

Predictors of post-traumatic stress disorder following physical trauma: an examination of the stressor criterion

ANTHONY FEINSTEIN¹ AND RAY DOLAN

From the Institute of Neurology and the National Hospital for Nervous Diseases, Queen Square, London

SYNOPSIS A prospective study documenting psychopathology was undertaken in 48 subjects exposed to a range of physical trauma, but whose injuries were of similar severity. No support was found for the DSM-III-R view correlating the severity of the stressor with the development of post-traumatic stress disorder (PTSD). Distress post injury (high scores on the impact of event scale), indicative of difficulty with cognitive assimilation of the traumatic event, was found to be highly predictive of psychiatric morbidity and PTSD at 6 months.

INTRODUCTION

Post-traumatic stress disorder as defined by DSM-III (APA, 1980) is now a decade old, but remains a subject of controversy. Despite an expanding literature and wider clinical acceptance of the concept, critics have voiced serious misgivings concerning its validity (Breslau & Davis, 1987). Recent revisions to the DSM-III criteria (APA, 1987) only partially resolved some of the doubts. While it is generally conceded that PTSD has face validity, descriptive validity has been challenged by reports (Sierles *et al.* 1983) citing overlap both in terms of symptomatology and diagnosis with other DSM-III axis I disorders. Little is known about the predictive validity of PTSD and the natural history and treatment response of the disorder requires more thorough research.

The biggest question mark over the PTSD concept concerns construct validity, in particular the significance DSM-III-R has attached to the stressor criterion. This issue is of central importance to the whole concept of PTSD. DSM-III-R has adopted the classic stress paradigm in which the magnitude of the stressor assumes aetiological primacy. Such an approach, traceable back to the reductionist, biological views of Selye (1956), is supported by a substantial body of evidence linking PTSD to stressors of over-

whelming magnitude (Green *et al.* 1990), and in particular to certain generic aspects of these stressors (Brett *et al.* 1988). However, it is also clear that not all individuals exposed to DSM-III-R type stressors develop PTSD and epidemiological findings in this regard lack consistency (March, 1990).

An alternative approach to aetiology, emphasizing the importance of constitutional and environmental factors and focusing on an individual's subjective response to a traumatic event, has been advocated by numerous research workers (Wheaton, 1983; Horowitz *et al.* 1987). Here the stressor serves as a trigger to the development of psychopathology rather than acting as an aetiological agent *per se*. Although the pendulum at present has swung firmly in favour of the DSM-III-R approach, sufficient dissent has been voiced to justify a closer look at the stressor criterion.

In an attempt to assess the importance of the stressor in the pathogenesis of post-traumatic psychopathology in general and PTSD in particular, we used a cohort of patients whose injuries were all of similar severity, but who may have sustained these injuries in different ways. It was thus hoped that by eliminating the confounding effect of degree of physical injury on outcome, we could focus attention on the nature of the traumatic event itself and directly test the hypothesis that the stressor is of prime aetiological significance in PTSD.

¹ Address for correspondence: Dr Anthony Feinstein, The Institute of Neurology, Queen Square, London WC1N 3BG.

METHOD

Entry criteria

The present study is part of a larger project prospectively documenting psychopathology following physical trauma. Participants in the study had to meet the following entry criteria: an age range between 15 and 60 years, have suffered a fracture of the femur, tibia or fibula without loss of limb, required admission to an orthopaedic ward for surgical correction of the fracture and be discharged by the first follow-up assessment (6 weeks). Exclusion criteria were a head injury or physical trauma other than a long bone fracture, an accident in which fatalities had occurred or self-induced injuries, i.e. suicide attempters.

Initial assessment

Patients were initially assessed on the orthopaedic wards of the Whittington Hospital, London. The extent of physical injury was documented using the Abbreviated Injury Scale (AIS) and Injury Severity score (ISS) (Greenspan *et al.* 1985). For the purposes of the AIS, the body is divided into five areas, each of which is rated separately. As all the subjects had injuries limited to their lower limbs, their AIS and ISS scores were confined to a single category and differed only with respect to severity of fracture. These trauma ratings were used as an additional safety check to prevent more severely injured patients being admitted to the study.

All patients were initially assessed within 4 to 7 days of admission. Demographic data included age, sex, marital status, nature of employment, social class, past psychiatric history and treatment, whether the person had been drinking prior to the accident, the number of units of alcohol consumed per week and the presence of major life events in the preceding 12 months. The latter included changes in the following areas: work, marital or relationship status, housing, financial difficulties, bereavement, birth of children and changes in physical health. The nature of the trauma, i.e. motor bike, motor car, sport etc., was ascertained. Information was obtained on whether the subjects had been either active or passive participants in the traumatic event. The patients were also asked to assess their responsibility for the event and given three possible choices, namely 'fully respon-

sible', 'partially responsible' or 'not at all responsible'. In addition, they were asked to rate the stressfulness of the event given the following choices: 'life threatening', 'moderate threat', 'little threat' and 'no threat'.

Psychological ratings

The 28-item version General Health Questionnaire (Goldberg & Hillier, 1979) was chosen as one of two measures of general psychiatric morbidity and scored in the simple Likert (0-1-2-3) way.

The Clinical Interview Schedule (CIS) (Goldberg *et al.* 1970), like the GHQ, is designed to detect neurotic symptomatology and in fact correlates well with the GHQ (Goldberg & Hillier, 1979). The additional use of the CIS was deemed necessary as it contains information on dissociative, phobic avoidance and psychotic phenomena. Scores above or equal to 14 were taken as indicating psychiatric 'caseness'.

The Impact of Events Scale (IES), containing an intrusion and avoidant subscale, records patient's subjective responses to the traumatic event and has been shown to possess both reliability and validity (Horowitz *et al.* 1979; Zilberg *et al.* 1982). Each subscale was analysed separately and the scores summated.

The Standardized Assessment of Personality (SAP) (Mann *et al.* 1981) was completed by interviewing an informant, who had to be a person close to the patient and have known the subject for a period exceeding 5 years. The version of the SAP used in this research had been adapted from the original and upgraded to incorporate the latest categories from the DSM-III-R section on personality disorders.

Follow-up assessments

The patients were followed up at two points, namely 6 weeks and 6 months post-accidental injury. At the 6-week follow-up the length of stay in hospital for each patient was recorded. Their level of physical morbidity was assessed at 6 months. All rating scales, with the obvious exception of the SAP, were re-administered at each follow-up assessment. Furthermore, at both follow-up examinations patients were assessed using a self-report symptom checklist derived from the DSM-III-R criteria for PTSD. Responses were either 'yes' or 'no' to symptoms that had been present during the previous week

and for a duration exceeding one month. To make a diagnosis of PTSD, subjects had to have endorsed a single criterion from section B (re-experiencing the traumatic event), three criteria from section C (numbing of responsiveness) and two from section D (autonomic arousal). Each subject received a PTSD questionnaire tailored to their particular traumatic event and were asked to endorse only those symptoms that had begun following the accident.

Statistical analysis and consent

Data were analysed using the Statistical Package for the Social Sciences (SPSS/PC, Norusis, 1986). Both parametric and non-parametric statistical analyses were used. If procedures other than χ^2 comparisons or *t* tests were used, they are mentioned in the text. Informed consent was obtained for all patients and the research was approved by the Ethics Committee of the Whittington Hospital, London.

RESULTS

Population

Forty-eight subjects seen over a 6-month period met the necessary inclusion criteria. All patients rated as either 4 or 9 on the AIS, indicating mild to moderately severe injury.

The subjects comprised 34 males and 14 females. The mean age of the sample was 30.5 years (± 11.7 yr) with a range from 16 to 60 years. The age distribution of the sample is shown in Fig. 1. Thirty-three patients were single (68.8%), 11 married (22.9%), 3 divorced (6.3%) and 1 widowed (2.1%). The majority of subjects were from social classes III, IV and V, with less than 20% from classes I and II. Thirty-six (75%) of the patients were employed and 12 (25%) unemployed.

Four patients had a past history of psychiatric disorder comprising 1 personality disorder, 1 generalized anxiety disorder and 2 patients with adjustment disorders. Personality traits were discernible in approximately half the sample (47.9%), the commonest being compulsive (12.5%), antisocial (10.4%), borderline (6.3%) and histrionic (4.2%).

The mean alcohol consumption of the sample was 11.8 units/week (± 13.3 units/week) with a range of 0 to 48 units (median = 5.5 units/week). Twelve patients (25%) admitted to drinking

immediately prior to their accident though details of blood alcohol levels on admission were not available. One female victim and 10 male victims could be classed as problem drinkers (in excess of 14 or 21 units of alcohol per week respectively).

The mean length of stay in hospital was 11.5 days (± 6.9 days) with a range of 5–35 days. Physical morbidity at 6 months revealed 84% of subjects fully mobile, 13% requiring some form of assistance and 1 subject still in a plaster cast. Ten patients (20.8%) were involved in medico-legal proceedings related to the accident.

Trauma

A breakdown of the nature of the trauma is shown in Fig. 2. The commonest form of accidental injury was motor-bike accidents, accounting for almost a third of all the trauma (29.2%). Pedestrian injuries accounted for the second (20.8%) and sports injuries the third most common grouping (14.6%).

Fifteen patients rated themselves as 'entirely responsible' for the trauma, 16 as 'partially responsible' and 17 as 'not at all responsible'. Thirty-three patients had been actively involved in the traumatic event while 15 had been passive participants. The majority rated their accidents as 'life threatening' (58.3%). Fifteen per cent regarded the threat as 'severe but not life threatening' as did a similar percentage who saw the accident as a 'moderate threat' to their physical integrity. In only 6 patients (12.5%) was the accident perceived as 'little threat'.

Psychopathology following accidental injury

At index assessment 30 subjects were classed as psychiatric 'cases' on the basis of scores of greater or equal to 14 on the CIS. These subjects were more likely to have been involved in a motor vehicle accident and to have had a life threatening accident ($P < 0.05$ for both). By 6 weeks the number of 'cases' had significantly decreased to 12 (McNemar; $P < 0.01$) and by 6 months the number was down to 10 (NS). At 6 weeks follow-up, motor vehicle accidents and stressfulness of the trauma no longer distinguished 'case' from 'non-case'. Twelve subjects were ascertained as having PTSD at 6 weeks and this had declined to 7 subjects by 6 months. The diagnosis of PTSD correlated highly with 'caseness' both at 6 weeks and at

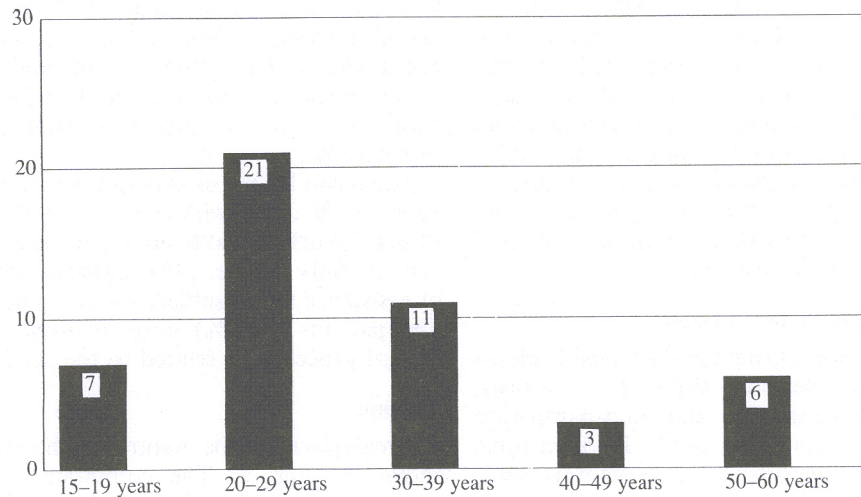


FIG. 1. Age distribution.

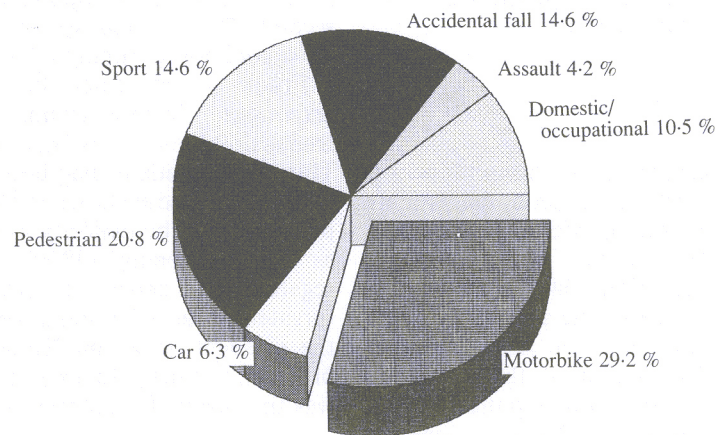


FIG. 2. Nature of the traumatic event that led to hospitalization.

6 months ($r = 0.73$ and $r = 0.64$; respectively). This decline in 'caseness' (and PTSD) over time was mirrored by a general decline in scores for the other rating scales as well (Table 1).

Predictive factors in outcome

The subjects of potentially greatest interest in this study were those with PTSD at 6 months ($N = 7$). They were assigned to a 'poor outcome' category and compared to a 'good outcome' category made up of those without PTSD. No differences were found between these two groups with respect to demographic characteristics, number of preceding life events, the presence of personality traits or disorders and whether

compensation was being sought. Those with PTSD at 6 months were not distinguishable by an excess of physical morbidity.

Index admission variables predictive of outcome at 6 months were sought using a discriminant function analysis. The following variables were entered; age, sex, marital status, social class, past psychiatric history, weekly alcohol consumption, employment status, nature and severity of the trauma, responsibility for the event, active/passive role in the event and the IES and GHQ scores. The IES and GHQ scores and weekly alcohol consumption were split around the median (25, 5.5 and 10.5 respectively) before inclusion into the analysis.

Table 1. Rating scale scores (initial, 6 week and 6 month assessments)

	Initial (N = 48)		6 week (N = 44)		6 month (N = 39)	
	Mean	s.D.	Mean	s.D.	Mean	s.D.
Clinical Interview Schedule	17.21	9.02	12.35	10.05	6.92	7.50
Impact of Event Scale	24.36	12.53	18.45	15.59	15.89	15.64
Intrusion Subscale	14.87	7.71	10.32	8.63	7.64	7.83
Avoidance Subscale	9.56	6.65	8.14	8.49	8.24	9.16
GHQ (Likert)	34.75	10.93	30.59	10.93	22.62	14.54

Two variables were found to predict outcome at 6 months with a 100% sensitivity and 87.5% specificity, namely the initial IES and weekly alcohol consumption. Thus, subjects with IES scores (at initial assessment) and a weekly alcohol consumption above their respective medians were at risk of developing PTSD. Of the two variables isolated by discriminant analysis, the IES was by far the most powerful predictor, having a predictive power of 87%. Adding weekly alcohol consumption above the median increased predictive power to 90%. An analogous situation was also found with respect to predictors of PTSD at 6 weeks, with IES scores again proving to be the most powerful of all index admission variables. Taking a broader definition of psychopathology, namely psychiatric 'caseness', as indicative of poor outcome at 6 months, the IES was again found to be the most powerful predictor. The nature of the stressor and its perceived stressfulness were not found to be important discriminating variables with respect to outcome.

To explore further the importance of the stressor in determining outcome, correlations were sought between PTSD at 6 months and three index admission variables, namely nature of the trauma, stressfulness of the event and initial IES scores. The first two variables indicated severity of the traumatic event, while the IES represented the individual's subjective response to accidental injury and attempts at cognitive assimilation. The nature of the trauma correlated highly with subjective severity of the event ($r = 0.57$), but neither correlated significantly with outcome at 6 months ($r = 0.03$; $r = -0.13$ respectively). The IES, however, correlated significantly with PTSD at 6 months ($r = 0.66$). The situation at 6 weeks was similar. Thus, PTSD again correlated sig-

nificantly with the index IES ($r = 0.49$; $P < 0.001$), but poorly with the nature of the traumatic injury ($r = -0.12$) and subjective stressfulness of the event ($r = -0.09$).

In view of the importance of the IES as a predictor of psychiatric morbidity its possible relationship with other variables was further examined. The IES was negatively correlated with both the stressfulness and nature of the traumatic accident ($r = -0.3$ and $r = -0.19$ respectively). The IES also correlated poorly with the presence of personality traits or disorders ($r = 0.13$). The only significant correlation was with sex ($r = 0.42$; $P < 0.001$) with females having higher IES scores.

DISCUSSION

This prospective study of the psychological sequelae following accidental injury revealed the following: approximately two-thirds of patients, within a week of injury, reported sufficient symptoms to be labelled as psychiatric 'cases'. Without intervention the natural history of these sequelae was towards improvement over time, with less than a quarter remaining as 'cases' by 6 months. Psychiatric 'caseness' was not synonymous with PTSD (it implies a broader degree of psychopathology) although the two were highly correlated. Two variables proved the most powerful predictors of PTSD at 6 months, namely scores above the median for both the initial IES and weekly alcohol consumption. Neither the nature of the stressor nor its perceived stressfulness influenced outcome. At 6 months follow-up physical morbidity in the group was minimal and did not influence psychiatric outcome.

The sample was biased towards younger male patients, with only 9 patients older than 40 years

and approximately 60% under 30 years of age. This probably reflects the nature of the trauma, almost a third being due to motorbike injuries. This bias towards younger male patients is consistent with previous findings from the accident literature, particularly among victims of traffic accidents (McGuire, 1976).

The percentage of subjects with PTSD in the present study is considerably higher than the 1% prevalence noted for the total USA population and the 3.5% prevalence for those exposed to physical attack (Helzer *et al.* 1987), but not as high as figures reported from war (Pitman *et al.* 1989) and disaster situations (Raphael, 1986). The percentage of victims with PTSD and scores on the IES reported in this study are significantly higher than those from Malt's (1988) Norwegian study, despite the similar extent of injuries suffered by victims in both studies. Malt reported only a single case of PTSD at 6 months and none at 2 years post-accident. The reason for the discrepancy is unclear, though the more rigid assessment of patients in the Norwegian study (extensive clinical interviews as opposed to self-report symptom checklists in the present study) may have reduced the number of PTSD false positives. This, however, would not explain the discrepancy with respect to scores on the impact of event scale, where our subjects scored considerably higher. The fact that almost 60% of the present sample rated their accident as life threatening may account for their high IES scores and it is conceivable that the Norwegian group's subjective assessment of their trauma may not have been as severe. However, information on this was not available from their study.

In the present study, potentially life-threatening trauma (e.g. motor vehicle accidents) and extreme subjective ratings of severity of trauma were present significantly more often among psychiatric 'cases' as opposed to 'non-cases' at initial assessment, but by 6 weeks and 6 months this distinction had disappeared. These two variables may, therefore, be regarded as influencing the degree of distress experienced post-accident but do not appear to exert any lasting influence on the development of psychopathology. More influential in this regard are scores on the initial impact of event scale, which was the single most important predictor of psychiatric morbidity in general and PTSD in

particular, at 6 weeks and 6 months. Furthermore, the findings indicate that when it comes to accidental injury, the DSM-III-R concept of the stressor assuming aetiological primacy is not supported. Rather, it suggests that the way an individual initially assimilates and deals with a traumatic event ultimately has the greatest influence in determining outcome. These findings are in broad agreement with those of McFarlane (1988) who found psychiatric impairment after a natural disaster (as measured by the GHQ-12) to be related more to levels of distress following the disaster (as measured by the IES) than to the victims' severity of exposure or loss.

The majority of research into PTSD has involved subjects exposed to war or disaster situations. As our subjects sustained their injuries in very different circumstances, it could be postulated that this accounted for our findings running counter to the DSM-III-R view on the pathogenesis of PTSD. There is evidence to suggest that risk factors pertinent to less extreme stressors lose their significance as stressors increase in magnitude and overwhelm coping resources (Shore *et al.* 1986). However, traumatic fracture of either femur or tibia/fibula requiring hospital admission via an accident and emergency department and necessitating fairly immediate surgery, would appear enough of a threat to a person's 'physical integrity' to satisfy the DSM-III-R stressor criterion.

The important role played by alcohol both before (Tsuang *et al.* 1985) and after traumatic events (Sierles *et al.* 1983) has been documented by previous research workers and confirmed by our findings. The fact that female subjects had higher scores on most rating scales is also in keeping with results from previous trauma research (Horowitz *et al.* 1980; Malt, 1988). However, the situation is more complex, as females in the present study were not more likely to end up with PTSD at 6 months. This may therefore reflect an increased willingness on the part of females to endorse symptoms more readily than their male counterparts.

Although we failed to find a strong association between poor outcome and pre-morbid personality traits/disorders, this is an area in need of further research. It may be that pre-morbid traits or disorders as defined by DSM-III-R do not occur more often in those with PTSD, but

what is present is a cognitive inability to master stressful situations. A similar opinion was reached by Hendin & Haas (1984) in a study comparing Vietnam veterans with and without PTSD. Horowitz *et al.* (1987) have lent further support to such a suggestion by recommending the formation of a separate diagnostic category, namely 'Stress Response Syndromes', which would include a new disorder entitled 'Post-traumatic character disorder'.

Our results must be interpreted with caution as the sample size was small. Nevertheless, we may conclude that with regard to accidental injury and the pathogenesis of PTSD, the findings do not support the importance attached to the stressor by DSM-III-R. Rather, individuals appear to vary their ability to cope with stressful situations independent of the stressor's severity. These results are applicable to disaster situations as well, for it is clear that even in those particular situations not everyone exposed to such overwhelming stressors will develop PTSD. The present study implies that levels of distress post accident, suggestive of early failure to cognitively master a stressful situation, predict poor prognosis. These findings, which need replication with other stressors, may prove potentially useful in identifying subjects at risk of PTSD and enable the concentration of limited resources following disasters.

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REFERENCES

- American Psychiatric Association (1980). *Diagnostic and Statistical Manual of Mental Disorders*, edn 3. AMA: Washington, DC.
- American Psychiatric Association (1987). *Diagnostic and Statistical Manual of Mental Disorders*, edn 3 revised. AMA: Washington, DC.
- Breslau, N. & Davis, G. C. (1987). Post-traumatic stress disorder. The stressor criterion. *Journal of Mental and Nervous Disease* **175**, 255-264.
- Brett, E. A., Spitzer, R. L. & Williams, J. B. W. (1988). DSM-III-R criteria for post-traumatic stress disorder. *American Journal of Psychiatry* **145**, 1232-1236.
- Goldberg, D. P. & Hillier, V. F. (1979). A scaled version of the general health questionnaire. *Psychological Medicine* **9**, 139-145.
- Goldberg, D. P., Cooper, B., Eastwood, M. R., Kedward, H. B. & Shepherd, M. (1970). A standardized psychiatric interview for use in community surveys. *British Journal of Preventive and Social Medicine* **24**, 18-23.
- Green, B. L., Grace, M. C., Lindy, J. D. & Gleser, G. C. (1990). War stressors and symptom persistence in post-traumatic stress disorder. *Journal of Anxiety Disorders* **4**, 31-39.
- Greenspan, L., McLellan, B. A. & Greig, H. (1985). Abbreviated injury scale and injury severity score: a scoring chart. *Journal of Trauma* **25**, 60-64.
- Helzer, J. E., Robins, L. N. & McEvoy, L. (1987). Post-traumatic stress disorder in the general population: findings of the Epidemiologic Catchment Area Survey. *New England Journal of Medicine* **317**, 1630-1634.
- Hendin, H. & Haas, A. P. (1984). Combat adaptations of Vietnam veterans without post-traumatic stress disorder. *American Journal of Psychiatry* **141**, 956-960.
- Horowitz, M. J., Wilner, N. & Alvarez, W. (1979). Impact of Event Scale: a measure of subjective stress. *Psychosomatic Medicine* **41**, 209-218.
- Horowitz, M. J., Wilner, N., Kaltreider, N. & Alvarez, W. (1980). Signs and symptoms of post-traumatic stress disorder. *Archives of General Psychiatry* **37**, 85-92.
- Horowitz, M. J., Weiss, D. S. & Marmar, C. (1987). Diagnosis of post-traumatic stress disorder. *Journal of Nervous and Mental Disease* **175**, 267-268.
- McFarlane, A. C. (1988). Relationship between psychiatric impairment and a natural disaster: the role of distress. *Psychological Medicine* **18**, 129-139.
- McGuire, F. L. (1976). Personality factors in highway accidents. *Human Factors* **18**, 433-442.
- Malt, U. (1988). The long-term psychiatric consequences of accidental injury. A longitudinal study of 107 adults. *British Journal of Psychiatry* **153**, 810-818.
- Mann, A. H., Jenkins, R., Cutting, J. C. & Cowen, P. J. (1981). The development and use of a standardized assessment of abnormal personality. *Psychological Medicine* **11**, 839-847.
- March, J. S. (1990). The nosology of post-traumatic stress disorder. *Journal of Anxiety Disorders* **4**, 61-82.
- Norusis, M. J. (1986). *SPSS/PC+_{TM}: for the IBM PC/XT/AT*. SPSS: Chicago.
- Pitman, R. K., Altman, B. & Macklin, M. L. (1989). Prevalence of post-traumatic stress disorder in wounded Vietnam veterans. *American Journal of Psychiatry* **146**, 667-669.
- Raphael, B. (1986). *When Disaster Strikes*. Hutchinson: London.
- Selye, H. (1956). *Stress in Health and Disease*. Butterworths: Boston.
- Shore, J., Tatem, E. & Vollmer, W. (1986). The Mount St. Helen's stress response syndrome. In *Disaster Stress Findings; New Methods and Findings*, (ed. J. Shore). American Psychiatric Press Association: Washington, DC.
- Sierles, F. S., Chen, J. J., McFarland, R. E. & Taylor, M. A. (1983). Post-traumatic stress disorder and concurrent psychiatric illness. A preliminary report. *American Journal of Psychiatry* **140**, 1177-1179.
- Tsuang, M. T., Boor, M. & Fleming, J. A. (1985). Psychiatric aspects of traffic accidents. *American Journal of Psychiatry* **142**, 538-546.
- Wheaton, B. (1983). Stress, personal coping resources, and psychiatric symptoms. An investigation of interactive models. *Journal of Health and Social Behaviour* **24**, 208-230.
- Zilberg, N. J., Weiss, D. S. & Horowitz, M. J. (1982). Impact of event scale: a cross validation study and some empirical evidence supporting a conceptual model of stress response syndromes. *Journal of Consulting and Clinical Psychology* **50**, 407-414.

