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The Psychological Sequelae of Disaster Stress Prospectively and Retrospectively Evaluated[1]

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Aimed to document the psychological sequelae of a disaster in the adult (17–68 years) population of the Caribbean island of Puerto Rico, by surveying 912 persons (including 375 previously interviewed) with a Spanish version of the Diagnostic Interview Schedule. A rigorous methodology, which included both

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retrospective and prospective designs, was used, enabled by the occurrence of a catastrophic disaster only a year after a comprehensive survey was completed. Framed in a stress theoretical perspective, disaster effects for new depressive, somatic, and posttraumatic stress symptoms were identified, even after adjusting for demographic and methodologic factors. All the effects, however, were relatively small, suggesting that most disaster victims were rather resilient to the development of new psychological symptoms. Comparison of results with previous findings and its implications for both disaster and stress research are discussed, as well as the role of community psychologists in disaster action.

Catastrophic natural events have long been an integral part of human life and their psychological effects a source of conjecture. Since many people live under conditions that make them susceptible to experiencing a disaster, the understanding of its sequelae is a topic of intense and essential study. Although knowledge about this topic has been greatly enhanced by excellent literature reviews (e.g., Bolin, 1986; Logue, Melick, & Hansen, 1981; Lystad, 1985), researchers continue to struggle with fundamental theoretical and methodological issues. Integration of findings from this line of research has been hampered by its largely atheoretical nature and by the vast methodological diversity across studies (Green, 1986). Moreover, since disasters are unforeseen events, most disaster research is based on cross-sectional and retrospective data, with the inherent limitations of such designs (Kessler, 1987).

Disaster research has been usually characterized by the lack of a formal theory to guide its methods and organize its findings (Green, 1986). However, some progress has been made recently to overcome this limitation. Stress theory has been proposed and used as a framework to study the psychological sequelae of disasters (Baum & Davidson, 1986; Melick, Logue, & Frederick, 1982). Viewed from this perspective, great disasters are seen as potentially strong stressors that may heavily tax the individual's habitual functioning, triggering both adaptive (Quarantelli & Dynes, 1973) and dysfunctional psychological reactions (e.g., Hocking, 1970).

Previous disaster research, although not necessarily framed in a stress perspective, has identified various types of specific symptoms as indications of dysfunctional responses. While depressive (e.g., Gleser, Green, & Winget, 1981), anxiety (e.g., Lima, Cruz, Lozano, Luna, & Pai, 1988), and specific posttraumatic stress symptoms (e.g., Green, Grace, & Gleser, 1985) have usually been observed, alcoholic (e.g., Gleser et al., 1981) and somatic symptoms (Logue, Hansen, & Struening, 1981) have also been identified occasionally.

Stress theorists have postulated that numerous social and personal factors may influence the impact of stress (B. S. Dohrenwend & Dohrenwend,

1981). Sociodemographic factors, which may be seen as indicators of people's material and social life conditions, can moderate this impact by affecting appraisal and coping responses (Lumsden, 1975), important components of the stress process (Lazarus & Folkman, 1984). Differential levels of psychopathology have been observed in disaster victims regarding gender (e.g., higher levels of depression and anxiety but lower levels of alcohol abuse in females; Gleser et al., 1981), age (e.g., higher symptom levels in people within a middle age range; Gleser et al., 1981) and education (higher levels in the less educated; Bolin, 1986). However, it is important to distinguish whether these differences among sociodemographic groups simply reflect prevailing tendencies that are seen even in normal circumstances or whether the identified subgroups are unusually susceptible to disaster stress. Addressing this issue, Shore, Tatum, and Vollmer (1986b) identified differential levels of susceptibility regarding age and financial means, whereas Smith, Robins, Przubeck, Goldring, and Solomon (1986) identified it in relation to marital status. The former observed that people in a middle age range (36–50 years) as well as those having financial difficulties showed a higher relative risk of developing new disaster-induced psychopathology, whereas the latter observed that the relationship of disaster exposure with persistent symptoms was significantly stronger for not-married people.

Although these findings point towards the presence of a disaster effect on psychopathology, controversy still exists on whether this negative impact is small or negligible or whether it entails significant consequences (Lima et al., 1988). Vast differences in methods across disaster studies have limited efforts to elucidate this issue. Fortunately, recent developments in mental health epidemiology have produced more uniform disaster studies (Medina-Mora, Tapia, Caraveo, Sepúlveda, & De la Fuente, 1988; Robins, Fischback, Smith, Cottler, Solomon, & Goldring, 1986; Shore et al., 1986a; Smith et al., 1986). All of these studies include community-based samples, most have control groups (except Medina-Mora et al.'s), and most use retrospective designs (except Robins et al.'s which is prospective). Moreover, all of them use English or Spanish versions of the same diagnostic instrument, the Diagnostic Interview Schedule (DIS; Robins, Helzer, Croughan, & Ratcliff, 1981), which evaluates criterion-based specific symptoms and disorders.

Although different types of disasters in culturally diverse populations have been involved, some consistent findings have been observed. Shore et al.'s (1986a, 1986b) and Medina-Mora et al.'s (1988) research involve studies of the Mount St. Helens volcanic eruption in Washington State and the 1985 Mexico City earthquake, respectively. Both found a significant incidence of depression, generalized anxiety, and posttraumatic stress disorder (PTSD) in the exposed. Smith et al. (1986), studying the Times Beach's and nearby counties' floods and toxic contamination in Missouri, observed a higher post-

disaster prevalence of these same disorders as well as of alcoholism and phobia, although a higher incidence was only observed for PTSD. Regarding symptoms, the exposed showed a higher onset of postdisaster depressive and PTS symptoms. When overall symptomatology (grouping all disorders together) was analyzed, simultaneously taking into account predisaster symptoms and demographics, a significant but small disaster effect was observed on persistent but none on new symptoms.

Contrary to these findings, Robins et al. (1986) did not identify any significant disaster effects on psychopathology while longitudinally studying a subsample (369 out of 547) of the Smith et al. (1986) study. Seeming ly discrepant results from these two sets of analyses can be explained by various factors. On the one hand, it can be argued that Smith et al.'s retrospective data (as well as that of Medina-Mora et al., 1988, and Shore et al., 1986a) may be biased by the problem of "telescoping" (Kessler, 1987), that is, previously occurring responses may have been incorrectly dated to the targeted postdisaster period. On the other hand, Robins et al.'s sample included few (44 out of 369) and mildly exposed (no serious injury nor loss of relatives or homes) participants. Additionally, these people had been interviewed twice before the disaster, a factor that may have downgraded postdisaster symptom report ("report effect") since a tendency for symptom attenuation has been observed in repeated DIS interviews (Robins, 1985).

An event that provided an unusual opportunity to contribute to the disaster literature was a calamity that occurred in the Spanish-speaking Caribbean island of Puerto Rico (P.R.) in October 1985. Since it happened only a year after an island-wide mental health survey was completed (Canino et al., 1987a), it enabled the assessment of the impact of the event both prospectively and retrospectively. Torrential rains caused by a stationary tropical wave produced widespread flooding and deadly mud slides, especially in the southern part of the island. There were nearly 180 deaths, scores of families were left homeless, with more than 4,000 persons having to be lodged in public shelters for up to several months, and approximately 19,000 suffering considerable material losses.

The present study aims to assess the psychological impact of this disaster on community samples of exposed and unexposed people, specifically studying the extent to which disaster stress evokes criterion-based depressive, somatic, posttraumatic stress, and alcoholic symptoms. The moderating effects of sociodemographic factors (i.e., gender, age, education) on this impact are also evaluated.

The study uses a stress theoretical perspective to guide its methods. The disaster had some particularly stressful features, as identified by Baum and Davidson (1986): It was inherently uncontrollable, unexpected (almost no forewarning was given), had a very high and extensive impact (it caused considerable damage and affected many communities), exposed many people to terror and horror experiences (life threatening, exposures to corpses), and

an extended temporal involvement in the stressful situation (due to evacuation and relocation). Based on the above, we hypothesized that the higher the level of disaster stress, the greater the individual's symptomatology. Additionally we predicted that the less educated and the middle-aged adults would show more susceptibility to the emergence of postdisaster symptomatology.

METHODS

Study Design

This research involves a small panel sample embedded within a larger cross-sectional probability sample. A total of 375 persons interviewed both in 1984 and 1987 make up the prospective study's panel sample. The larger sample includes these 375 persons plus 537 who were interviewed in 1987 for the first time, for a total of 912 retrospectively assessed participants. An analytic approach which independently analyzes and compares the prospective and retrospective data is used in this paper.

Population and Sample

The study's sample was designed to increase the chance of obtaining people exposed to the 1985 disaster, especially those previously interviewed in 1984. Public agencies' reports and on-site inspections provided the information on how to divide the island of Puerto Rico into disaster-exposed and unexposed areas. All previously interviewed persons living in exposed areas and a systematic random sample of those previously interviewed living in the unexposed areas were included in the panel sample. To increase the study's sample, not-previously interviewed people were included in two probability samples of households, one located in exposed and the other in unexposed communities. In the selected households, a single person (17–67 years) was chosen using a sampling scheme designed to provide a sex–age distribution similar to that of the total population (Kish, 1965). Thus, a total sample of 912 persons (375 previously and 537 not-previously interviewed) was successfully interviewed with high response rates (92.9% for first-time interviews and 86.6% for reinterviews).

Instruments and Measures

Psychological Symptoms

The field research instrument used in this study was a Spanish version of the Diagnostic Interview Schedule/Disaster Supplement (DIS/DS), an

adapted version of the DIS (Robins et al., 1981) designed to evaluate the mental health of disaster victims (Robins & Smith, 1983). It is a structured schedule designed for use by trained lay interviewers which allows criterion-based diagnostic assessments for the study of psychiatric symptoms and disorders. A symptom is scored positive only if it has been experienced by the respondent in his/her lifetime, meets severity criteria, and is not entirely explained by physical illness or substance use. Each positive symptom is probed to date its first (onset) and most recent (recency) occurrence for evaluated diagnoses (except for the panic and generalized anxiety disorders).

The DIS/DS was translated into Spanish and adapted for our study. Nine DSM-III disorder schedules, namely, major depressive episode, dysthymia, PTSD, alcohol and drug abuse/or dependence (DAD), generalized anxiety (GA), panic, and antisocial personality disorder (ASP), were included. Since somatization is a low-prevalence disorder, only those somatic symptoms that form an empirically defined symptom scale were included (Rubio-Stipec, Shrout, Bird, Canino, & Bravo, 1989). Five of the diagnoses present in our DIS/DS version had been studied in the 1984 P.R.'s epidemiological study (the exceptions are PTSD, DAD, GA, and ASP). These schedules had been adapted to the population and culture of Puerto Rico using a comprehensive cross-cultural adaptation model which takes into account the semantic, content, technical, criterion, and conceptual equivalence among the languages and cultures involved (Bravo, Canino & Bird, 1987; Bravo, Canino, Rubio-Stipec, & Woodbury, in press). Its reliability and concordance with clinical diagnoses have been assessed (Canino et al., 1987b), obtaining results comparable to similar studies in the United States (Burnam, Karno, Hough, Escobar, & Forsythe, 1983; Robins et al., 1981).

Specific symptoms that form empirically defined scales (Rubio-Stipec et al., 1989) associated with three disorders evaluated both in 1984 and 1987 (depression, somatization, and alcohol abuse/dependence) were used as main indicators of psychological dysfunction in the present report. The sum of symptoms associated with PTSD, although only evaluated in 1987, was also included due to its importance in stress research. To study the emergence of new symptoms after the disaster, two types of symptom measures were employed. The level of lifetime symptoms associated with a particular disorder, as assessed in 1987, were used in the present report as measures of symptom levels reached in the postdisaster period for both the prospective and retrospective data. To evaluate predisaster symptom levels, different measures were needed. For retrospective data, predisaster symptom level refers to the sum of those symptoms experienced in the person's lifetime whose onset antedated the disaster (as reported in 1987); for the prospective, it refers to the sum of lifetime symptoms reported in the 1984 interview.

Disaster Exposure

The section of the DIS/DS evaluating disaster exposure was revised in order to adapt it to our conceptual framework and the P.R. disaster. The adaptation was based on information collected via open-ended unstructured interviews with disaster victims. The persons' appraisal of their disaster experiences was considered since even in extreme circumstances the consequences of stress cannot be understood solely in terms of the event itself due to differences in personal perceptions and meanings with which an individual imbues any event (Benner, Roskies, & Lazarus, 1980). However, aiming to avoid the possible confounding effect between antecedents and consequences inherent in "subjective" measures (Leventhal & Tomarken, 1987), we opted for the use of self-reports of exposure devoid of personal evaluations and reactions (Kasl, 1987).

Participants were ranked into four degree of exposure stress levels, based on answers to questions that evaluate individual disaster experiences. "Severe exposure" refers to both severe damage to property and relocation (temporary or permanent) *or* to the loss of family members by death *or* serious threat to own or family member's life. "Moderate exposure" refers to damage to property or relocation *or* to the death or serious life threat to significant other's life (not a family member) *or* to moderate threat to family member. "Near exposure" refers to only slight or no damage to own property, but considerable damage to neighbors' *or* to death or life threat to neighbors or nearby community members. Both personal and material losses or threats were considered; fulfilling either the criteria for personal or for material losses qualified a person for the highest appropriate level; not fulfilling any criteria for the exposure categories classified a person as not exposed. The distribution of the samples among exposure categories are presented on Table I.

Table I. Samples Classified by Degree of Exposure

Exposure level	Prospectively evaluated sample		Retrospectively evaluated sample	
	n	%	*n*	%
Severe	39	10.4	228	25.0
Moderate	38	10.1	93	10.2
Near	62	16.5	155	17.0
None	236	62.9	436	47.8
Total	375	100.0	912	100.0

Field Procedures

Previous to its use the instrument was tested with 30 community subjects from different socioeconomic strata which allowed for its fine tuning. The field interviews were conducted in 1987 by ten lay interviewers who underwent an intensive 5-week training session and successfully demonstrated their mastery of the schedule by interviewing four persons under close supervision. Measures to assure the quality of the data, which address sampling, fieldwork, and data analysis itself as possible sources of error, were modeled on those used in our 1984 prevalence study (Canino et al., 1987a).

RESULTS

Demographic and Psychopathologic Characteristics of the Samples

The groups classified according to degree of exposure were found to have had generally similar demographic characteristics (Tables II and III). Using one-way analysis of variance and Scheffé tests, the only significant difference between the groups identified in both samples was for education: the unexposed were more educated than some of the exposed groups (the severely and nearly exposed in the retrospectively evaluated sample and the nearly exposed in the prospective). Significant gender differences were identified in the prospectively evaluated sample at the variable's breakdown level but no differences between specific groups were identified in the post hoc comparisons.

Table II. Demographic Characteristics of Retrospectively Evaluated Sample Classified by Degree of Exposure to the Disaster (N = 912)

Characteristics	Exposure level							
	None		Near		Moderate		Severe	
	n	%	*n*	%	*n*	%	*n*	%
Sex								
Male	172	39.4	72	46.5	47	50.5	98	43.0
Female	264	60.6	83	53.5	46	49.5	130	57.0
Age (years)								
17-24	96	22.0	38	24.5	17	18.3	60	26.3
25-44	196	45.0	58	37.4	50	51.7	101	44.3
45-68	144	33.0	59	38.1	26	30.0	67	29.4
Education (years)								
0-11	188	43.1	96	61.9[a]	44	47.3	140	61.4[a]
12	102	23.4	32	20.7	26	28.0	46	20.2
13+	146	33.5	27	17.4[a]	23	24.7	42	18.4[a]

[a]Significantly different from the "none" group (unexposed) at the $p < .05$ level.

Table III. Demographic Characteristics of Retrospectively Evaluated Sample Classified by Degree of Exposure to the Disaster (N = 375)

Characteristics	Exposure level: None (n = 236)		Near (n = 62)		Moderate (n = 38)		Severe (n = 39)	
	n	%	n	%	n	%	n	%
Sex								
Male	94	39.0	33	53.2	23	60.5	19	48.7
Female	144	61.0	29	46.8	15	39.5	20	51.3
Age (years)								
17-24	28	11.9	7	11.3	4	10.5	9	23.1
25-44	119	50.4	33	53.2	24	63.2	17	43.6
45-68	89	37.7	22	35.5	10	26.3	13	33.3
Education (years)								
0-11	96	40.7	42	67.8[a]	15	39.5	24	61.5
12	55	23.3	10	16.1	11	28.9	8	20.6
13+	85	36.0	10	16.1[a]	12	31.6	7	17.9

[a]Significantly different from the "none" group (unexposed) at the $p < .05$ level.

Those exposed to the 1985 disaster tended to have higher levels of predisaster lifetime symptoms than those unexposed (Table IV). The retrospective analyses of the total sample indicate that the unexposed had significantly lower levels of somatic symptoms than the moderately exposed and of alcoholic or PTS symptoms than the severely exposed (for PTS the

Table IV. Level of Predisaster Symptoms in Retrospectively and Prospectively Evaluated Samples Classified by Degree of Exposure to the Disaster

Symptoms	Exposure level: None		Near		Moderate		Severe	
	M	SD	M	SD	M	SD	M	SD
	Retrospective sample (N = 912)							
Depressive[a]	1.21	2.37	0.95	1.70	1.57	2.77	1.70	2.62
Somatic[b]	0.53	1.05	0.61	1.12	0.91	1.67	0.74	1.27
Alcoholic[c]	0.45	1.53	0.73	1.70	0.55	1.46	0.94	2.20
PTSD[d]	0.39	1.28	0.45	1.22	0.29	1.11	0.87	1.89
	Prospective sample (N = 375)							
Depressive	1.88	2.77	2.26	3.00	1.37	1.87	1.59	2.01
Somatic	1.09	1.69	1.32	1.91	1.24	1.44	1.51	2.29
Alcoholic[e]	0.61	1.86	1.73	3.42	0.71	1.68	1.03	2.23

[a]Severe significantly different from Near.
[b]Moderate significantly different from None.
[c]Severe significantly different from None.
[d]Severe significantly different from None and from Moderate.
[e]Near significantly different from None.

Table V. Level of Lifetime Symptoms in Retrospectively and Prospectively Evaluated Samples Classified by Degree of Exposure to the Disaster (N = 912)

	Exposure level							
	None		Near		Moderate		Severe	
Symptoms	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
	Retrospective sample (N = 912)							
Depressive[a]	1.81	2.77	1.80	2.47	2.02	3.02	2.75	3.21
Somatic[b]	0.74	1.28	1.05	1.59	1.26	1.95	1.18	1.69
Alcoholic[c]	0.58	1.69	0.95	2.14	0.76	1.87	1.11	2.42
PTSD[d]	0.56	1.51	0.72	1.66	0.52	1.47	1.41	2.33
	Prospective sample (N = 375)							
Depressive	1.73	2.74	2.00	2.61	1.84	2.83	2.05	3.08
Somatic	0.75	1.28	1.13	1.59	1.13	1.56	0.87	1.22
Alcoholic	0.59	1.84	1.40	2.79	0.87	2.04	1.00	2.38

[a]Severe significantly different from None and from Near, $p < .05$.
[b]None significantly different from Severe and from Moderate, $p < .05$.
[c]Severe significantly different from None, $p < .05$.
[d]Severe significantly different from each of the three other groups, $p < .05$.

moderately were also significantly less symptomatic than the severely exposed). The prospective analyses of the panel sample show that in 1984 the unexposed had a significantly lower level of alcoholic symptoms than the nearly exposed.

Symptom Levels and Degree of Exposure (Univariate Results)

Our data show a tendency for those exposed to the disaster to have higher levels of lifetime symptoms 2 years after the disaster (Table V). One-way analysis of variance and Scheffé tests indicated that the severely and/or the moderately exposed show a significantly higher level of symptoms in the retrospective evaluations during the postdisaster period than the unexposed for all the four symptoms groups studied. A similar tendency for the exposed groups to show higher levels of symptoms was observed in the prospectively evaluated sample, but the differences did not reach statistical significance.

Disaster Impact (Multivariate Results)

The previously presented results suggest that disaster stress had an effect on psychological functioning. However, we felt that we could be more rigorous in analyzing our data. First, the composition of our study's comparison groups may have influenced the previously presented univariate

results. Symptom differences between the exposed and unexposed may be due to predisaster differences on levels of psychopathology (i.e., higher predisaster levels in the exposed) or demographic characteristics (i.e., higher education in the unexposed). Second, a report effect may be present in the prospective data since, as previously mentioned, one study observed a tendency for less DIS lifetime symptoms to be reported in reinterviewing when logically only similar or more symptoms are plausible (Robins, 1985).

One way to better address these methodological issues is to use multiple regression analyses. One regression model was specified in both the prospective and the retrospective data banks for each outcome variable (except for PTS symptoms which could be only retrospectively analyzed). The level of lifetime symptoms up to 1987 associated with a particular diagnosis is used as the outcome variable, and the level of symptoms of that diagnosis before the disaster is used as a covariate in each set of analyses. In this way the explained variance refers to those "new" symptoms emerging after the event. Variables in the analytic model were entered into the analysis in two steps: first, the covariates (demographics, predisaster symptom levels, and being previously interviewed or not) and second "degree of disaster exposure." (Only results of the second step are presented in the tables.)

Specific Symptoms as Responses to Disaster Stress. Results of the multiple regression analyses with the total sample's retrospective data showed that, even after accounting for gender, age, education, predisaster symptom levels, and interview status, the higher the degree of disaster exposure the higher the level of depressive, somatic, and PTS symptoms (Table VI). The panel sample's prospective data tend to confirm these results for depressive and somatic symptoms (as mentioned, for PTS it could not be prospectively tested) (Table VII). Although the results in the panel sample do not reach statistical significance ($< .05$), the relationship between exposure and symptoms is in the same direction in both samples with the magnitude of the regression coefficients being not significantly different (it tends to be larger in the prospective sample, i.e., 0.12 vs. 0.18 for depression). Since the standard errors for the coefficients associated with exposure in the panel sample are larger (e.g., 0.04 vs. 0.11 for depression), this results in a loss in the statistical power needed to detect significant associations. The results thus suggest that while a true depressive and somatic symptom increment was present after the disaster, it was not large enough to be detected with a sample the size of the panel ($N = 375$). No disaster effect was observed for alcoholic symptoms in either the prospective or the retrospective results.

Previous Symptomatology and Interview Status. As expected, the predisaster level of lifetime symptoms were good predictors of postdisaster lifetime symptom levels in both samples (see Table VI and VII). Contrary to our expectations, however, no significant report effect was observed in

Table VI. Regression of Disaster Exposure on Lifetime Symptoms, Retrospectively Evaluated Sample (N = 912)[a]

	Depressive		Somatic		Alcoholic		PTSD	
Variables	B	*SE*	B	*SE*	B	*SE*	B	*SE*
Gender (male)	−0.14	0.10	−0.09	0.06	0.26	0.05[b]	−0.13	0.07
Age (years)								
17-24	0.14	0.14	0.15	0.08	0.19	0.07[b]	0.07	0.11
25-39	−0.08	0.13	0.14	0.07	0.18	0.06[b]	−0.01	0.10
55-68	0.10	0.14	0.19	0.08[b]	−0.02	0.07	−0.01	0.11
Education (years)								
0-11	0.29	0.12[b]	0.34	0.07[b]	0.16	0.06[b]	0.07	0.09
13+	0.19	0.14	−0.02	0.08	0.03	0.06	0.05	0.11
Interview status	0.06	0.10	0.01	0.06	0.01	0.05	−0.11	0.08
Predisaster symptoms	1.05	0.02[b]	1.05	0.02[b]	1.05	0.01[b]	0.97	0.03[b]
Exposure level	0.12	0.04[b]	0.05	0.02[b]	−0.01	0.02	0.11	0.03[b]
R^2	0.76		0.72		0.89		0.64	
F	312.13[b]		257.18[b]		800.78[b]		174.40[b]	

[a]Reference groups for covariates are: Female for sex, 40-54 years for age and 12 years of schooling for education and not previously interviewed for interview status. B = regression coefficient; *SE* standard error.
[b]$p \leq .05$.

postdisaster symptom levels: The number of postdisaster symptoms did not seem to significantly vary with the person's previous interview experience.

Demographic Correlates. The associations between demographic variables and symptomatology generally fell along expected lines (see Tables VI and VII). Alcoholic symptoms were more prevalent among males (both samples) and somatic symptoms among females (prospective sample). Younger adults (17–39 years) tended to show higher levels of new alcoholic symptoms than older adults (40–68 years) in both samples. The less educated tended to show more depressive, somatic, and alcoholic symptoms in the retrospective evaluations.

Differential Vulnerability to Disaster Stress (Interaction Findings)

As previously stated, we aimed to assess whether certain sociodemographic groups showed more susceptibility to the impact of the disaster. To evaluate this possibility, we extended the analyses reported in Tables VI and VII by including in a third step a multiplicative interaction between disaster exposure and each one of the gender, age (17–24, 25–39, 40–54, 55–68), and education variables (0–11, 12, 13+) included in the analyses (the set of in-

Table VII. Regression of Disaster Exposure on Lifetime Symptoms, Prospectively Evaluated Sample ($N = 375$)[a]

	Depressive		Somatic		Alcoholic	
Variables	B	*SE*	B	*SE*	B	*SE*
Gender (male)	−0.14	0.24	=0.39	0.13[b]	0.39	0.15[b]
Age (years)						
17-24	−0.30	0.40	−0.20	0.22	0.46	0.24[b]
25-39	−0.07	0.30	0.02	0.16	0.56	0.17[b]
55-68	0.45	0.33	0.18	0.18	0.30	0.19
Education (years)						
0-11	−0.45	0.13	−0.04	0.16	−0.27	0.18
13+	−0.68	0.32[b]	−0.32	0.17	−0.23	0.19
Predisaster symptoms	0.62	0.04[b]	0.33	0.04[b]	0.71	0.03[b]
Exposure level	0.18	0.11[c]	0.07	0.06	0.03	0.07
R^2	0.38		0.27		0.64	
F	28.56[b]		17.17[b]		81.23[b]	

[a]Reference groups for covariates are: Female for sex, 40-54 years for age, and 12 years of schooling for education. B = regression coefficient; *SE* = standard error.
[b]$p \leq .05$.
[c]$p \leq .10$.

teraction terms concerning each variable were entered together into one regression analysis). Contrary to our expectations, no evidence of differential vulnerability to disaster stress among the sociodemographic groups studied was identified (regressions not shown).

DISCUSSION

The main aim of this paper was to evaluate the psychological sequelae of a disaster using a rigorous methodological approach that combined the use of both retrospective and prospective designs. Using the emergence of new specific symptoms in the postdisaster period as an indicator of psychological dysfunction, we identified a significant, albeit small, disaster effect on depressive and somatic symptom levels in the retrospective analyses which tended to be confirmed by the prospective. A significant disaster stress impact was also retrospectively identified for posttraumatic stress symptoms, although the unavailability of panel data for this group of symptoms precluded its prospective confirmation. A second aim of this study was to identify any differential susceptibility to disaster stress among identified sociodemographic groups. We failed, however, to obtain evidence of this type of vulnerability in any of the gender, age, or education groups studied.

Our findings indicate that people exposed to the 1985 flood and mudslide disaster in P.R. showed slightly higher levels of new depressive, somatic, and posttraumatic stress symptoms in a 2-year span following the event when retrospectively assessed. Moreover, the higher the level of the disaster stress, the greater the individual's symptomatic response. Although significant results were observed regarding depressive and somatic symptoms in the retrospective analyses, their prospective counterparts did not reach established significance levels. However, the identified associations can be considered "true," and not the product of methodological artifacts (e.g., a telescoping effect), for various reasons. First, the relationship between exposure and symptoms was of similar magnitude and in the same direction in both samples. Second, strict controls were used to study the relationships, thus precluding the interpretation that they could have resulted from demographic differences among exposed and unexposed groups or predisaster differences on levels of symptoms. Finally, the findings are concordant with results of previous research. The presence of depressive, posttraumatic, and somatic symptoms (especially the first two) have been repeatedly associated not only with disaster exposure in previous research (Bolin, 1986; Logue et al. 1981) but also with exposure to many other stressful events (Rabkin, 1982). Moreover, the emergence of these specific symptoms have been reported in all retrospective DIS-based studies (Medina-Mora et al., 1988; Shore et al., 1986a; Smith et al., 1986). Therefore, following this line of thought, the main significance of the findings lies not in the magnitude of the disaster effects but in that they were obtained using rigorous controls and are a replication of similar previous research across different disasters and populations.

The magnitude of the observed disaster effects, were, however, rather small (e.g., .18 and .12 for depressive symptoms) and could be considered clinically insignificant. Therefore, following this view, they can be interpreted as supporting the notion that disaster stress effects are small or negligible (Bromet, Schulbert, & Dunn, 1982; B. P. Dohrenwend et al., 1981; Quarantelli & Dynes, 1977). Our results can thus be interpreted from a "strength" perspective. They suggest that people can be very resilient to the development of new psychological symptoms even in the presence of such strong stressors as life threat, heavy personal or material losses, as well as evacuation and relocation.

Even though the study employs a rigorous methodological approach, it, nevertheless, presents a limitation that may have influenced its results in that interviews were carried out 2 years after the disaster. Although the whole 2-year span was targeted for evaluating the postdisaster emergence of new symptoms, people may have forgotten some of their initial psychological reactions to the disaster when interviewed 2 years after the event. In fact, while all the symptoms emerging in the whole 2-year period were grouped together

in these analyses, without distinguishing between immediate or longer lasting reactions, a detailed inspection of the data showed that most of the new symptoms were reported as emerging in the second year after the disaster. It thus suggests that a "recall" factor may have downgraded the observed effects. Therefore, our results probably more accurately reflect long-term, rather than immediate, psychological responses to the disaster. Our findings are thus consistent with the view of disaster victims as normal individuals temporarily disrupted by stress (Farberow, 1978) who tend to return to their predisaster functioning levels.

The relationship of disaster exposure with alcoholic symptoms is different than that for the other groups of symptoms studied. Although a higher level of alcoholic symptoms was initially observed in the exposed, differences in demographic characteristics and previous symptomatology levels among comparison groups were shown to account for the results. Salient among them are probably gender differences since alcoholism is a male prevalent disorder worldwide (Nace, 1984; Taylor & Helzer, 1983) with Puerto Rico having a particularly high male/female ratio (Canino et al., 1987a; Helzer et al., 1988). Any group including relatively more males (like our exposure groups) would thus tend to show higher levels of alcoholic symptoms.

The demographic correlates observed for the studied symptom groups generally fell along expected lines. For example, somatic symptoms were more prevalent among women and higher levels of all types of symptom, except PTSD, were shown by the less educated. These results suggest that the P.R. disaster victims had a symptom profile along these lines. However, this profile seems to be the result of an overall small increase of symptoms across all studied groups, thus reflecting prevailing symptom patterns in the population, since no differential susceptibility to disaster stress was identified among the studied sociodemographic groups. That is, none of the studied groups showed a particular vulnerability to the development of new disaster-induced symptoms. Prevailing symptom differences among population segments are thus more probably explained by the presence of chronic stressors in their daily lives rather than the result of acute ones, like a disaster (McGonagle & Kessler, 1989). We must recognize, however, that the obtained findings regarding no differential vulnerability among age groups cannot be generalized to all life stages since children and the elderly are not included in this study.

Various methodologic issues also merit discussion. The present study illustrates the advantage of combining multiple designs in stress studies. Stress research has been hampered by the practice of focusing on stressors that actually could be either antecedents or consequences of the person's psychological functioning (e.g., divorce, job loss). Studying fortuitous events, such as natural disasters, can help to overcome this limitation (Solomon,

1989). These events are out of the realm of control of participants and in this sense can be considered exogenous factors. Since they usually also occur at an easily determined time, the sequence of events and consequences is easier to disentangle. However, the availability of an adequate baseline from which one can assess the psychological sequelae is usually lacking. In some instances, as in our case, a subsample of a large community survey is impacted by this kind of event. The use of a design that involved a small panel study embedded within a larger cross-sectional enabled us to generate greater statistical power than would have been otherwise possible with the panel design alone. It enabled us to conclude that the disaster effect observed in the prospective data from depressive and somatic symptoms, although not reaching statistical significance, was nonetheless true when seen in the context of the retrospective results. Moreover, the simultaneous use of the retrospective and prospective designs compensated for the methodological limitations inherent in both types of designs, namely, the problem of telescoping (anchoring of psychological phenomena to the postdisaster period) in the former and the interview effect (effect of previous measurement on follow-up measures) in the latter (Kessler, 1987). The independent but simultaneous use of prospective and retrospective data, with its inherent strengths and limitations, allowed a comparison of results which promoted a better understanding of the studied phenomena that is greater than that which would have been obtained with any one design alone.

The study also illustrates the importance of the use of rigorous methods, such as control groups and preevent data, in disaster (and other stress) studies. For instance, a study that includes a sample entirely composed of disaster-exposed participants can obtain a sociodemographic profile of victims suggesting that a certain population segment is more susceptible to the development of symptoms after a disaster (e.g., somatic symptoms in females). The inclusion of an unexposed control group in our study enabled the empirical evaluation of this interpretation against the alternative one indicating that the observed differences reflect prevailing population patterns. Our results regarding this issue emphasize the importance of making this distinction. Similarly, the evaluation of predisaster level of symptoms (either retrosepctive or ideally prospective) is a very important aspect to consider in disaster stress research. A catastrophic event, such as a disaster, occurs in the context of lifelong experiences. Although disasters are fortuitous happenings, their impact on a population is not altogether random since people living in precarious material conditions are prone to be more vulnerable to its physical force. Therefore, natural disaster victims frequently come from socioeconomically disadvantaged groups. Since these groups usually exhibit higher levels of symptomatology (Allen & Britt, 1983; Pearlin, 1982), the exposed usually then

tend to show higher levels of symptoms than the unexposed in community samples, even before the occurrence of a disaster. Since that was the case in our study, if predisaster levels of symptoms would have not been taken into account, the effect of the disaster on our population would have been overestimated.

The obtained findings have not only scientific merit but also practical implications. They point towards the desirability of incorporating community psychologists (rather than psychotherapists) as key participants in disaster plans and interventions. Their skills and concerns are particularly suited for this endeavor. Results from this study indicate that the disaster effect on new symptomatology is rather small, thus suggesting that people are rather resilient to a strong stressor. Disaster victims may be viewed as people who have to adapt to new circumstances in a short period, but do not generally tend to become psychologically dysfunctional. Community interventions that tend to promote psychological health via coordinating supportive and organizational efforts, rather than focusing on psychopathology, are thus most appropriate in the postdisaster period. Actions such as those that enhance the victims' strengths via the preservation of preexisting community ties (Quarantelli, 1986), the enhancement of their autonomy and power (Rappaport, Swift, & Hess, 1984), and the use of the communities' indigenous resources (Solomon, 1986), should be encouraged. Disaster efforts that render people helpless and passive in the recovery process should be avoided (Lindy & Grace, 1986) since they tend to undermine people's strengths and resiliency.

In sum, we found a true but small increase in new depressive, somatic, and posttraumatic stress symptoms after disaster exposure, thus suggesting that disaster victims are rather resilient to the development of new psychologic symptoms. Interestingly, no differential susceptibility to disaster stress was observed in the studied sociodemographic groups. It follows that disaster victims must continue to be the subject of thoughtful and sensitive study and action.

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