-term social psychological impacts have been documented from a wide-variety of studies (Erikson, 1976; Bromet, 1980; Gleser, Green and Wingate, 1981; Gill and Picou, 1990). Indeed, prolonged psychological impacts may characterize technological disasters when they are defined as a particular type of stressor (Elliott and Eisdorfer, 1982; Ahearn and Cohen, 1984; Green, Lindy and Grace, 1985). Technological disasters

have produced long-term stress and disruption in effected communities.

From this brief discussion it is evident that technological disasters increasingly pose a risk to communities throughout the world. The existence of a technological disaster may actually go unnoticed by the community (toxic waste disposal sites), threaten the economic viability of a community (oil spills) or effectively eliminate communities (nuclear meltdown). All of the technological disasters noted above may potentially disrupt community structure and produce post-traumatic stress patterns for extensive periods of time. A conceptual approach for studying these impacts is presented below.

Technological Disaster Impacts: A Conceptual Approach

Technological disasters are complex social events which can be understood in terms of disaster structure and disaster consequences. This research focuses on the "consequences" or "impact" of a specific technological disaster (the Exxon Valdez oil spill) on a small Alaskan fishing community (Cordova). Figure 1 presents a comprehensive conceptual framework for evaluating the social impacts of technological disasters. Hazards are viewed as resulting from the mass introduction of chemical industrial technologies which have the potential to cause harm to both the environment and people (Bogard, 1989). The existence of an increasingly hazardous environment increases the potential for technological accidents stemming from various combinations of human error and technological malfunctions. The severity of the technological accident, in turn, leads to a "definition of the situation" of the accident as being a technological disaster. Research on the social impacts of any technological disaster should minimally include economic, cultural and psychological dimensions (Picou, 1984).

[Figure 1 about here]

The assessment of economic impacts include "quantifying and assigning monetary values to the damages to the natural resources of the impactal region" (Freeman and Kopp, 1989). Based on the idea of compensation, economic assessments involve research activities ranging from the calculation of direct loss of dollars lost to the quantification of estimates of dollar losses for various resources of the ecosystem, e.g., the salmon fishery in Prince William Sound.

Cultural impacts involve identifying types of disruption of the day-to-day activities of members of a community, as well as their changing perceptions of the "quality of life" available. Cultural impacts include changes in community values, social activities, perceived risks and out-migration desires. Essentially cultural impacts are disruptive to various social groupings of community members in that patterned behavior is altered drastically.

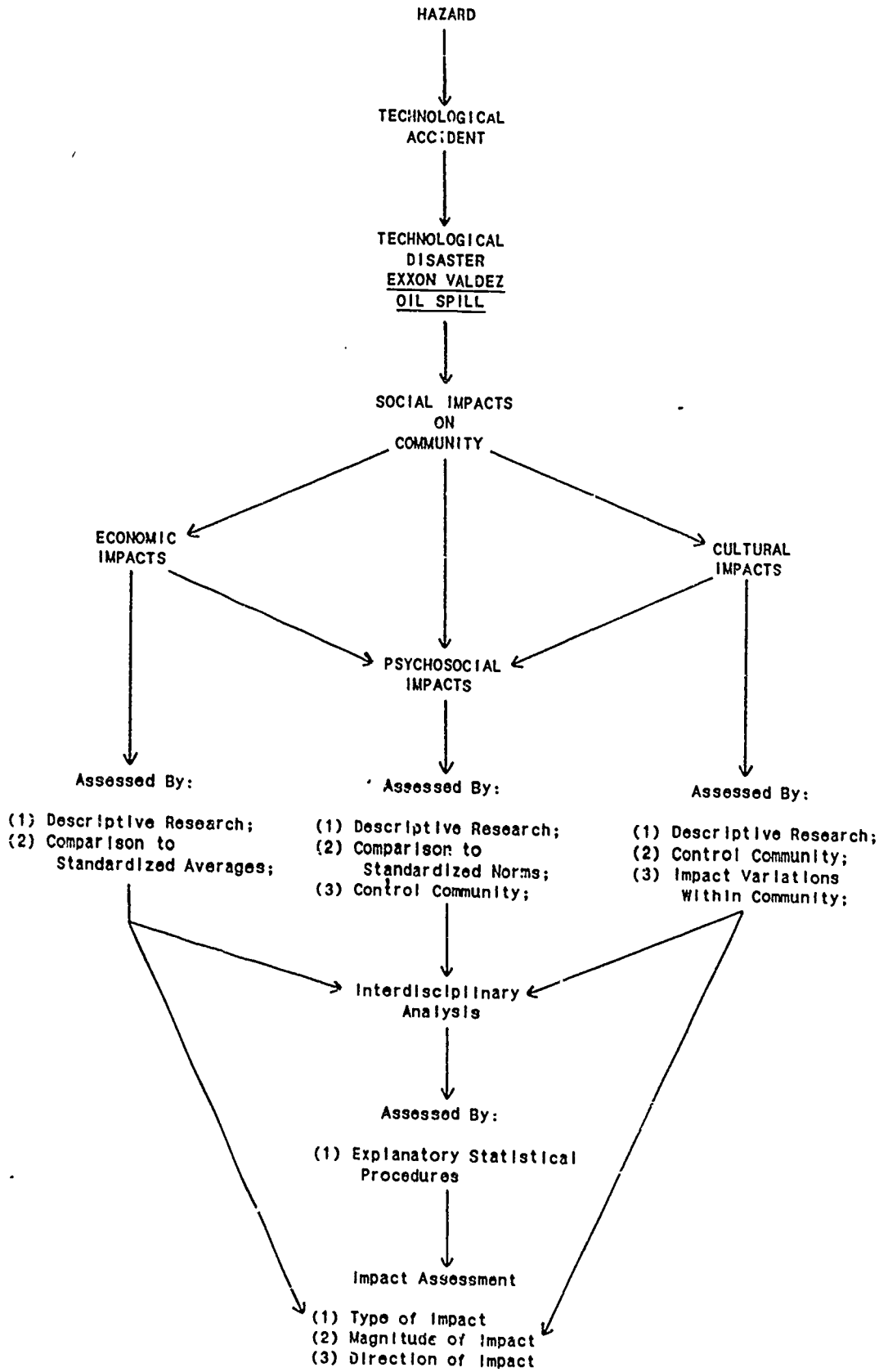


FIGURE 1: A Conceptual Model for Disaster Impact Assessment

Psychosocial impacts include a wide variety of individual-level consequences which result in increased stress, fear and attitudes of vulnerability, which, in turn, contributes to illness and personal dysfunction (Ahearn and Cohen, 1984). Social psychological stress may be measured in terms of post-traumatic stress disorder patterns.

Figure 2 identifies the conceptual focus of the present study. Our research focuses on social disruption and post-traumatic stress existing five months after the spill in the fishing community of Cordova, Alaska. As such, Figure 2 identifies the impacts of the spill as being disruptive and producing types of post-traumatic stress disorders (Diagnostic and Statistical Manual of Mental Disorders, 1987). Returning to Figure 1, this research is an interdisciplinary analysis of cultural and psychosocial impacts determined through a comparative analysis of differences observed between control and impact communities.

[Figure 2 about here]

The Exxon Valdez Oil Spill

On March 24, 1989 at 12:04 a.m. the supertanker Exxon Valdez ran aground on Bligh Reef, resulting in the largest oil spill in United States history. Within five hours of the accident, ten million gallons of Prudhoe Bay (North Slope) crude escaped into the pristine waters of Prince William Sound. Over the next two weeks Exxon offloading operations resulted in the transfer of over 950,000 barrels of oil from the Exxon Valdez to other tankers. During this time period additional oil was released into Prince William Sound (National Response Team, 1989). This oil spill of eleven million gallons would be too large for any response plan or technology to contain.

The immediate impact of the spill on the local ecosystem was devastating. Figure 3 identifies the location of the Exxon Valdez spill in terms of bird, marine and mammal concentrations in the Prince William Sound area. The environmental conditions characterizing this spill actually increased the severity of the environmental impact (National Response Team, 1989). For example, the type of oil spilled and the lower temperatures resulted in a much slower rate of biodegradation, physical weathering and evaporation of the oil. In addition, considerably more coastline (350 miles) was impacted from the Exxon Valdez spill than the 68 million gallon Amoco Cadiz (240 miles) spill off the coast of Northwest France.

[Figure 3 about here]

Six months following the spill the death toll for birds and marine mammals in the Prince William Sound area was staggering. Conservative estimates had over 33,000 birds, 980 sea otters, 30 harbor seals, 17 gray whales and 14 sealions documented in the

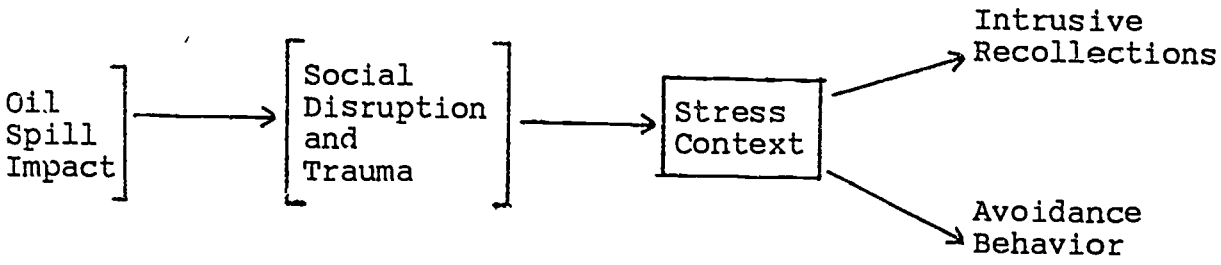


FIGURE 2: Conceptual model of social disruption and post-traumatic stress.

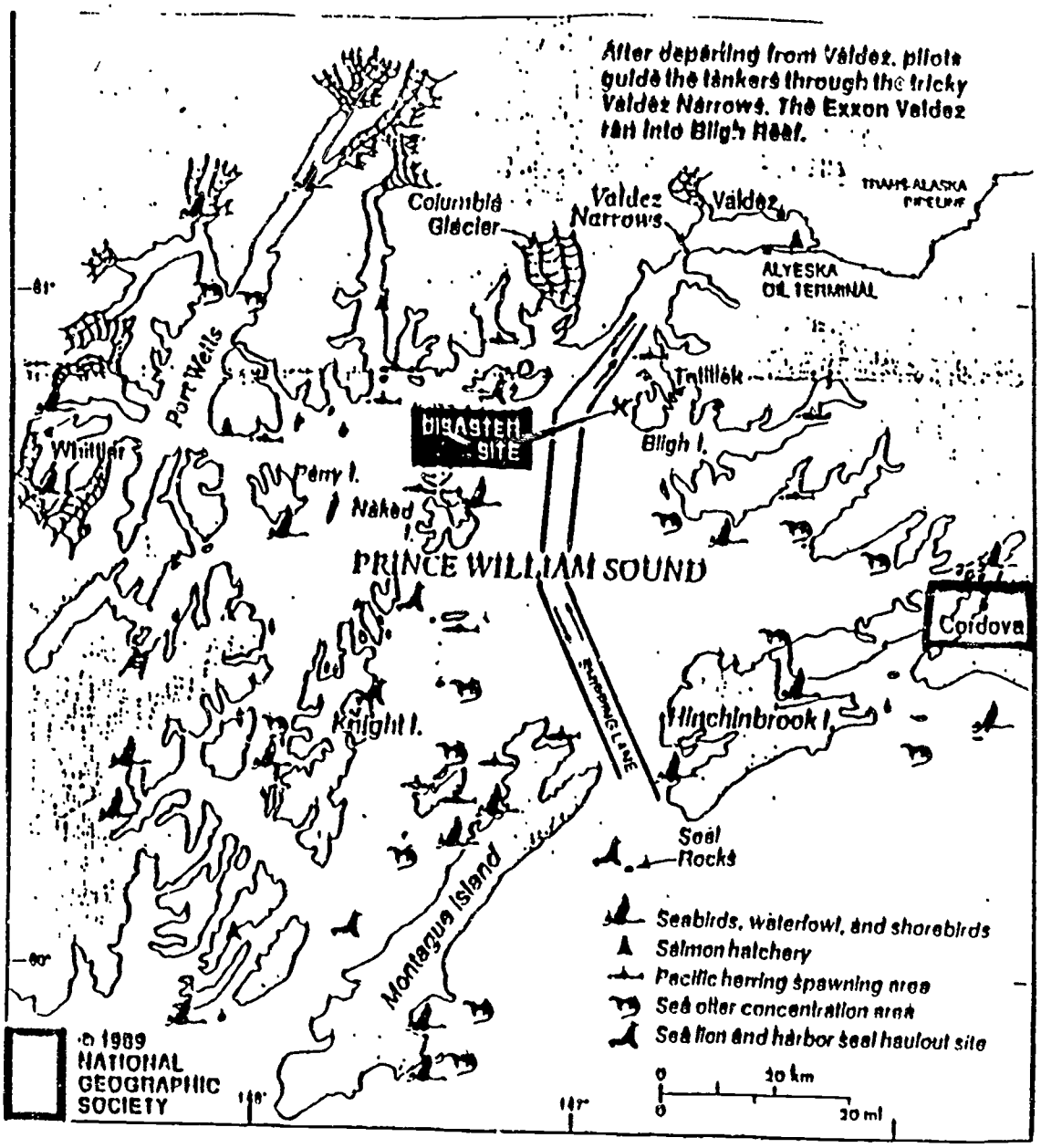


FIGURE 3: Location of spill, wildlife concentrations and Community of Cordova.

death toll (Nichols, 1989). However, fears of food chain contamination and the observation of aberrant bird behavior (75 per cent of all bald eagles failed to nest) portends continued contamination risks for birds and marine mammals well into the future.

The impact of the spill on microbiotic life in intertiddal zones and for the various fisheries in Prince William Sound is highly uncertain. The 1989 Herring season was closed following the spill. Long-term impacts on the large salmon fishery in Prince William Sound will not be accurately known until fry released this year begin to return (National Response Team, 1989). Therefore, salmon, halibut, herring, crab and clam fishermen will not understand the full economic consequences of the spill for local fisheries until the 1992 to 1994 fishing seasons.

The Research Setting

Cordova is a small, picturesque fishing community located in Prince William Sound in southcentral Alaska. Cordova is isolated from other communities by mountains, glaciers, rivers and the sea. No roads have connected Cordova to other communities since the earthquake of 1964. A maritime climate of heavy percipitation and moderate temperatures characterizes this region.

The economy of Cordova is dominated by commercial fishing. Cordova fishermen hold 44 percent of all Prince William Sound herring fishery permits and 55 percent of all Prince William Sound salmon fishery permits (Stratton, 1989). Subsistence activities characterize most of the residents of Cordova. Harvesting, receiving and giving away fish, moose, deer, berries, etc. are activities common to the vast majority of the residents in Cordova.

Historically, the community of Cordova can be traced to four Eyak Indian Villages and the territories of the Chugach Eskimos. Early documents identify the 1898 Alaska gold rush as a reason for growth in Cordova's population. The city was officially incorporated in 1909 and quickly became the export center of copper being mined in the Wrangell mountains north of Cordova (Stratton, 1989). Following the closing of these mining operations and the railroad in 1939, Cordova residents became involved in the growing salmon industry. Cordova's population remained around 1000 residents until the 1970's found the population to almost double. This decade of growth stemmed from a diversification of the commercial fishing industry in the area and increased in-migration trends to Alaska in general.

At the time of Exxon Valdez oil spill Cordova could be described as an isolated community, highly dependent on commercial fishing for an economic base, and having a cultural history of subsistence practices stemming directly from a Native-

Alaskan heritage. Approximately 20 percent of the residents of Cordova are Native-Alaskans. Due to the community's location (see Figure 3), no oil from the Exxon Valdez reached the shores or immediate vicinity of Cordova. However, the spill directly impacted critical fishing grounds of Prince William Sound which are used by local fishermen.

Research Design

A disaster impact assessment research design guided the methodological procedures for this study (Picou and Gill, 1989). This design includes all assessment procedures noted in Figure 1 for a comprehensive social impact assessment of technological disasters. Cordova was selected as the impact community of interest because of its economic dependency on commercial fishing and its cultural heritage of subsistence activities. The overall research design is presented in Figure 4. Data were collected from: (1) a stratified, random sample of households in Cordova; (2) an ethnographic network sample of Native-Alaskans; (3) a random telephone survey of Petersburg, Alaska residents (see below) and (4) a random telephone survey of Cordova residents. This research report does not include data on Native-Alaskans. Separate studies on this population are in progress (see: Dyer, Picou, Gill and Curry, 1990).

[Figure 4 about here]

The logic of these data-collection procedures relates to unique research problems associated with identifying and evaluating the impacts of disasters (Picou and Gill, 1989). Minimally, such an assessment should include: proper sampling procedures, control community comparisons, appropriate methodologies for special populations and standardized indicators of impacts used in previous disaster research (Solomon, 1989; Picou and Gill, 1989).

Control Community Selection: After an evaluation of demographic characteristics of Alaskan communities from census and cultural information, the city of Petersburg, Alaska was selected as a control community for this research. Like Cordova, Petersburg is isolated by not having roads linked directly to it and is dependent economically on commercial fishing. Petersburg has a population of 3,137 people and has an Alaskan Native population which comprises approximately 20 percent of the community (Smythe, 1988). A 29.5 million dollar salmon fishery exists in Petersburg, while a 36 million dollar salmon fishery characterizes Cordova's economy (Smythe, 1988; Stratton, 1989). Petersburg residents share subsistence harvests in a manner similar to Cordova residents. For example, in terms of salmon subsistence activities 72 percent of Cordova residents harvest salmon, while 63 percent of Petersburg residents engage in salmon harvesting. In Cordova, 58 percent of the residents receive salmon while 61 percent receive salmon in Petersburg. Percentages of residents who give away salmon are also similar

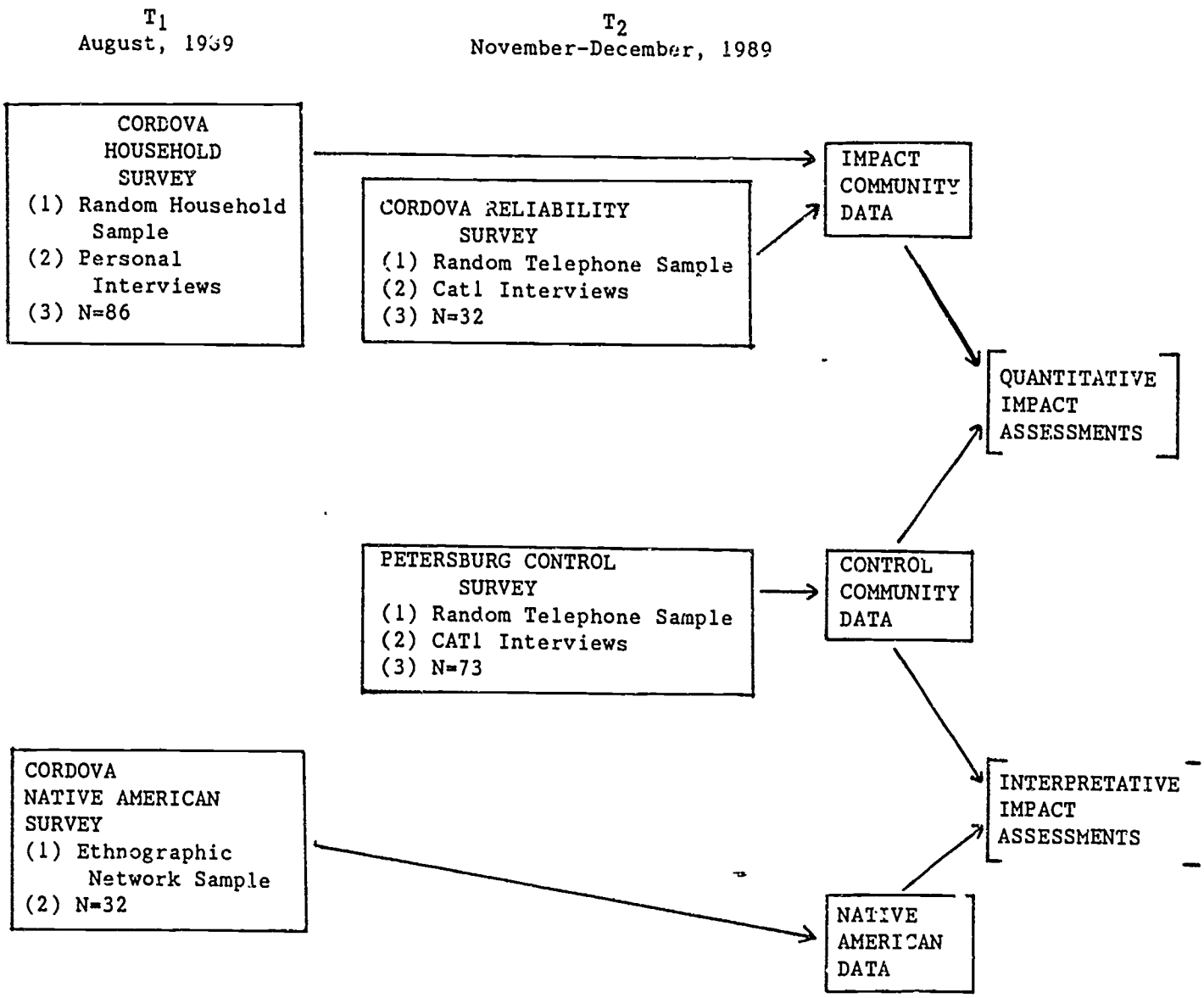


FIGURE 4: Research Design for Disaster Impact Assessment

(61% Cordova; 55% Petersburg. For more information, see: Smythe, 1988 and Garrett, 1989).

Given the demographic and cultural information discussed above, it was further decided that Petersburg received minimal direct impacts from the Exxon Valdez spill. Fishing seasons were not directly effected, although some limited leasing of boats by Exxon for the clean up did occur. It should be noted that it is highly probable that some Petersburg residents were impacted upon negatively by the spill. It is obvious that all Alaskan communities are sensitive to environmental stress and related political issues involving the oil industry and state government. Because of this fact, the use of Petersburg should provide a very conservative estimate of the magnitude of any impacts observed.

The data for the control community were collected by telephone interviews by the Survey Research Unit of the Social Science Research Center, Mississippi State University. In addition, telephone interviews were also collected in Cordova during the same time period data were collected for the control community. The households to be interviewed were randomly selected from a list of all possible telephone numbers in both communities (people interviewed in the household survey were excluded). Once a household was reached by the telephone interviewer, interviewers randomly asked to talk to: 1) the oldest male; 2) youngest male; 3) the oldest female; and 4) youngest female (over 17 years of age). This procedure reflects a modified version of the Throldahl-Carter approach for random household sampling for telephone interviews (for more information, see: Frey 1983). The interviews were conducted in early to mid-December, 1989.

Household Sample Selection: A research team of two sociologists and one anthropologist arrived in Cordova, Alaska on August 19, 1989. Upon arrival and throughout the first day, the researchers identified seven (7) residential areas in the town of approximately 2,300 residents (see map 1). Once these seven residential areas were identified, households were identified and assigned numbers for random selection. Tables of random numbers were utilized for selection of households. A stratified, random household sample was obtained. Data were collected in approximately seventy (70) households, resulting in a final sample of eighty-six (86) residents of the community. Households members present in selected locations were interviewed by members of the research team. During the morning of the first day of interviewing, the researchers conducted a field pre-test of the interview instrument. These pre-testing activities identified a number of questionnaire indicators which were inappropriate for use. Indicators were eliminated, added and several items were modified. These activities resulted in a final questionnaire which contained items judged to be communicable, relevant, accurate and appropriate for collecting in-depth data on the economic, psychological, cultural and community impacts of the Exxon Valdez oil spill.

[Map 1 about here]

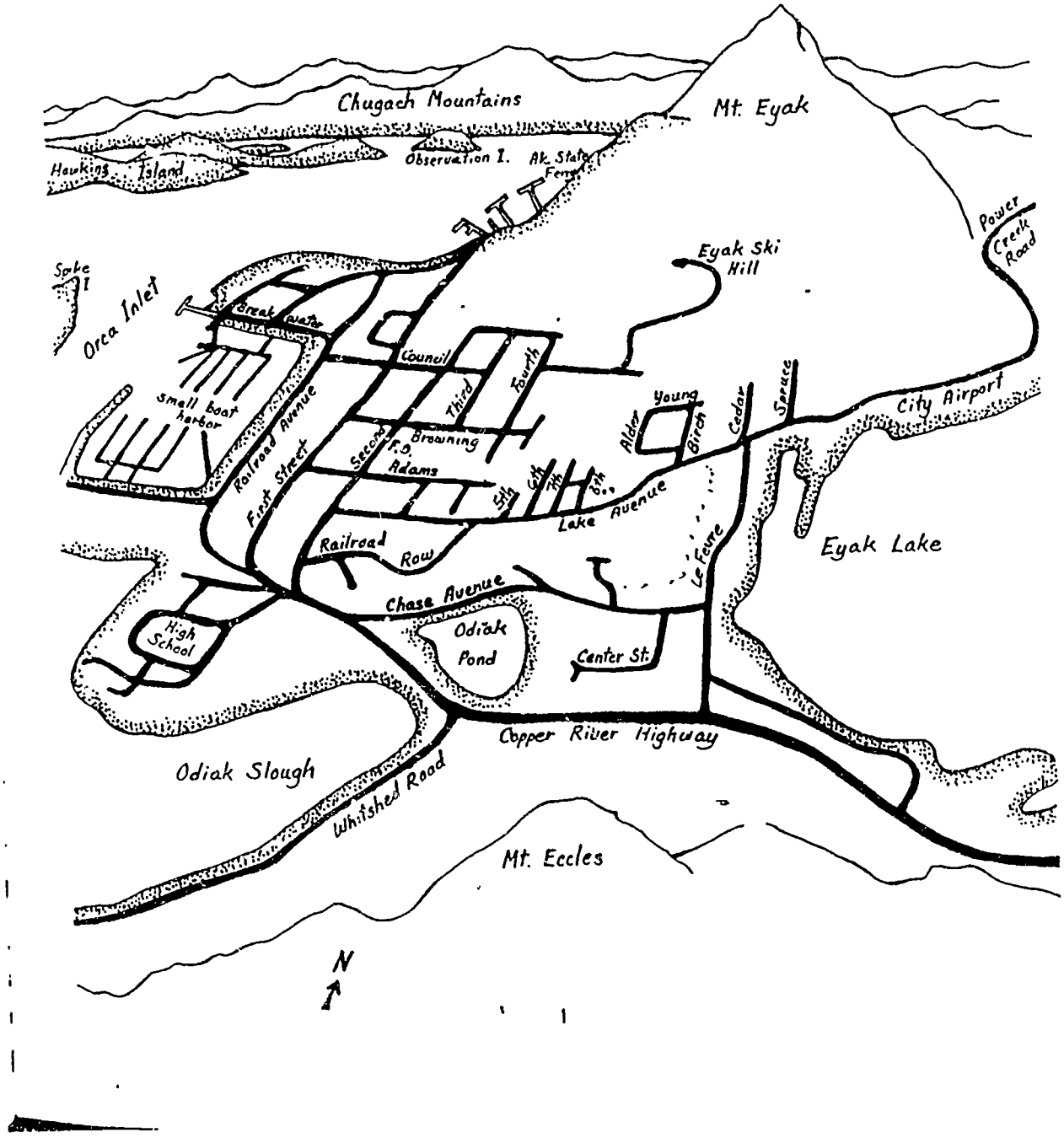
Indicators and Measures: Questionnaires containing similar indicators were used for both telephone and personal interviews. The instruments included on the questionnaire were selected because of their use in previous disaster research, their acceptance in previous toxic tort litigation and their documented relevance to the actual disaster experience (Siegel, et al, 1984; Picou, 1984; Solomon, 1989). Four indicators of perceived social disruption are analyzed in this research. The specific items were operationalized in terms of changes in the way family members get along, making changes in future plans, having relatives make changes in future plans, and having made changes in the work place setting (see Table 1). These items provide a indicator of general social disruption for community groups (families and work groups).

Psychological stress was operationalized in terms of the "Impact of Events Scale (IES)" which provides a basis for determining and measuring Post-Traumatic Stress Disorder, a clinically recognized stress disorder which has been documented as often having delayed symptoms (2 years) resulting from traumatic events (Horowitz, Wilner and Alvarez, 1979; Diagnostic and Statistical Manual of Mental Disorders, 1987; Glesner, Green and Winget, 1981; Green, Lindy and Grace, 1985; Solomon, 1989). The logic of the IES scale suggests that very stressful, traumatic events, such as a disaster, result in a high-incidence of recurring, distressing thoughts about the event and attempts to avoid thought and behavior associated with the disaster or traumatic event (Horowitz, Wilner and Alverez, 1979; Diagnostic and Statistical Manual of Mental Disorders, 1987; Solomon, 1989). These two PTSD Components will be comparatively analyzed below.

Data Analysis

The data analysis will be conducted in the following manner. First an item-by-item comparison of control and impact community responses will be conducted for indicators of both social disruption and post-traumatic stress disorder. A chi-square test of differences was conducted for each response comparison (Yeomans, 1968). Second, the post-traumatic stress indicators were divided into scale indicators for intrusive recollections and avoidance behavior (Seigel, et al, 1984). These scale items were summated and comparisons of mean scores were conducted by t-tests of differences (Yeomans, 1968). Comparisons of mean scores were made for the control community and impact community, as well as for the various sources of data identified in Figure 4. Finally, correlation coefficients were calculated between the disruption indicators and the two forms of PTSD within the impact community.

Table 1 presents the four social disruption items for both control and impact communities. All four chi-square comparisons were found to be statistically significant, indicating from an



MAP 1: Cordova Community

inspection of the response patterns that considerably more social disruption was reported in the impact community. Almost forty percent of the respondents in the impact community reported that as a result of the spill they had experienced changes in their family relations. Approximately nine percent of the control community respondents gave a similar response (Table 1).

[Table 1 about here]

The uncertainty generated from the spill is apparent in that fifty-one percent of the impact community respondents reported that they had made changes in their future plans. Only 14 percent of the control community respondents had similar responses. Thirty percent of the impact community also reported that other family members and made changes in their future plans, suggesting a broad impact in terms of the creation of an uncertain future.

The focus of this uncertainty for the future may be the workplace, or immediate economic uncertainty, generated by the spill. Table 1 reveals that almost seven of every ten respondents reported "things had changed for them at work. The nature of these work-based changes reflect the dependency of the impact community's economic base on Prince William Sound's resources. Commercial fishing activities were directly disrupted by the spill, resulting in a corresponding series of mixed impacts on the canneries and the entire business community in Cordova. In some instances work was stopped or slowed down, while in other situations work loads increased as a result of rapid job shifts (e.g., clean-up, influx of media, technical and political representatives, etc.).

The results presented in Table 1 can be summarized as follows. Significantly more social disruption is apparent in the impact community as a result of the spill. The nature of this disruptive impact can be described as including family relations and future plans of community members. We suggest that this "general uncertainty" that characterizes Cordova directly relates to threats posed by the spill for the future economic viability of the community. The vest majority of all respondents interviewed in the impact community reported disruption and changes in their work role, further suggesting an immediate social impact on traditional day-to-day work activities.

Table 2 provides the item-by-item comparisons of the sixteen post-traumatic stress disorder items for control and impact communities. Chi-square tests were applied for all sixteen items. Fifteen of the sixteen chi-square applications were found to be statistically significant ($Pr \leq .05$), indicating the existence of a stronger symptomology of PTSD in the impact community.

[Table 2 about here]

TABLE 1: Patterns of Social Disruption for Control and Impact communities.

As a result of the spill...	(Control) % Yes	% No	(Impact) % Yes	% No
1) Have you noticed any changes in the way your family gets along together?	9	91	39	61
		*Pr $\leq$ .0001		
2) Have you made any changes in your plans for the future?	14	86	51	49
		*Pr $\leq$ .0001		
3) Have other family members changed their future plans?	17	83	30	70
		*Pr $\leq$ .029		
4) Have things changed for you at work?	19	81	68	32
		*Pr $\leq$ .0001		

*Chi-Square Analysis

TABLE 2: Control and Impact Community Responses to Post-raumatic Stress Items*

		Not at All	Rarely	Some-Times	Often	
I thought about it when I didn't mean to. (The thought of it just popped into my head).	(control)	36	19	24	21	*Pr ≤ .0001
	(Impact)	14	9	29	48	
Pictures about it popped into my mind.	(Control)	29	26	26	19	*Pr ≤ .031
	(Impact)	17	17	32	34	
Other things kept making me have thoughts about it it (even when I didn't want to)	(Control)	26	22	30	22	*Pr ≤ .005
	(Impact)	15	12	27	46	
I had to stop myself from getting upset when I thought about it or was reminded of it.	(Control)	45	14	22	19	*Pr ≤ .001
	(Impact)	18	19	28	35	
I tried to remove it from my memory. (To make it as though it never happened)	(Control)	82	9	5	4	*Pr ≤ .001
	(Impact)	55	17	10	18	
I had trouble falling asleep or staying asleep because of pictures or thoughts about it that came into my mind.	(Control)	82	11	4	3	*Pr ≤ .050
	(Impact)	58	16	17	9	
I had waves of strong feelings about the spill. (Feelings about it just seemed to wash over me).	(Control)	26	15	33	26	*Pr ≤ .036
	(Impact)	12	20	33	35	

		Not at All	Rarely	Some-Times	Often	
I didn't feel upset. My feelings about it were Kind of numb. (I really don't have any feelings about it.)	(Control)	70	12	13	5	*Pr ≤ .037
	(Impact)	60	19	15	6	
I had a lot of feelings about it that I didn't deal with (or didn't didn't know how to handle.	(Control)	69	14	10	7	*Pr ≤ .005
	(Impact)	46	16	17	21	
I had dreams about it.	(Control)	85	8	4	3	*Pr ≤ .017
	(Impact)	64	20	8	8	
I stayed away from reminders of it (e.g., like the road by the tracks.	(Control)	90	7	2	1	*Pr ≤ .0001
	(Impact)	63	20	9	8	
I felt as if it hadn't really happened (or as if it wasn't real).	(Control)	88	3	5	4	*Pr ≤ .007
	(Impact)	70	16	10	4	
I tried not to talk about it.	(Control)	85	4	6	5	*Pr ≤ .001
	(Impact)	61	16	19	13	
I tried not to think about it. (tried to force my attention away from it - perhaps to other things).	(Control)	79	8	7	6	*Pr ≤ .002
	(Impact)	54	13	20	13	
Any reminder brought back the way I felt about it.	(Control)	43	14	22	21	*Pr ≤ .275
	(Impact)	30	15	28	27	

		Not at All	Rarely	Some-Times	Often	
I suddenly felt like it was happening all over gain.	(Control)	79	8	8	5	*Pr $\leq$ .023
	(Impact)	49	18	15	8	

*Probability estimates derived from chi-square analysis.

The first four indicators of PTSD were found to reveal that majority of the respondents in the impact community had intrusive recollections of the spill (i.e., they inadvertently thought about, experienced pictures of the spill or had to prevent themselves from getting upset). Other contrasts of intrusive recollection and avoidance behavior items also reveal proportionately more reports of experiences of stress behavior (i.e., avoidance, numbing and recollections of the trauma) in the impact community. The item "any reminder brought back the way I felt about it" manifested no statistically significant difference between the two communities. However, the response pattern for this question revealed that the trend observed for other item comparisons also held. That is, proportionately more impact community respondents had experienced such thoughts than respondents in the control community.

At this stage of the analysis it is apparent that more disruption and post-traumatic stress experiences characterize the impact community (Cordova) than the control community (Petersburg). In an attempt to further clarify this observed impact of the Exxon Valdez spill, summated scores were calculated for the PTSD items, reflecting experiences of intrusive recollections and avoidance behavior (Siegel, Blanchard-Fields, Gottfried and Lowe, 1984). Table 3 presents means and standard deviations for these scales and results from the calculation of t-tests. Several sets of comparisons were made in order to evaluate the validity of the research design, as well as to evaluate differences between control and impact communities.

[Table 3 about here]

Table 3 presents PTSD scores for three sets of comparisons for both the intrusive recollections and avoidance behavior scales. The first comparison involved the control community and the impact community. Scores for both scales were found to be statistically significantly higher in the control community from the results of t-test applications.

The second set of comparisons of these scales involved desegregating the impact community data into the household survey data (Impact 1) and telephone interview data (Impact 2) and comparing differences in mean scale scores between these groups. A visual inspection of the mean scale scores, as well as t-test results, revealed no difference between the two impact community samples. These findings further validate the disaster impact design employed in this research and suggest that the PTSD patterns originally observed in August for the impact community remained relatively constant through December. The final comparison between the telephone interview data gathered in our research design further validates both the direction and continuing pattern of experiencing significantly more PTSD by respondents from the impact community.

TABLE 3: Independent Samples T-Tests for Post Traumatic Stress Disorder Components.

	$\bar{X}$	S.D.	
Intrusive Recollections			
Impact (N=118)	61.07	19.14	*T-Test = 4.275; Pr $\leq$ .0001
Control (N=73)	49.70	17.02	
Impact 1 (N=86)	61.08	19.20	*T-Test N.S.
Impact 2 (N=32)	61.04	19.28	
Impact 2 (N=32)	61.04	19.28	*T-Test = 2.871; Pr $\leq$ .006
Control (N=73)	49.70	17.02	
Avoidance Behavior			
Impact (N=118)	47.80	16.75	*T-Test = 5.306; Pr $\leq$ .0001
Control (N=73)	36.73	12.01	
Impact 1 (N=86)	48.55	16.38	*T-Test N.S.
Impact 2 (N=32)	45.80	17.83	
Impact 2 (N=32)	45.80	17.83	*T-Test = 2.628; Pr $\leq$ .012
Control (N=73)	36.73	12.01	

In order to clarify the patterns of PTSD observed, Pearson correlation coefficients were calculated between the four sources of social disruption (see Table 1) and the two PTSD indicators (see Table 3) for the control community data. Table 4 provides the results of these calculations.

[Table 4 about here]

Interestingly, the strongest coefficients were observed for the association between "disruption of family relations" and PTSD components and "disruption of future plans" and PTSD components. These results point to an important relationship between sources of social disruption and experiencing perceptions and behaviors characteristic of PTSD. The fact that uncertainty and family dysfunction is associated with high-levels of PTSD clearly identifies a pattern characteristic of the short-term social impact of the Exxon Valdez oil spill.

Summary and Conclusions

This research provides initial empirical data which documents the social impacts of the Exxon Valdez oil spill on an Alaskan fishing community in Prince William Sound. The Exxon Valdez spill was conceptually approached as a technological disaster, resulting from human and technological malfunctions of an ecosystem hazard (oil transportation activities in Prince William Sound). The study of these social impacts requires an interdisciplinary research design which minimally evaluates economic, cultural and psychosocial impacts. The present research provides data on patterns of social disruption and post-traumatic stress disorder derived from a comparison to control community data.

The empirical analysis clearly documented the existence of significantly more social disruption and post-traumatic stress disorder in Cordova. All but one of the twenty individual-item contrasts of data from Cordova and Petersburg were found to be statistically significant, documenting the existence of higher-levels of disruption and stress in the impact community. The existence of higher levels of both forms of PTSD, i.e., intrusive recollections and avoidance behavior, was documented through community and sample comparisons of mean scale scores. This analysis further revealed that there was no significant decline of PTSD in the Cordova community from August to December of last year. A correlation analysis further documented that PTSD was most acute for community residents who, as a result of the spill, had experienced family relations problems and were forced to change their plans. This disruption of family cohesion and an uncertain future provide the most important contexts for experiencing high-levels of PTSD. In short, the initial social impact of the Exxon Valdez spill on Cordova has been negative. Significantly more social disruption and stress has been experienced by Cordova residents. The implications of findings will be briefly discussed below.

TABLE 4: Correlation Coefficients Between Types of Social Disruption and PTSD Components Within Impact Community (N=118)

Source of Social Disruption	PTSD Intrusive Recollections Scale	PTSD Avoidance Behavior Scale
As a result of the spill:		
1. Have you noticed changes in the way your family gets along together?	.31*	.37*
2. Have you made changes in your future plans?	.33*	.33*
3. Have other family members changed their future plans?	.24*	.27*
4. Have things changed for you at work?	.10	.13

*Pr $\leq$ .01

The results of this study are relevant to the growing body of interdisciplining research on technological disasters. Although all disasters provide a context for having negative impacts on communities, the impacts of technological disasters can be more long-term and involve a host of "secondary disasters", which, in turn, produce additional negative consequences. A sense of continued uncertainty often characterizes communities effected by technological disasters. The documentation of perceptions of uncertainty, deteriorating family relations and PTSD five months following the Exxon Valdez spill establishes an understanding of the initial pattern of technological disaster impacts.

This study also provides data relevant to class-action litigation associated with compensation claims of Prince William Sound residents against Exxon and other parties. Increasingly social science data is being used by plaintiffs, defendants and the courts to mitigate settlements and provide data for court judgments (Picou, 1984; Edelstein, 1989; Rosebrook and Picou, 1990). Although the results of this research may only be directly applicable to the Cordova community, we suggest that similar, short-term negative impacts exist for all Prince William Sound communities which have an economy based on commercial fishing. It is apparent that appropriately designed research on communities in Prince William Sound will be needed over the next four years to adequately understand the continuing social impacts of the Exxon Valdez oil spill.

Finally, the results of this research are important for identifying the program and service needs of all communities in Prince William Sound. This study clearly documents the need for the delivery of counseling and mental health services by local, state and federal agencies to Cordova. The timely delivery of appropriate services involves a variety of issues associated with organizational activities and outreach programs (Baisden and Quarantelli, 1981; Lindy, Jacob, Grace and Green, 1981). Carefully designed, innovative programs have been found to mitigate negative disaster impacts (Heffron, 1977; Dohrenwend, 1978; Lindy, Jacob, Grace and Green, 1981). The identification of specific program needs for the Cordova community goes beyond the scope of the data analyzed in the present research.

In summary, the negative impacts of the Exxon Valdez oil spill go beyond the direct destruction of ecosystem resources in Prince William Sound. This research has documented the existence of negative social impacts reflected in terms high-levels of social disruption and post-traumatic stress disorder. These impacts characterized the Cordova community from late summer through early winter. Future longitudinal research is needed to monitor these and other social impacts of the largest oil spill in United States history. Such information is critical for understanding the threats to community viability and survival posed by technological disasters.

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