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The Longitudinal Course of Posttraumatic Morbidity

The Range of Outcomes and Their Predictors

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This study examined the longitudinal course, over a 25-month period, of posttraumatic morbidity in a group of 469 firefighters exposed to a bushfire disaster. The patterns of posttraumatic morbidity were defined by the General Health Questionnaire. Contrary to expectation, an acute pattern of morbidity was less common than the delayed-onset or chronic forms. Predisaster variables were found to be as important in the onset and course of the disorder as were the firefighters' losses or extent of exposure to the disaster. These data suggest that exposure to an extreme trauma is necessary but not sufficient to explain the onset and pattern of posttraumatic morbidity.

DSM-III describes three separate forms of posttraumatic stress disorder (PTSD): acute, chronic and delayed (American Psychiatric Association [APA], 1980). However, there is little available information about the relative frequency of the various types of disorder following different stressors or about the determinants and typical course of the different forms of PTSD.

DSM-III contests that acute PTSD has a good prognosis in the majority of cases and does not progress to the chronic form (APA, 1980). However, the existing evidence from the available longitudinal studies is conflicting and incomplete. Three longitudinal studies have examined the psychological impact of cyclones. Two (Fairley et al., 1986, Parker, 1977) found that most of the early morbidity resolved, whereas Patrick and Patrick (1981) demonstrated that 87% of acute reactions became chronic. In a study of the management of combat stress reactions, Solomon and Benbenishty (1986) found that more than 50% of the soldiers went on to develop chronic PTSD despite acute treatment. Most of the accounts of delayed-onset PTSD are clinical descriptions and, in the absence of any longitudinal cohort studies (La Guardia et al., 1983), no conclusive statement can be made about the frequency of this pattern of morbidity. However, a delayed pattern of psychological disability was found in one longitudinal study of cyclone victims (Patrick and Patrick, 1981). Thus, many unanswered questions remain about the longitudinal course of posttraumatic morbidity and the relationship among the three different types of PTSD.

There is similarly little information about the etiology of the different types of PTSD. In one of the most recent summaries of the etiology and natural history of PTSD, Green et al. (1985) have suggested that three factors need to be taken into account: the nature and intensity of the stressor, the characteristics of the individual, and the characteristics of the recovery environment. While acknowledging the ongoing debate about the relative importance of the traumatic event in contrast to premorbid characteristics in etiology, they argue that the primary determinants of the onset and outcome are the nature and intensity of exposure to the triggering event (Green et al., 1983). The paucity of knowledge about the typical course of PTSD and factors that influence the maintenance of symptoms has also led Green et al. (1985) to call for longitudinal research examining these questions. However, several methodological problems exist in designing such studies.

Patient groups are unsuitable for such research; they are an unrepresentative sample of PTSD sufferers because many people with PTSD do not seek treatment (Leopold and Dillon, 1963) and because treatment is likely to alter the natural history of the disorder. Equally, the establishment of adequate control groups has been a major weakness of much research in PTSD (La Guardia et al., 1983). The possibility of gaining financial compensation is another factor that may influence the nature and course of posttraumatic morbidity and therefore should ideally not be a variable operating in any longitudinal study (Lopez-Ibor et al., 1985).

The purpose of the present study was to investigate the longitudinal course of posttraumatic morbidity using a community sample exposed to a disaster—a bushfire—that did not select subjects on the basis of

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being disordered. In this way the methodological problems described were circumvented.

From the evidence reviewed, three hypotheses were tested:

1. Three forms of posttraumatic morbidity would be observed, namely acute, delayed, and chronic. Some of those with the chronic form of the disorder would have a fluctuating course (Horowitz, 1976).
2. The acute form of morbidity would resolve in the majority of cases and the nature and intensity of the disaster experience would be its major predictor, in contrast to premorbid vulnerability factors.
3. The people with chronic posttraumatic morbidity would have had the highest exposure and have sustained the most losses. Also, personality factors and postdisaster experiences would play a significant role in predicting the chronic form of the disorder.

Setting

A bushfire disaster (McFarlane and Raphael, 1984) occurred in South Australia on February 16, 1983, which destroyed 2804 square kilometers of bush, grazing land, orchards, and national parks. Several thousand trained volunteer firefighters who lived within and outside the fire-affected area were exposed to an extreme level of danger for many hours without respite. Three were killed, a number lost their homes, others had their stock and farms destroyed, and many were injured. Because of the voluntary nature of this firefighting organization, none of these people was seeking financial compensation for the psychological trauma caused by the disaster.

Methods

Study Design

A four-stage longitudinal design was used. The study was designed to commence 1 month after the disaster. However, for logistical reasons and because of the immediate problems of reconstruction after the disaster, such as rebuilding the 10,000 kilometers of farm fences that had been destroyed, the questionnaires were not distributed until 3 months after the fire. They were returned a mean of 1 month later. A subsample of firefighters was interviewed 8 months after the fire to establish whether PTSD did occur among the group, to validate the General Health Questionnaire (GHQ; Goldberg, 1972) as an instrument for detecting PTSD (McFarlane, 1986), and to develop the questionnaire for the subsequent stages of the study.

The original sampling method (McFarlane, 1987) and the selection criteria of the group who were interviewed are to be described in detail elsewhere. At 11 and 29 months after the disaster, 469 firefighters who had returned a usable response at 4 months were mailed a questionnaire with a postage-paid envelope. If the questionnaire was not returned within 3 weeks, two subsequent reminders were sent.

Questionnaire Data

The stage 1 questionnaire consisted of an inventory of the disaster, a brief life events inventory, the Impact of Events scale (IES; Horowitz et al., 1979), and the 12-item GHQ. The inventory of the disaster documented the firefighters' personal and property losses, the nature and duration of the firefighters' exposure to the fire, and the type of injuries sustained. The development of the disaster inventory, the scaling of its components, and the life events inventory, which was taken from that of Tennant and Andrews (1976), have been described in another report (McFarlane, 1987).

The third component of the questionnaire was the IES, which measures intrusion, *i.e.*, intrusive-repetitive images and thoughts, and avoidance, *i.e.*, attempts to dispel these images and thoughts. Four items (Table 4) were added to investigate the role certain types of cognitive preoccupations can play in blocking the integration of traumatic memories. These had previously been described by Krupnick and Horowitz (1981) and could be adapted for a questionnaire.

The final component was the 12-item GHQ (Goldberg, 1972), which, despite its brevity, has been found to be a valid and sensitive measure of psychiatric impairment in Australian populations (Henderson et al., 1981; Tennant, 1977). In this group of firefighters, the GHQ was found to have a 90% specificity and a 78% sensitivity for identifying PTSD (McFarlane, 1986) using a cutoff between one and two for the definition of disorder.

The 11-month questionnaire consisted of questions examining the firefighters' involvement in the firefighting service during and after the disaster, the recovery from injury sustained during the fire, the nature, duration, and quality of imagery experienced since the disaster, the methods used to deal with the disaster and its memories, and the firefighter's efforts to obtain professional assistance for stress-related problems since the fire. The details of these questions are outlined in Tables 3 and 5. The brief life events inventory, the IES with four extra items, and the GHQ were readministered.

The 29-month questionnaire contained items documenting the firefighters' exposure to the fires since the previous stage, the characteristics of continuing posttraumatic imagery, and past history of seeking professional help for psychological problems before the disaster. Where possible, the same questions as at the 11-month stage were administered; details are

reported in Table 6. As well as including the brief life events inventory, the IES with extra items, and the GHQ, the Eysenck Personality Inventory (EPI; Eysenck and Eysenck, 1964) was administered. This personality measure has been found to be acceptable and reliable in Australian populations (Henderson et al., 1981). The prefix asked the subjects to answer the EPI according to the way that they saw themselves before the disaster. This procedure minimized their current symptoms confounding their responses to this test of trait phenomena.

Statistical Analysis

Only the data for the 315 (67%) firefighters who had returned completed questionnaires on all three occasions were analyzed. This group was representative of the original sample as no longitudinal response bias was found between those defined as cases and as noncases by the GHQ (McFarlane, 1986). Initially, no assumption was made about the existence of acute, chronic, and delayed-onset patterns of morbidity; instead eight groups were defined according to the subjects' GHQ score at 4, 11, and 29 months (Table 1). The subjects, who were not disordered on any occasion, formed an unbiased control group of people exposed to the same trauma.

The scaled variables were compared using one-way analysis of variance with Scheffé's procedure. The categorical data were examined using χ^2 analysis (with Yates correction where appropriate) (SPSS Inc., 1983). The not disordered group was compared with all the disordered subjects in one group ($df = 1$) and only if this analysis was significant ($p < .01$) were the separate disordered groups compared with the not disordered group. To further reduce the potential for type 1 error in these multiple categorical comparisons, a probability level of .01 was chosen to designate significance. The data were analyzed using the Statistical Package for Social Sciences (SPSS Inc., 1983).

Because of the possible covariance of a number of the variables, the data were further analyzed using discriminant function analysis. The variables were chosen for these analyses if they had been found to be significant on univariate analysis or were of theoretical interest and were not confounded measures of disorder. The three types of posttraumatic morbidity defined by DSM-III (delayed onset, acute, and chronic as defined in Table 1) were simultaneously compared with the no disorder group (Table 8).

Results

Sample

At the beginning of the study, the mean age of the firefighters was 35.1 ± 10.6 years; 74% were married and 88% were Australian born. The return rate was 84% ($N = 395$) at 11 months and 72% ($N = 337$) at 29 months.

Disaster-Related Experience

The individual experience of the disaster varied widely. Twenty-three percent of the sample suffered some degree of property damage, often affecting their livelihood. None of the subjects had lost a first-degree relative, although 7% had experienced some bereavement due to the death of a more distant relative, fellow firefighter, or close friend. The mean duration of time spent fighting the fire was 15.6 hours and during that time 20% believed they came close to dying. Forty-one percent had to protect themselves from the fire using emergency procedures, demonstrating how little control they had over the inferno. Of the 26.6% injured, 12% were hospitalized. During the blaze 20.6% stated that they came close to panic or panicked.

Prevalence of Psychological Morbidity and Different Outcomes

When the prevalence of cases was calculated in the total population using the cutoff between one and two on the 12-item GHQ, 32% qualified as cases at 4 months, 27% at 11 months, and 30% at 29 months after the disaster. The various combinations of being disordered and not disordered at 4, 11, and 29 months are indicated in Table 1 and seven patterns of posttraumatic morbidity were defined. Only 49.8% of the sample who responded on all three occasions were not disordered at some time, whereas 10.3% were disordered on all three occasions.

Determinants of Longitudinal Course

The seven patterns of posttraumatic morbidity (Table 1) were then examined on four sets of etiological variables. The significant results are summarized in Table 7.

TABLE 1

Longitudinal Course of Posttraumatic Morbidity: Definition of Range of Outcomes and Their Prevalence Calculated According to GHQ Classification (Case = GHQ > 1, ≤ 2) (N = 315)

Disorder Pattern	Case at 4 Months	Case at 11 Months	Case at 29 Months	% Frequency	*N*
No disorder group	No	No	No	50.2	158
Acute group	Yes	No	No	9.2	29
Chronic groups				21	66
Persistent chronic	Yes	Yes	Yes	10.2	32
Resolved chronic	Yes	Yes	No	5.7	18
Recurrent chronic	Yes	No	Yes	5.1	16
Delayed-onset groups				19.7	62
Persistent	No	Yes	Yes	3.2	10
11 month only	No	Yes	No	5.4	17
29 month only	No	No	Yes	11.1	35

TABLE 2
Comparison of Different Outcome Groups with the No Disorder Groups on Predisaster and Trait Measures

Outcome Groups[a]	N	Age (yrs)[b]	Adverse Life Events before Fire (N)[b]	EPI			When Have Problems Stop Self Thinking about Them[c] (%)[d]	Previous Major Fires (N)[b]	Past Treatment for Psychological Disorders (%)[d]
				Neuroticism[b]	Extraversion[b]	Lie Scale[b]			
1. No disorder	158	34.5 ± 10.5	.64 ± .89	6.9 ± 4.5	11.7 ± 4.1	3.6 ± 1.8	28 (44)*	4.7 ± 6.3	6 (10)
2. Acute	29	32.2 ± 7.8	.93 ± .92	8.0 ± 4.6	9.8 ± 4.1	3.3 ± 1.6	55 (16)**	3.4 ± 3.3	14 (4)
3. Persistent chronic	32	32.5 ± 7.8	1.3 ± 1.29	14.7 ± 4.9	10.0 ± 4.6	3.3 ± 1.9	64 (21)***	7.8 ± 12.0	30 (10)***
4. Resolved chronic	18	31.5 ± 9.6	1.0 ± .97	10.5 ± 5.1	11.8 ± 4.8	2.9 ± 1.3	61 (11)**	4.4 ± 6.9	28 (5)**
5. Recurrent chronic	18	35.6 ± 7.3	1.06 ± 1.0	11.5 ± 4.8	11.3 ± 3.8	3.8 ± 2.1	31 (5)	7.3 ± 9.6	33 (5)**
6. Persistent delayed onset	10	38.8 ± 10.5	1.3 ± 1.3	11.7 ± 3.9	10.8 ± 3.4	3.1 ± 1.6	60 (6)	4.8 ± 3.7	20 (2)
7. Delayed onset 11 month only	17	39.9 ± 10.6	.59 ± .62	8.6 ± 5.5	12.5 ± 3.3	2.8 ± 1.3	65 (11)**	3.9 ± 2.9	18 (3)
8. Delayed onset 29 month only	35	32.9 ± 8.1	.62 ± .65	8.4 ± 5.0	11.1 ± 4.3	3.4 ± 1.6	50 (17)	5.0 ± 4.6	15 (5)
χ^2 or F-value		1.85	3.27**	10.50	1.25	.84	23.51***	1.45	14.16***
Group difference using Scheffé's procedure			3 > 1	3 > 1, 2, 4 and 7					

[a] *N* values may vary slightly in individual calculations due to missing data.
[b] $\bar{X} \pm SD$.
[c] Never, rarely, *vs.* sometimes, often.
[d] χ^2, *df* 1 used for analyses.
[e] Numbers in parentheses, *N*.
** $P \leq .01$.
*** $P \leq .001$.

Predisaster and trait measures. Age did not predict outcome (Table 2). Adverse life events before the fire were reported significantly more commonly only by the persistent chronic disorder group, who were also the only group to score significantly higher on trait neuroticism when compared with normal subjects.

A tendency to avoid thinking through problems was demonstrated by the acute ($\chi^2 = 7.19$ *df* 1, $p = .007$), persistent chronic ($\chi^2 = 14.02$, *df* 1, $p = .000$), resolved chronic ($\chi^2 = 6.85$, *df* 1, $p = .009$), and 11-month ($\chi^2 = 8.04$, *df* 1, $p = .004$) delayed disorder groups. A history of treatment for psychological disorder before the disaster was reported by the fluctuating chronic ($\chi^2 = 9.34$, *df* 1, $p = .001$, the resolved chronic ($\chi^2 = 6.91$, *df* 1, $p = .009$), and the persistent chronic groups ($\chi^2 = 14.14$, *df* 1, $p = .000$).

Disaster experience. The recurrent chronic group was the only group that had a significantly more intense experience of the fire, having sustained greater property losses than the no disorder group (Table 3). Although exposure varied significantly between the groups, Scheffé's procedure could not identify the most exposed groups.

Four-month state measures. The persistent and recurrent chronic groups were the only firefighters experiencing higher levels of imagery at 4 months (Table 4). A trend existed for the fluctuating chronic ($\chi^2 = 5.53$, *df* 1, $p = .02$) and the persistent chronic ($\chi^2 = 4.19$, *df* 1, $p = .04$) to report a greater fear of another fire occurring.

Eleven-month measures. The persistent chronic group were experiencing significantly more imagery (IES score) than the not disordered group (Table 5). All groups were equally likely to have discussed their thoughts with their confidants. The persistent chronic group also reported more adversity since the fire. No group was more likely to have sought professional treatment, suggesting that this factor had not influenced the comparative course of morbidity between the groups.

Twenty-nine-month measures. Exposure to subsequent fires did not differentiate the outcome of any of the groups (Table 6). The persistent delayed-onset ($\chi^2 = 32.79$, *df* 3, $p = .000$), persistent chronic ($\chi^2 = 25.65$, *df* 3, $p = .000$), and resolved chronic ($\chi^2 = 15.67$, *df* 3, $p = .003$) groups were all significantly more distressed by television reminders of the fire. The persistent chronic disorder group was again the only group to have reported an increased frequency of life events between 11 and 29 months. Treatment had not been sought more frequently by the group during this period. The level of imagery and its avoidance remained significantly higher (IES score) in the persistent chronic group only.

Discriminant function analysis. When the determi-

TABLE 3
Comparison of Different Outcome Groups with the No Disorder Groups on Disaster Experiences

Outcome Groups[a]	N	Property Loss[b]	Personal Loss[b]	Exposure[b,c]	Injury (%)	Perceived Threat[b]	Panicked or Close to Panic (%)[d]	Helped Cope during Disaster (%)[d]				Subsequent Debriefing with Unit (%)
								Training	Religious beliefs	Past experience of fires	Leadership	Support from Fellows	
1. No disorder	158	.33 ± .75	.36 ± .83	6.9 ± 1.4	20 (30)[e]	2.6 ± .72	16 (26)	73 (116)	17 (27)	52 (82)	53 (83)	59 (93)	76 (120)
2. Acute	29	.69 ± 1.1	.24 ± .52	6.5 ± 1.6	18 (5)	2.5 ± .71	18 (5)	66 (19)	10 (3)	52 (15)	34 (10)	48 (14)	55 (16)
3. Persistent chronic	32	.48 ± 1.0	.30 ± .64	7.1 ± 1.6	24 (7)	2.8 ± .8	48 (16)	67 (22)	12 (4)	39 (13)	45 (15)	70 (23)	64 (21)
4. Resolved chronic	18	.72 ± .90	.33 ± .69	7.4 ± 1.2	31 (5)	2.7 ± .83	33 (6)	78 (14)	11 (2)	61 (11)	39 (7)	78 (14)	88 (15)
5. Recurrent chronic	16	1.30 ± 1.74	.56 ± .73	8.1 ± 1.2	53 (8)	3.1 ± .73	13 (2)	75 (12)	31 (5)	69 (11)	63 (10)	81 (13)	94 (15)
6. Delayed onset	10	.30 ± .68	.70 ± .82	7.2 ± 1.0	20 (2)	2.5 ± .53	30 (3)	80 (8)	30 (3)	60 (6)	80 (8)	90 (9)	90 (9)
7. Delayed onset 11 months only	17	.24 ± .44	.29 ± .59	7.2 ± 1.6	14 (2)	2.6 ± .74	12 (2)	77 (13)	18 (3)	65 (11)	53 (9)	47 (8)	76 (13)
8. Delayed onset 29 months only	35	.09 ± .29	.21 ± .48	6.8 ± 1.3	31 (10)	2.5 ± .85	12 (4)	85 (29)	12 (4)	47 (16)	50 (17)	68 (23)	71 (24)
χ^2 or *F*-value		4.43***	.78	2.08*	7.57	1.22	2.55	.05	.07	.00	.53	1.52	.33
Group difference using Scheffé's procedure		5 > 1, 8											

[a] *N* values may vary slightly in individual calculations due to missing data.
[b] $\bar{X} \pm SD$.
[c] Recorded at 4 months *df* 4.
[d] χ^2, *df* 1 used for analysis.
[e] Numbers in parentheses, *N*.
* $p \leq .05$.
*** $p \leq .001$.

nants of the acute, chronic, and persistent delayed-onset and not disordered subgroups were examined, the three discriminating functions defined allowed the correct classification of 57% of the subjects. Property loss was the only disaster-related variable contributing significantly to any of the functions in contrast to the dominant role of the three predisaster variables of neuroticism, avoidance of thinking about problems, and history of treatment for a psychological disorder (Table 8). Function 1 was characterized by these variables and this proved to be the best discriminator of the chronic and not disordered groups. The acute group was best discriminated by a negative score on function 2, defined by avoidance, not attending debriefing, and property loss. A combination of functions 2 and 3 best discriminated the delayed-onset group, emphasizing the impact of attending debriefing and of neuroticism.

Discussion

Patterns of Outcome

This longitudinal study examined the course of posttraumatic morbidity in these firefighters according to three sampling frames over its 25-month duration. This arbitrary design created the possibility of seven different patterns of posttraumatic morbidity (Table 1). The validity of their separation, in part, depended on the finding that other variables could also predict their existence (Goodwin and Guze, 1984) (Table 7). The existence of these seven different patterns of morbidity suggests that the definition of acute, delayed-onset, and chronic PTSDs in DSM-III may be an arbitrary generalization based on clinical experience and could require further refinement.

At the same time, these data do provide some support for the definition of the three general groups defined in DSM-III because subjects were allocated to these groups correctly, 57% of the time, on discriminant function analysis of the etiological variables operating (Table 8). Thus, although a number of important differences existed within the general patterns of chronic and delayed-onset morbidity (Table 7), they can equally be separated with a moderate degree of specificity.

The chronic and delayed-onset patterns of posttraumatic morbidity accounted for 42% ($N = 66$) and 39.5% ($N = 62$) of those firefighters who were disordered at some stage. Thus, the majority of people (69%) who were symptomatic at 4 months went on to develop a chronic disorder, contrary to the prediction that acute posttraumatic morbidity has a good prognosis (APA, 1980). However, 51.5% of the chronic groups were not symptomatic at all three sampling

TABLE 4
Comparison of Different Outcome Groups with No Disorder Groups on 4-Month State Measures

Outcome Groups[a]	*N*	GHQ[b]	IES[b]	IES Extra Items[c]	Fear of Another Fire (%)[d]	Felt Bad about Not Containing Fire (%)[d]	Felt Angry about Arsonists (%)[d]	Guilty about Suffering Less (%)[d]
1. No disorder	158	.16 ± .37	13.1 ± 13.7	7.5 ± 5.5	45 (71)*	36 (56)	74 (117)	25 (39)
2. Acute	28	4.1 ± 2.0	20.5 ± 14.2	8.9 ± 4.6	48 (14)	41 (12)	86 (25)	34 (10)
3. Persistent chronic onset	32	6.1 ± 3.4	31.8 ± 17.8	10.3 ± 5.6	67 (22)*	55 (18)	82 (27)	36 (12)
4. Resolved chronic	18	4.1 ± 2.1	24.8 ± 12.8	9.9 ± 4.6	61 (11)	50 (9)	89 (16)	28 (5)
5. Recurrent chronic	16	4.9 ± 3.0	33.4 ± 14.7	12.3 ± 5.00	80 (12)*	73 (11)	80 (12)	44 (7)
6. Persistent delayed onset	10	.20 ± .42	20.0 ± 7.3	10.7 ± 3.4	70 (7)	40 (4)	100 (10)	40 (4)
7. Delayed onset 11 months only	17	.18 ± .40	16.1 ± 15.7	9.1 ± 6.3	59 (10)	41 (7)	82 (14)	35 (6)
8. Delayed onset 29 months only	35	.35 ± .49	15.5 ± 13.1	8.3 ± 5.5	53 (18)	42 (14)	76 (26)	18 (6)
χ^2 or F-value		97.2***	10.1***	2.87***	6.50**	4.67*	3.49	1.65
Group differences using Scheffé's procedure		2, 3, 4, 5 > 1, 6, 7, 8	3, 5 > 1, 8	No group difference				

[a] *N* values may vary slightly in individual calculations due to missing data.
[b] $\bar{X} \pm SD$.
[c] Same coding as in IES (Horowitz et al., 1979).
[d] IES extra items. χ^2, *df* 1, 1 used for analyses: not at all, rarely *vs.* sometimes, often.
[e] Numbers in parentheses, *N*.
* $p \leq 0.05$.
** $p \leq 0.01$.
*** $p \leq 0.001$.

frames, emphasizing the fluctuating nature of symptoms in the chronic group.

Predictors of Outcome

One justification for the validity of PTSD as an independent diagnostic entity is that exposure to an extremely traumatic event is the major etiological factor, with the role of predisposing premorbid factors being less important (Horowitz, 1973). However, this study found that the recurrent chronic disorder group (10% of those who were disordered) were the only firefighters to have experienced significantly greater losses, exposure, injury, or perceived threat. In contrast to the findings of Green et al. (1983) these factors did not predict a persistent or resolved chronic course.

These data suggested that, following an extreme stressor, different patterns of posttraumatic morbidity may be partially predicted by the combination of four predisaster variables (Table 2): adversity before the event, neuroticism, a history of treated past psychological disorder, and the tendency to avoid thinking through unwanted or negative experiences. A pattern of persistently chronic morbidity seems to be predicted when all four variables operated together. The resolved and recurrent chronic groups were similar, except that the recurrent groups did not avoid thinking about problems (Table 7). These groups appeared to have been vulnerable, as they had a past history of psychological treatment, but may have had a different course from the persistently chronic groups because they did not have the same degree of neuroticism. The prolonged impact of the greater level of property loss in the recurrent chronic group may have combined with their past history of psychological disorder to cause a return of their symptoms at 29 months. Thus, in contrast to neuroticism and "avoidance" as a character trait, a past history of treated psychological symptoms may not be a major risk factor, unless the individuals' experiences of the disaster were particularly extreme.

The delayed-onset group was of particular interest because these firefighters seemed to have initially contained the experience of the disaster. The discriminant function analysis suggested that they had been more likely to use the support of their fellows and attend debriefings, thereby minimizing their distress in the immediate postdisaster period. Rather, their disorder seemed to have grown out of the failure of these attempts to resolve their experience. This failure to "work through" their traumatic memories may have been due to the influence of other vulnerability factors. In contrast, the acute disorder group was characterized in the discriminant function analysis by the tendency to avoid debriefings and to shun the support of colleagues. Hence, their acute symptoms may have oc-

TABLE 5
Comparison of Different Outcome Groups with No Disorder Group on 11-Month Measures

Outcome Groups[a]	N	Watch TV Films about Fires[b]				Talked to Some about Thoughts[b,c]	Consulted Professional[b]	GHQ $\bar{X} \pm SD$	IES $\bar{X} \pm SD$	Major Adversity since Fire
		Avoid	Watch but unpleasant	Neutral response	Interesting					
1. No disorder	158	2 (3)	14 (22)	12 (19)	72 (113)	59 (93)	2 (3)	.19 ± .40	7.6 ± 9.0	.69 (1.06)
2. Acute	29	3 (1)	24 (7)	0 (0)	72 (21)	45 (13)	7 (2)	.38 ± .49	7.6 ± 8.3	1.0 (1.0)
3. Persistent chronic	32	13 (4)	32 (10)	9 (3)	47 (15)	76 (25)	22 (7)	4.9 ± 2.7	23.6 ± 16.0	1.6 (1.3)
4. Resolved chronic	18	6 (1)	17 (3)	11 (2)	67 (12)	65 (11)	6 (1)	4.2 ± 1.7	16.5 ± 11.8	.61 (.85)
5. Recurrent chronic	16	0 (0)	38 (6)	0 (0)	63 (10)	81 (13)	13 (2)	.38 ± .50	12.7 ± 9.3	1.06 (1.1)
6. Persistent delayed onset	10	0 (0)	20 (2)	0 (0)	80 (8)	90 (9)	0 (0)	3.9 ± 3.0	19.6 ± 13.9	.80 (1.23)
7. Delayed onset 11 months only	17	6 (1)	29 (5)	12 (2)	53 (9)	53 (9)	0 (0)	3.6 ± 1.9	14.3 ± 15.2	1.1 (.8)
8. Delayed onset 29 months only	35	0 (0)	15 (5)	9 (3)	76 (26)	59 (20)	0 (0)	.38 ± .49	8.6 ± 10.6	.62 (.95)
χ^2 or F-value					10.05	.79	4.59	93.86	10.65	3.39
Group differences using Scheffé's procedure								3, 4, 6, 7 > 1, 2, 5, 8	3 > 1, 2, 8	3 > 1

[a] *N* values may vary slightly in individual calculations due to missing data.
[b] Values represent percentages; numbers in parentheses, *N*.
[c] χ^2, *df* 1 used for analyses: not at all, rarely *vs.* sometimes, often.
[d] χ^2, *df* 3 used for analyses.
* $p \leq .05$.
** $p \leq .01$.
*** $p \leq .001$.

curred because they failed to discuss their experience in the immediate postdisaster period. I hypothesized that they did not become chronic because of the absence of other vulnerability factors operating.

This study did not examine how the role of being a firefighter influenced the pattern, prevalence, or etiology of psychological morbidity in contrast to other victims of the disaster. However, in another study, the GHQ was used to examine all the registered disaster victims 12 months after the disaster and 37% of the men in that group were defined as "cases," in contrast to 27% in the 11-month stage of this project (Clayer et al., 1985). The lower prevalence of disorder in the firefighters could be interpreted in several ways. On one hand, they may have been an unusually psychologically healthy group who volunteered for community service. On the other, their active role in trying to contain the disaster may have lessened their degree of traumatization. However, many of the victims, particularly the farmers, also took an equally active role in protecting their property, indicating that this role was not unique to the firefighters.

Recall Problems in PTSD

Many studies of PTSD in war veterans (Foy et al., 1984; Laufer et al., 1984; Lund et al., 1984) and disaster victims (Lindy et al., 1981) retrospectively have attempted to establish the intensity of exposure to the traumatic event. This investigation demonstrated that a major difference can occur in the retrospective recall of the event between the disordered and not disordered groups. In particular, the frequency of injury in these firefighters was recorded at both 4 months and 11 months. In the persistent and resolved chronic groups, the reported frequency of injury due to the fires had remained unchanged over this period of 7 months. In contrast, only 43% (13 of 30) of firefighters in the not disordered group who reported being injured in the fire at 4 months also reported being injured in the fire when asked at 11 months.

Thus a significant falloff occurred in the reporting of some components of the disaster in those who were not disordered in contrast to the victims who had chronic PTSD over the relatively short interval of 7 months. Hence any investigation examining the etiology of PTSD that does not collect quantitative data about the event within very close proximity to the event may exaggerate the size and nature of the association between the stressor and disorder because of lower rates of recall by the not disordered group. This may explain some of the current emphasis (Green et al., 1985) in the literature about the importance of the event in PTSD.

TABLE 6
Comparison of Different Outcome Groups with No Disorder Group on 29-Month Measures

Outcome Groups[a]	N	Watch TV Films about Fires[b,c]				Consulted Professional about Stress since Last Survey[b,d]	GHQ $\bar{X} \pm SD$	IES $\bar{X} \pm SD$	Major Adversity since 11 Months ($\bar{X} \pm SD$)	Large Fires (3 or More)[b,d]	Small Fires (3 or More)[b,d]	House Fires (3 or More)[b,d]
		Avoid	Watch but unpleasant	Neutral response	Interesting							
1. No disorder	158	0 (0)	11 (18)	22 (35)	66 (104)	3 (4)	.21 ± .41	5.3 ± 7.9	.43 ± .74	18 (22)	60 (90)	21 (23)
2. Acute	29	0 (0)	14 (4)	32 (9)	54 (15)	0 (0)	.28 ± .46	4.1 ± 5.6	.55 ± .78	9 (2)	50 (12)	7 (1)
3. Persistent chronic	32	12 (4)***	24 (8)	12 (4)	51 (17)	14 (3)	5.3 ± 2.9	17.2 ± 13.7	1.3 ± 1.1	23 (6)	59 (17)	21 (5)
4. Resolved chronic	18	6 (1)**	18 (3)	0 (0)	76 (13)	18 (3)	.44 ± .51	9.1 ± 7.6	.56 ± .98	23 (3)	50 (9)	17 (2)
5. Recurrent chronic	10	0 (0)***	38 (6)	13 (2)	50 (8)	15 (2)	3.9 ± 2.6	11.8 ± 10.4	.50 ± .82	43 (6)	57 (8)	9 (1)
6. Persistent delayed onset	10	20 (2)***	10 (1)	10 (1)	60 (6)	10 (1)	3.7 ± 2.6	13.3 ± 7.1	.80 ± .92	38 (3)	70 (7)	13 (1)
7. Delayed onset 11 month only	17	0 (0)	18 (3)	29 (5)	53 (9)	0 (0)	.59 ± .51	9.1 ± 11.4	.82 ± .73	0 (0)	60 (9)	0 (0)
8. Delayed onset 29 months only	35	0 (0)	21 (7)	9 (3)	71 (24)	10 (3)	3.5 ± 1.7	7.5 ± 9.2	.65 ± .81	29 (7)	72 (23)	19 (5)
χ^2 or *F*-value					14.82***	3.27	80.64***	78.01***	24.74***	.64	.00	1.19
Group difference using Scheffé's procedure							3, 5, 6, 8 > 1, 2, 4, 7	3 > 1, 2, 8	3 > 1			

[a] *N* values may vary slightly in individual calculations due to missing data.
[b] Values represent percentages; numbers in parentheses, *N*.
[c] χ^2, *df* 3 used for analyses.
[d] χ^2, *df* 1 used for analyses: not at all, rarely *vs.* sometimes, often.
** $p \leq .01$.
*** $p \leq .001$.

This problem of inaccurate recall may similarly have caused the persistent chronic group to report more adverse events before the disaster and during both postdisaster periods (Table 7). However, this finding could be interpreted in two other ways. First, life events may only contribute to the morbidity in the persistent chronic group. Second, the persistent chronic disorder subjects may experience more adverse life events because these events were caused by their disorder. Thus these data emphasize the complexity of the possible associations between the onset of psychiatric illness and reported life events without allowing any firm conclusion.

Re-exposure and Phobic Avoidance

Contrary to anticipation (Lindy et al., 1983) the prevalence of cases at the 11-month stage was less than that at 29 months although many of the 11-month questionnaires were returned at or about the time of the anniversary of the disaster and during the middle of the summer fire risk period. Hence the realistic threat of fire and the anniversary effect appeared to have no significant impact on the fluctuations of posttraumatic symptoms. However, the fear of another fire in the recurrent chronic and persistent chronic disorder at 4 months (Table 4) may have been an important dynamic theme leading to a chronic outcome in these groups (Krupnick and Horowitz, 1981).

Reexposure to major or minor fires did not differentiate any of the groups on univariate analysis. The disordered groups were no less or more likely to have been exposed to subsequent fires. This seems to contradict the hypothesis that flooding or exposure in vivo is an effective treatment for PTSD (Black and Keane, 1982; Keane and Kalompek, 1982; Kipper, 1977).

Watching television reports of the disaster was noted to be a frequent and troubling traumatic stimulus in the early period after the disaster. However, many firefighters continued to expose themselves to this stimulus despite finding it highly unpleasant (Tables 5 and 6) and avoidance of such reports only emerged to separate the majority of the disordered groups at 29 months. These results suggested that avoidance of the traumatic stimuli was a secondary response to the disorder rather than being etiological (Table 6). Thus reexposure to the traumatic stimulus in this group of firefighters does not appear to have been an important predictor of the course of their posttraumatic morbidity.

Validity of Measures

The findings of this study need to be discussed against the background of the validity of the GHQ as

TABLE 7

Summary of Major Etiological Differences and Similarities Between No Disorder Group and Other Outcome Groups

	2. Acute	3. Persistent Chronic	4. Resolved Chronic	5. Recurrent Chronic	6. Persistent Delayed-Onset	7. 11-Month Only Delayed-Onset	8. 29-Month Only Delayed-Onset
Predisaster or independent variables							
Adverse life events before fire		+					
Neuroticism		+					
Avoidance of thinking about problems	+	+	+		+	+	
Past psychological treatment		+	+	+			
Disaster experience							
Personal, property loss, exposure, perceived threat, injury				+			−
4-month measures							
Fears of another fire		(+)		(+)			
11-month measures							
Adverse life events since fire		+					
29-month measures							
Avoidance of TV films or unpleasant to watch		+	+		+		
Adverse life events since 11 months		+					

(+)Significant at the .05 level only.

TABLE 8

Standardized Canonical Discriminant Function Coefficients and Discriminant Functions Evaluated at Group Centroids for Functions Distinguishing Acute, Chronic, Persistent Delayed-Onset, and No Disorder Groups

	Function 1	Function 2	Function 3	% of Cases Correctly Classified
Standard canonical discriminant function coefficients				
Neuroticism	.55	.40	.39	
Avoidance of thinking about problems	.25	−.35	.12	
Past psychological treatment	.39	.00	−.37	
Property loss	.36	−.61	.13	
Support from other firefighters	.22	.40	−.10	
Attended debriefing	−.16	.47	.72	
Number of large fires fought between 4 and 29 months	.26	.22	−.48	
Adverse events between 11 and 29 months	.35	−.34	−.04	
Variance accounted for	68%	26%	6%	
Canonical correlation	.54	.37	.19	
Discriminant functions evaluated at group centroids				
Chronic	.98	.11	−.11	46
Persistent delayed onset	.34	.73	.78	53
Acute	.15	−1.12	.19	55
Not disordered	−.50	.08	−.04	62

a measure of posttraumatic morbidity and adequacy of the personality and trait measures. First, examination of the psychometric qualities of the GHQ in the 8-month interviews of this study suggested that it was an adequate measure of posttraumatic syndromes (McFarlane, 1986). As well, 16 questions were added to the GHQ at 11 and 29 months; these questions covered the range of phenomenology listed in the DSM-III diagnostic criteria for PTSD. At both 11 and 29 months, these posttraumatic items had a very high degree of correlation with the 12-item GHQ (11 months $r = .93$, 29 months $r = .94$, $p = .000$). Thus the GHQ appeared to have adequate validity for detecting posttraumatic phenomena when this was checked at 8, 11, and 29 months.

The second issue requiring examination was the possibility that, because the trait measures were collected after the onset of disorder, they may have been confounded by the firefighters' disorder. However, the observation that there was no single pattern of rela-

tionship between the various disordered groups and the various trait measures counted against this possibility (Table 7). As well, the prefix of the EPI asked the firefighters to focus on their personality before the fire. The test-retest reliability over 21 months of the EPI was also examined in the subsample who were interviewed at 8 months and found to be adequate (neuroticism $r = .67$, extraversion $r = .68$). This demonstrated greater stability than the GHQ over time (11 *vs.* 29 months, $r = .36$).

Conclusions

The outcome data from this study may have a general relevance to the etiology of psychiatric disorders. First, the different patterns of morbidity and their different etiological associations demonstrated that a single life event, the disaster, can have multiple etiological relationships with consequent psychiatric morbidity, a possibility seldom considered in life events research (McFarlane, 1985).

Second, although exposure to a disaster or other extreme event is necessary to trigger PTSD, it is not sufficient to explain its onset. Similarly, none of the other etiological variables identified to be important in this population were either necessary or sufficient to explain the pattern of morbidity in any of the groups identified. Thus, the onset and maintenance of posttraumatic morbidity can only be understood when a complex etiological web of biological, psychological, and social phenomena are taken into account (Edlund, 1986).

Although they provide some support for the hypotheses about the existence of three types of PTSD, these data suggest that a range of outcomes exist within the chronic and delayed-onset groups. The absence of any decrease in the prevalence of disorder between 4 and 29 months emphasized the chronic nature of posttraumatic morbidity. Premorbid factors appeared to be particularly important predictors of the course of this morbidity. This finding suggests that future research should aim to examine the role traits such as avoidance play in the internalization of extreme experiences such as natural disasters (Helzer, 1981).

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