

## Psychological Functioning Following an Acute Disaster

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We investigated personal and organizational functioning following an acute disaster in an explosives factory in which 14 people were killed and 14 others were injured. Multivariate analyses of covariance (controlling for age and organizational tenure) assessed whether there were any differences between the experimental group (40 individuals physically exposed to the explosion) and two control groups (one from the same site performing a different job, the second from a separate site performing the same job;  $n = 76$  and  $n = 40$ , respectively). During the 2nd week following the blast and 2 months afterward, there were no between-group differences in terms of job satisfaction, organizational commitment, marital satisfaction, or psychological distress. Failure to find any differences was attributed to the acute (as opposed to chronic) nature of the disaster. At both time periods, family support was correlated with personal functioning, whereas supervisory support was associated with job satisfaction; this is discussed in terms of the source of the stressor being consistent with the source of the support and the nature of the outcome.

Research on work stress and its consequences is increasing tremendously (Staw, 1984). Because ethical considerations and problems of generalizability largely rule out the induction of stress in laboratory situations, research on work stress has relied mainly on correlational designs in community (e.g., Motowidlo, Packard, & Manning, 1986) or "at-risk" samples (e.g., Barling & Rosenbaum, 1986). This approach has produced retrospective (e.g., Loo, 1986), cross-sectional (e.g., Motowidlo et al., 1986), and prospective (e.g., Barling & Milligan, 1987) analyses of the correlates of work stress. A problem inherent in most of this research, however, is that correlational or "pre-experimental" designs preclude any true causal inferences regarding the consequences of work stress (cf. Cook & Campbell, 1979).

One way of reducing the limitations of correlational research and the ethical, and content and external validity, issues inherent in analogue research is to study the consequences of work stress in naturalistic field settings that permit the inclusion of relevant control groups. Perhaps the most widely studied work stressor in a naturalistic situation is the disaster at Three Mile Island (TMI; e.g., Chisholm & Kasl, 1982; Chisholm, Kasl, & Eskenazi, 1983; Chisholm, Kasl, & Mueller, 1986; Kasl, Chisholm, & Eskenazi, 1981a, 1981b). These analyses showed that TMI workers experienced negative work-related effects in comparison with control groups in which workers at nuclear power stations did not experience a disaster. Workers at TMI evidenced increased demoralization, job dissatisfaction, and role strains, and negative work-related outcomes were still evident

30 months after the explosion. Chisholm et al. (1986) also showed that social support buffered some negative effects of the TMI disaster.

Findings from studies on the effects of the TMI disaster may not be generalizable to other disasters. Given that disasters vary on a number of dimensions (Baum, Fleming, & Davidson, 1983; Berren, Beigel, & Ghertner, 1986), the generalizability of the TMI phenomenon may be limited to disasters with similar characteristics. The incident at TMI was a man-made disaster, was difficult to predict and of sudden onset, involved a loss of control rather than a lack of control, initially was of unspecified severity, and invoked no visible damage. Also, the disaster at TMI exhibited no "low point" when the effects of the disaster could clearly be said to be finished (Baum et al., 1983; Berren et al., 1986), and as a result, some of the stress and uncertainty associated with the disaster still exists.

One interpretive problem with naturalistic field studies results from the absence of true experimental manipulation, preventing any possibility of sequentially dismantling the various components of the disaster to isolate its true causal components. Therefore, it is not clear which of the characteristics of the TMI disaster led to the negative outcomes reported. Because experimental manipulation of disaster characteristics is not possible, one alternative is to sequentially study several disasters differing in salient characteristics. By comparing two disasters in which only one characteristic varies, the influence of that characteristic could be ascertained.

In the present study, this became possible following a workplace disaster differing from that at TMI. In this situation, three explosions in the nitroglycerine issuing house at the world's largest explosives factory resulted in 14 workers losing their lives and 14 workers suffering injuries of varying severity. Like TMI, this was a man-made disaster of sudden onset that was difficult to predict and that involved a loss of control over the production process. The major difference between the two disasters is that at the explosives plant there was tremendous physical damage and considerable loss of life, and an immediate low point

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was reached. As such, we suggest that the incident at the explosives factory was as an acute disaster, whereas the TMI incident can be characterized as a chronic disaster (Pratt & Barling, 1987b). Thus, any differences in outcome between the TMI disaster and the disaster investigated in the present study may be attributable to this acute-chronic distinction, if other explanations (e.g., differences between South African and other national samples) can be excluded. Because of the acute nature of this disaster, and the deaths and physical injuries that resulted, the first hypothesis of the present study is that survivors would experience negative psychological effects.

If this fatal blast is indeed associated with negative psychological outcomes, it is appropriate to investigate variables that moderate its negative effects. Consistent with previous research and theorizing, two general types of coping mechanisms (*viz.*, personality hardiness, and support from friends or supervisor) were hypothesized to moderate the effects of the acute disaster. First, personality hardiness consistently moderates the influence of work stress on health (e.g., Kobasa, 1982; Maddi & Kobasa, 1984) and marital satisfaction (Barling, 1986), at least amongst all-male samples (see MacEwen & Barling, *in press*; Pratt & Barling, 1987a). Personality hardiness includes three personality dimensions: commitment, as opposed to alienation; perceived control, rather than powerlessness; and the perception of events as a challenge rather than a threat. Second, social support moderates the negative influence of work stress on personal and organizational functioning (House, 1981). The effects of social support may depend on its source. Due to suggestions that the source of the support should be consistent with the nature of the stressor (e.g., Beehr, 1985; Kobasa & Puccetti, 1983; Russell, Altmaier, & Van Velzen, 1987), we investigated support from one's supervisor and family.

The present study permits an examination of several additional hypotheses regarding the main or moderating effects of hardiness and support in an acute disaster situation. The second major hypothesis of this study is that personality hardiness is more likely than social support to moderate the influence of stress immediately following the disaster. This is consistent with the suggestion that personality resources will be more effective in acute situations that are of a sudden onset, because they are within the repertoire of the individual and thus readily accessible. On the other hand, it takes time to seek and receive support, and so social support cannot immediately moderate the effects of stress (Hobfall & London, 1986).

It is becoming clear that social support does not always exert positive effects (Beehr, 1985; Kaufmann & Beehr, 1986). Like other findings (e.g., Kaufmann & Beehr, 1986; MacEwen & Barling, *in press*), Hobfall and London (1986) found that support exacerbated the effects of a stressor, as individuals experiencing stress and receiving high levels of support fared significantly worse than did their counterparts who received low levels of support. It has been suggested that positive buffering effects are likely when the source of the stressor and the support are congruent (Beehr, 1985; Russell et al., 1987). Thus, the third major hypothesis in this study is that supervisor support should be more effective because of the work-related nature of the stressor in the present study.

It has also been hypothesized that for social support to be effective, the source of the support must be consistent with the

nature of the outcome (Ganster, Fusilier, & Mayes, 1986; Pratt & Barling, 1987b). We tested this fourth hypothesis by investigating a variety of diverse outcomes. Work-related outcomes included job satisfaction, which is the result of a comparison between the individual's expectations and the current situation (Locke, 1983), and is often an outcome of job stress (e.g., Ganster et al., 1986; Kaufmann & Beehr, 1986). Organizational commitment, which represents the individuals' attachment to the company and is based on an exchange relation between satisfaction of salient needs of the individual and the organization (Mowday, Porter & Steers, 1982), was also measured. We operationally defined personal functioning with two variables, psychological distress and marital satisfaction. Psychological distress reflects the individual's mental health in the occupational setting (Banks et al., 1980) and is associated with the experience of unemployment (Jackson, Stafford, Banks, & Warr, 1983). Both psychological distress and marital dissatisfaction are associated with involvement in a strike situation (Barling & Milligan, 1987), and negative work experiences are associated with marital dissatisfaction (Barling & Rosenbaum, 1986). It was predicted that supervisor support would directly influence organizational commitment and job satisfaction, and would also moderate the effects of the disaster on these two variables. On the other hand, family support would exert a main effect on psychological distress and would moderate the effects of the blast on psychological distress. Personality hardiness would directly affect personal and organizational outcomes equally because it is a stable personality disposition always available to the individual, and hardy individuals exposed to the blast would fare significantly better in terms of psychological functioning than would their nonhardy counterparts.

A fifth and final hypothesis that we considered concerns the duration of any outcome of the disaster. No low point has yet been reached at TMI because community residents remain concerned whether long-term genetic or chromosomal effects remain possible, so it is not surprising that chronic strain is evident (Davidson & Baum, 1986). The disaster we studied, however, was consistent with an acute stressor, where a low point was reached immediately (Pratt & Barling, 1987b). Loo (1986) indicated that the consequences of acute stressors are experienced immediately and dissipate after a few days. Therefore, it was hypothesized that any negative effects would be more likely to emerge immediately following the blast and to dissipate within 2 months thereafter.

## Method

### *Subjects and Setting*

On February 14, 1985, an explosion occurred in the nitroglycerine issuing house of the world's largest explosives factory just outside Johannesburg, South Africa. Even though all work in this issuing house was robotically controlled, the initial blast involving 1.5 tons of explosives in this unit immediately set off two sympathetic blasts in adjacent units, one involving an ammonium nitrate store. The effects of the blast were devastating. As an indication thereof, note that despite the fact that the buildings housing the various units were geographically separated and designed so that the effects of an explosion would be deflected upwards, the units in which the blasts occurred were physically annihilated, windows were shattered for miles around, shock waves from the blast were

felt in a radius of 15–20 miles, and a large pall of black smoke could be seen rising from the scene after the blast. In all, 14 workmen were killed and 14 sustained minor or major injuries, mainly involving burns. Of those killed, 3 died instantly, 6 died in the first few days following the blast, and the bodies of the remaining 5 were never recovered.

The experimental group included the 40 survivors employed in the blasting department who were present at the scene of the blast. Two control groups were formed in this study. The first (Control Group 1) included the 76 White employees who were working in an ammonia plant in the same organization and at the same site at the time of the blast. They all heard the blast and felt the shock waves of the blast, but were in no physical danger themselves. However, their proximity to the blast itself may increase their similarity to the experimental group, and therefore, reduce their value as a control. As a result, a second control group (Control Group 2) was used, which included 40 individuals in a nitroglycerine issuing department at a different site, owned and operated by the same company but where no explosion had occurred.

Initially, there were 4 Black employees in the experimental group and 3 in the control groups. All 7 were excluded from the study, however, as there is some evidence that the work-related needs and attitudes of Blacks and Whites in South Africa differ (Fullagar & Barling, 1986), and the small number of Blacks in these groups would not have allowed a statistical comparison of race as a moderator of the effects of the blast.

The three groups then differed in terms of age (experimental group, *M* age = 37 years; Control Group 1, *M* age = 34 years; Control Group 2, *M* age = 41 years), and length of tenure with the organization (experimental group, *M* years = 11; Control Group 1, *M* = 9 years; Control Group 2, *M* = 14 years). However, there were no differences between the three groups in terms of monthly salary (*M* = R2118; i.e., ±\$900) or educational level (43% had completed grade 12; 57% had completed some tertiary education). Because supervisory status may influence an individual's response to a work-related disaster (Chisholm & Kasl, 1982), only employees at the nonsupervisory level were included in this study.

Of the initial sample, 63% agreed to participate at the 2-month follow-up phase. There were no differences between those who agreed to respond and those who did not, in terms of demographic characteristics, moderator, or dependent variables immediately following the blast (*p* > .05).

**Procedure**

During the 2nd week following the disaster, and again 2 months after the disaster, all of the subjects completed a questionnaire package. Subjects were assured of the confidentiality of their responses.

**Measuring Instruments**

All of the data were collected via self-reports obtained from questionnaires. Questionnaires were selected according to whether they had proven to be psychometrically acceptable. Descriptive statistics, internal and temporal consistency, and intercorrelations of all variables included are presented in Table 1.

*Dependent variables.* Two different aspects of psychological functioning were investigated, namely, work and personal functioning. To assess job satisfaction, Warr, Cook, and Wall's (1979) 15-item job satisfaction measure, which was developed specifically to be appropriate for blue-collar workers, was administered. However, a 3-point rating scale (*unhappy, not sure, happy*) was used instead of the 7-point rating scale, to facilitate understanding. Mowday, Porter and Steers's (1982) 9-item short form of the Organizational Commitment Questionnaire was used to assess respondents' attachment to the company. Again, a 3-point rating scale (*disagree, not sure, agree*) was used. The 12-item General Health Questionnaire (GHQ; Goldberg, 1972) assessed psychological

Table 1  
Descriptive Data and Intercorrelations of Variables

Variable	<i>M</i>	<i>SD</i>	$\alpha$	Test-retest	1	2	3	4	5	6	7	8	9
1. Tenure	12.06	9.04	—	—	—	.80	.18	.01	.07	.31**	.09	.07	-.06
2. Age	37.89	10.44	—	—	.80	—	.25**	.10	-.01	.30**	.18*	.03	-.03
3. Supervisor support	18.89	4.35	.62	.67	.02	.10	—	.13	.19*	.33**	.50**	-.25**	.13
4. Family support	50.26	5.96	.82	.80	-.02	.07	.04	—	.33**	.34**	.22*	-.27*	.70**
5. Personality hardness	30.69	5.74	.71	.73	-.07	-.01	.34**	.25**	—	.28**	.32**	-.39*	.45**
6. Organizational commitment	20.94	4.84	.87	.84	.21**	.25**	.22*	.26**	.24**	—	.52**	-.20*	.27**
7. Job satisfaction	36.73	6.04	.81	.69	.11	.18*	.51**	.20**	.40**	.66**	—	-.24**	.24*
8. Psychological distress	10.65	4.27	.76	.66	-.15*	.12	-.02	-.32**	-.25**	-.28**	-.35**	—	-.32**
9. Marital satisfaction	113.46	35.04	—	.54	-.05	.01	.13	.65**	.33**	.25**	.27**	-.35**	—

Note. Data during the 2nd week following the blast are presented below the diagonal (*n* = 156, except for marital satisfaction, where *n* = 102 because of nonmarried individuals); data 2 months following the blast are presented above the diagonal (*n* = 122, except for marital satisfaction, where *n* = 73).  
\**p* < .05. \*\**p* < .01.

distress. This scale provides useful data within the occupational context (Banks et al., 1980) and is scored such that a high score reflects psychological distress. Locke and Wallace's (1959) 15-item Short Marital Adjustment Test (SMAT) was used to assess marital satisfaction. The SMAT remains the most frequently used scale of marital satisfaction (O'Leary & Turkewitz, 1978) and reliably discriminates between clinically distressed and satisfactory marital relationships (O'Leary & Arias, 1987).

*Moderator variables.* To assess personality hardiness, Kobasa's (personal communication, 1982) 20-item shortened form of the original hardiness scale was administered. Although no data was provided initially for this scale, subsequent research has shown that it exhibits adequate internal and temporal consistency (Barling, 1986; MacEwen & Barling, in press; Pratt & Barling, 1987a). To assess family support, Procidano and Heller's (1983) 20-item Perceived Social Support From Family scale was also completed by all subjects. Finally, Moos's (1981) 9-item Supervisor Support subscale from the Work Environment Scale-Real Form was completed.

### Data Analysis

A test of the first hypothesis—namely, that exposure to an acute disaster will result in negative psychological effects—requires an evaluation of whether significant differences emerge between the experimental group and either or both of the two control groups. The second, third, and fourth hypotheses revolve around the issue of whether support or personality hardiness, or both, moderate any detrimental psychological effects of exposure to the acute disaster. Within a univariate analysis of variance (ANOVA) design, an assessment of any moderating effects can be undertaken through an inspection of the interaction term. In general, for example, family or supervisory support, or both, would serve as a moderator variable if those individuals who were exposed to the blast and who received high family or supervisory support, or both, fared significantly better than their counterparts who were exposed to the disaster but were not in receipt of such support. Likewise, personality hardiness would fulfill a moderating role if hardy individuals exposed to the blast functioned significantly better thereafter than did nonhardy individuals (cf. Thoits, 1982). For the purpose of the ANOVA design, median splits were performed on the moderator variables (supervisory support,  $mdn = 20$ ; family support,  $mdn = 51$ ; personality hardiness,  $mdn = 39$ ).

### Results

Because the experimental and control groups differed in length of service in the company and in age, these two variables were controlled statistically in all of the analyses. A series of  $3 \times 2$  (Group Status  $\times$  Moderator Variable) multivariate analyses of covariance (MANCOVAs) were computed to assess whether there were significant differences between the control and experimental groups. Multivariate analyses were computed because of the numerous significant correlations between the dependent variables within the 2nd week following the blast and 2 months thereafter (see Table 1), and because of the large number of analyses computed. In all of these MANCOVAs, the Pillai-Bartlett trace  $F$  approximation was used to test for significant between-group differences.

The number of subjects for whom data was available for each of the four dependent variables differed. First, not all of the subjects were married; hence, the SMAT could not be completed by all subjects. Second, there were instances in which incomplete data led to a particular questionnaire being unusable for

specific subjects. Consequently, ANOVAs are based on a somewhat different sample size.

### *Psychological Functioning During the Second Week After the Blast*

There were no significant differences between the control and experimental groups on any of the four dependent variables (viz., job satisfaction, organizational commitment, marital satisfaction, or psychological distress) during the 2nd week following the blast ( $p > .05$ ), after controlling for age and organizational tenure. At the same time, the moderating role of supervisor support, family support, and personality hardiness were investigated. Neither supervisory support, family support, nor personality hardiness emerged as significant moderator variables ( $p > .05$ ) in the multivariate analyses.

At that stage, however, supervisory support,  $F(4, 89) = 5.69$ ,  $p < .01$ ; family support,  $F(4, 89) = 9.01$ ,  $p < .01$ ; and personality hardiness,  $F(4, 89) = 4.94$ ,  $p < .01$ , all exerted significant multivariate main effects. To assess which of the univariate dependent variables contributed to these multivariate effects, univariate analyses were computed. However, because this involves computation of numerous  $F$  tests, the probability of Type I errors increases. Thus, Bonferroni's procedure (Larzelere & Mulaik, 1977) was used to adjust the significance level. This resulted in adopting a significance level of .003 in all analyses (i.e., alpha level/number of  $F$  tests).

Supervisory support did not predict psychological distress,  $F(1, 123) = 0.10$ ; marital satisfaction,  $F(1, 89) = 0.67$ ; or organizational commitment,  $F(1, 123) = 4.39$ , but was associated with job satisfaction,  $F(1, 123) = 36.37$ ,  $p < .003$ , after controlling for age and tenure in each case. Family support predicted marital satisfaction,  $F(1, 78) = 38.37$ ,  $p < .003$ , and psychological distress,  $F(1, 83) = 8.65$ ,  $p < .003$ , but neither organizational commitment,  $F(1, 122) = 4.21$ , nor job satisfaction,  $F(1, 123) = 4.01$ . Personality hardiness was not significantly associated with organizational commitment,  $F(1, 104) = 7.22$ , but was associated with job satisfaction,  $F(1, 104) = 16.50$ ,  $p < .003$ ; marital satisfaction,  $F(1, 78) = 14.13$ ,  $p < .003$ ; and psychological distress,  $F(1, 104) = 20.98$ ,  $p < .003$ . The adjusted mean scores for all these analyses are presented in Table 2.

### *Psychological Functioning Two Months Following the Blast*

This pattern of results was largely replicated 2 months following the blast. After again controlling for the influence of age and tenure in the organization, MANCOVAs showed that there were no significant differences between the experimental and control groups on any of the four dependent variables. In addition, neither personality hardiness nor family support or supervisory support (measured 2 months following the blast) interacted with group status. However, there was a significant multivariate main effect for supervisory support,  $F(4, 59) = 7.44$ ,  $p < .001$ ; family support,  $F(4, 54) = 6.40$ ,  $p < .001$ ; and personality hardiness,  $F(4, 55) = 4.07$ ,  $p < .005$ .

Univariate  $F$  tests were again computed, and Bonferroni's procedure again resulted in a significance level of .003 being accepted to reduce the probability of Type I errors because of

Table 2  
Adjusted Mean Scores and Variance Accounted for During the Second Week Following the Blast\*

Dependent variable	Group status				Supervisor support			Family support			Personality hardiness		
	Control 1	Control 2	Experimental	Variance (%)	High	Low	Variance (%)	High	Low	Variance (%)	High	Low	Variance (%)
Organizational commitment	20.56	21.08	20.97	7.6	21.78	19.97	9.6	22.20	19.55	6.2	22.12	19.72*	12.2
Job satisfaction	35.25	37.45	37.18	6.2	39.85	34.02*	26.1	37.75	36.27	5.9	38.72	34.13	15.8
Psychological distress	10.69	10.50	10.26	3.6	10.58	10.33	3.1	9.70	12.56*	8.8	9.11	12.99*	18.9
Marital satisfaction	101.30	115.63	120.47	4.9	114.01	110.55	1.8	129.73	91.76	31.2	120.07	102.98	16.9

Note. N = 156.

\* Controlling for age and length of service in the organization.

\* Indicates a significant difference, with  $p < .003$ .

the numerous  $F$  tests computed. The main effects for supervisory support on psychological distress,  $F(1, 88) = 3.89$ , and marital satisfaction,  $F(1, 68) = 0.10$ , were not significant. Job satisfaction, however, was associated with supervisor support,  $F(1, 88) = 26.20, p < .001$ , as was organizational commitment,  $F(1, 88) = 8.68$ . Family support was significantly associated with marital satisfaction,  $F(1, 63) = 16.28, p < .001$ , and psychological distress,  $F(1, 83) = 8.19, p < .003$ , but not with job satisfaction,  $F(1, 81) = 2.46$ , or organizational commitment,  $F(1, 82) = 4.55$ . Personality hardiness predicted job satisfaction,  $F(1, 83) = 8.2, p < .003$ , and organizational commitment,  $F(1, 83) = 10.78, p < .002$ , but neither marital satisfaction,  $F(1, 64) = 3.32$ , nor psychological distress,  $F(1, 83) = 6.05$ . These main effects were all in the predicted direction, and the adjusted mean scores are presented in Table 3.

### Discussion

The major finding of this research is that workers directly exposed to the blast evidenced no detrimental psychological effects within the 2nd week following the blast or 2 months thereafter, as compared with the two control groups. Thus, no support emerged either for the first or the fifth hypothesis. In attempting to understand the reasons for this seemingly counterintuitive finding, note that some degree of confidence can be placed on the results from this naturalistic quasi-experimental study. Even though the presence of pretest data must obviously be sacrificed in such disaster studies, the experimental group did not differ from either of two control groups across any of the four dependent variables at either of the two testing phases. Thus, the results of the present study do not replicate the analyses conducted on work-related or personal consequences of the TMI disaster (Chisholm & Kasl, 1982; Chisholm et al., 1983, 1986).

We suggest that the major difference between the nature of the stressor in these two disasters might account for the fact that no detrimental psychological effects emerged following the fatal blast. Specifically, unlike the disaster at TMI that continues to exert detrimental effects because of its chronic nature (Chisholm et al., 1983, 1986; Davidson & Baum, 1986), the fatal blast investigated in this research can be characterized as an acute stressor (Pratt & Barling, 1987b): It was of sudden onset, high intensity, extremely low frequency, and a low point was reached immediately after the fatal blast. The fact that no negative psychological functioning was apparent in the experimental group in the present study is consistent with other findings suggesting that most of the detrimental effects of acute work stressors dissipate within 3 days of the stressor (Loo, 1986). Consistent with Loo's findings, it would be premature to suggest that acute work-related stressors exert no negative effects because the first measurement in the present study occurred during the 2nd week following the fatal blast. Rather, it remains possible that negative symptoms were experienced immediately following the blast but were no longer apparent a few days thereafter. Future research should investigate this possibility, which could not be assessed in this study due to logistic difficulties.

Two alternative explanations should be considered. First, it has been suggested that negative functioning following a disaster is more likely to become apparent if psychiatric interviews are

Table 3  
Adjusted Mean Scores and Variance Accounted for Two Months Following the Blast\*

Dependent variable	Group status			Supervisor support			Family support			Personality hardiness			
	Control 1	Control 2	Experimental	Variance (%)	High	Low	Variance (%)	High	Low	Variance (%)	High	Low	Variance (%)
Organizational commitment	20.43	21.11	21.42	11.0	22.32	19.42	17.5	21.94	19.80	17.3	22.66	19.24*	19.0
Job satisfaction	36.56	36.85	37.70	5.4	39.89	34.23*	26.7*	37.98	35.80	6.3	39.14	35.17*	13.1
Psychological distress	10.22	10.80	9.40	2.7	9.28	11.12	5.3	8.90	11.61*	7.6	8.95	11.17	7.6
Marital satisfaction	119.23	102.37	108.68	5.9	111.68	114.25	1.4	122.45	96.34*	20.8	116.62	104.07*	5.3

Note.  $N = 122$ .

\* Controlling for age and length of service in the organization.

\* Indicates a significant difference with  $p < .003$ .

used to gather information rather than standardized psychological tests, the assumption being that the former are more sensitive to the nature of psychiatric symptoms (Perry, 1979). However, this argument is not supported. (a) Using the data obtained at TMI, it can be seen that consistent negative effects emerged for 58 months following the disaster using standardized questionnaires (Davidson & Baum, 1986). (b) Dollinger, O'Donnell, and Staley (1984) have shown that the effects of an acute stressor can be isolated whether interview or survey methodologies are used.

Second, the argument that standardized psychological questionnaires may fail to detect psychiatric symptoms following a disaster can also be refuted because of the nature of two of the four questionnaires used. Specifically, the SMAT and the GHQ are particularly sensitive measures that can detect clinical symptoms. Locke and Wallace's (1959) SMAT remains the most widely used measure of global marital satisfaction in the clinical field (O'Leary & Turkewitz, 1978), and scores below 100 consistently denote a marriage that is clinically at risk (cf. Barling & Rosenbaum, 1986). Yet individuals who were physically exposed to the blast yielded marital satisfaction scores that clearly place them in the range of maritally satisfied couples, both 2 weeks and 2 months following the disaster ( $M = 120.47$  and  $M = 108.68$ , respectively). Likewise, the GHQ is a sensitive measure of occupational mental health (Banks et al., 1980), and research has shown that psychological distress associated with a strike (Barling & Milligan, 1987) or unemployment (e.g., Jackson et al., 1983) can be detected with the GHQ. The GHQ scores of individuals in the experimental group in the 2nd week following the blast or 2 months thereafter ( $M = 10.26$  and  $9.40$ , respectively) is within the normal range of other studies (cf. Banks et al., 1980; Jackson et al., 1983) and did not differ from either of the two control groups used in the present study.

It remains possible, however, that even though two measures of each of organizational and personal functioning were obtained, areas of functioning most likely to be affected following a disaster were not considered. Lifton and Olson (1986) suggested that the content of dreams might well change following a disaster, and that there may be significant increases in psychic numbing, death anxiety, and death guilt. The questionnaires used in the present study did not address these possible outcomes. In addition, whereas the present research concentrated on somewhat general aspects of psychological functioning, Dollinger et al's (1984) results suggested that highly specific fears may follow disasters. As a result, it is suggested that, where possible, future research should be conducted immediately following an acute disaster (i.e., within a few days) and should focus on general experiences such as those identified by Lifton and Olson (1986) or on fears that might be considered to be highly specific to the nature of the disaster.

The second major finding of the present study concerns the role of hypothesized moderator variables. A number of issues emerge. First, contrary to the second, third, and fourth hypotheses, no moderating effects emerged. Although it is becoming apparent that social support does not necessarily exert positive buffering effects (e.g., Ganster et al., 1986; Hobfall & London, 1986; Kaufmann & Beehr, 1986; MacEwen & Barling, in press; Pratt & Barling, 1987a), the failure to find evidence for a moderating role in this study is probably due to the fact that at both

testing phases, individuals in the experimental group were not functioning at a level different from those in either of the two control groups. Any evidence for a moderating role for social support assumes the existence of high levels of stress (Thoits, 1982). Certainly, scores on both the GHQ and the SMAT for workers in the experimental group at both testing phases are not significantly different from those experiencing satisfactory marital relationships (see Barling & Rosenbaum, 1986) or psychological well-being (Banks et al., 1980; Jackson et al., 1983). It is argued that the absence of stress related to the disaster for workers in the experimental group also accounts for the failure of personality hardiness to exert a moderating effect. Thus, the second and third hypotheses—namely, that personality hardiness would exert immediate moderating effects, whereas those for social support would be delayed—could not be assessed because of the absence of any stress effects.

A further, although not necessarily alternative, explanation for the findings regarding supervisor and family support concerns the nature of the support measured. Only emotional support from the supervisor and family was measured in this study. Yet recent research results show that although emotional support is usually positively associated with various outcome measures, emotional support either exacerbates (e.g., Hobfall & London, 1986; Kaufmann & Beehr, 1986; Kobasa & Puccetti, 1983; MacEwen & Barling, in press; Pratt & Barling, 1987a) or exerts no moderating effect (Ganster et al., 1986) on diverse measures of strain. Even though most studies have focused on emotional support—presumably because of the existence of appropriate questionnaires—future research should focus on instrumental and informational support (e.g., House, 1981), particularly inasmuch as research at TMI has suggested the moderating role of informational support (Chisholm et al., 1986).

Consistent with the fourth hypothesis, the results of the present research strengthen the suggestion that the source of the support should be congruent with the nature of the outcome (Ganster et al., 1986; Pratt & Barling, 1987b). At both testing periods, family support was associated positively with personal functioning, whereas supervisor support was positively correlated with work-related variables. However, family support predicted personal outcomes, and supervisor support predicted job satisfaction, irrespective of prior levels of stress. In addition, the positive benefits accruing to personality hardiness were not limited to either personal or organizational functioning. Most previous research has focused on the role of support and hardiness during normal situations. The results of the present study suggest that social support and hardiness continue to exert main effects on relevant outcomes during disaster situations.

A major strength of the present study is its inclusion of two control groups that permit an evaluation of plausible explanations concerning the absence of any detrimental effects during the 2nd week following the blast, and 2 months thereafter. A further strength concerns the use of a specific rationale for predicting when the effects of the disaster might emerge. A potential limitation concerns the exclusive reliance on self-report measures. However, given the nature of research in disaster situations, desirable experimental procedures (including the use of pretest measures) may often need to be sacrificed in an effort to test the victims as soon as possible. Even so, it remains questionable whether the use of self-report in this research is a limi-

tation for two reasons, both of which are related to primary concerns about the use of single source data sets. First, previous research on disasters has shown that the results of self-report data (as opposed to behavioral measures) do not overestimate the effects of the disaster (e.g., Davidson & Baum, 1986; Dollinger et al., 1984). Second, to remain congruent with the experience of the stressor, victims might be more likely to represent themselves as psychologically impaired. This possibility can be excluded in this study as individuals in the experimental group did not function any worse than those in either of the two control groups on the four outcome variables measured.

It remains for future researchers investigating the acute effects of work-related disasters to focus on other outcome measures (e.g., psychic numbing, grief, nightmares, and fears specific to the disaster) at time periods different from those used in the present study. Where possible, data should be gathered within the first 3 days following the disaster and perhaps up to a year or more following the disaster. This would enable an assessment of whether there are immediate negative effects that dissipate within a few days. Alternatively, perhaps no negative effects emerged in this study because it takes longer than 2 months before any negative outcomes become apparent.

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