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Psychiatric morbidity and comorbidity following accidental man-made traumatic events: incidence and risk factors

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Abstract The aims of this study were to examine the incidence and risk factors of major depression, bipolar disorder, psychoactive substance use, psychotic and anxiety disorders in relation to post-traumatic stress disorders (PTSD) in a study group exposed to two different traumatic events, i. e. 128 fire and 55 motor vehicle accident victims. Data have been collected 7–9 months after the traumatic event. The diagnosis of axis-I diagnoses, other than PTSD, was made according to DSM-III-R criteria using the Structured Interview according to the DSM-III-R. The incidence of new-onset major depression was 13.4 %, generalised anxiety disorder (GAD) 12.6 %, agoraphobia 10.2 % and psychoactive substance use disorders 6 %. Simple phobia, panic disorder and obsessive compulsive disorder had a much lower incidence (< 2.0 %). Fifty-one percent of the victims with PTSD had one or more additional axis-I diagnoses, major depression (26.2 %), agoraphobia (21.0 %) and generalised anxiety disorder (24.6 %) being the most common. Physical injury was the single best predictor for major depression. The best predictors for the development of new-onset anxiety disorders, other than PTSD, were: type and horror of the trauma, the extent of physical injury, the loss of control during the traumatic event, contextual stimuli, younger age and female sex. In conclusion: comorbid disorders, such as depression, GAD and agoraphobia, commonly occur within the first few months after man-made accidental traumata. Trauma variables, which are known to be related to the development of PTSD, are also related to the occurrence of these comorbid disorders.

Key words Post-traumatic stress disorder · Comorbidity · Major depression · Prevalence · Anxiety disorder

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Introduction

Post-traumatic stress disorder (PTSD) is classified as an anxiety disorder (APA 1980, 1987, 1994) and describes the cluster of symptoms associated to a traumatic event outside the range of usual human experience (APA 1987). Epidemiologic studies have linked the exposure to traumatic events to the onset of PTSD as well as other specific psychiatric disorders, such as major depression, other anxiety and psychoactive substance use disorders (Smith et al. 1990; Engdahl et al. 1991; Gleason 1993; David et al. 1996; Dew et al. 1996; Shalev et al. 1998). Some reports have documented a high incidence of major depression, anxiety disorders, such as generalised anxiety disorder (GAD), and psychoactive substance use disorders following deliberate man-made traumata, such as in prisoners of war, concentration camp survivors and battered women (Eitinger 1959; 1971; Hoppe 1971; Niederland 1964; Engdahl et al. 1991; Gleason 1993). In accidental man-made traumatic events and natural disasters a high incidence of new-onset major depression and GAD was found (Shalev et al. 1998; David et al. 1996).

PTSD often grades into or is comorbid with other psychiatric disorders (Tomb 1994). Previously, significant levels of comorbid diagnoses were found to exist in war veterans with PTSD, e. g. psychoactive substance use disorders, unipolar major depression, intermittent explosive disorder, other anxiety disorders and psychosis (Hryvniak

and Rosse 1989; Engdahl et al. 1991; Bleich et al. 1994; Tomb 1994; North et al. 1994; Butler et al. 1996). Recent epidemiologic research pointed to a disproportionate rate of OCD in combat veterans (Pitman 1993). While there are now numerous reports on comorbidity in combat veterans with PTSD (Deering et al. 1996), studies on PTSD resulting from accidental man-made traumata and natural disasters are just beginning to emerge. In the latter group, the most common comorbid diagnoses are major depression and GAD (Hubbard et al. 1995; McFarlane and Papay 1992; Blanchard et al. 1995b). Victims with comorbid disorders appear to suffer from a greater symptom severity and lower levels of psycho-social functioning (Shalev et al. 1998; Blanchard et al. 1998).

There is some evidence that the development of PTSD is determined by the nature and the power of the traumatic event (Tomb 1994). Established predictors or risk factors for developing PTSD are, amongst others, the presence and extent of physical illness (Abenhaim et al. 1992; Blanchard et al. 1995a) the threat to one's own life or receipt of serious injury (Blanchard et al. 1995a; Resnick et al. 1993) and a sense of helplessness during the disaster (Joseph et al. 1994). However, it has remained elusive whether other trauma-induced disorders such as depression, GAD and substance abuse are related to these trauma-related variables.

The aims of the present study were to examine 1) the incidences of other axis-I diagnoses in survivors of man-made accidental trauma; 2) the comorbidity between PTSD and other axis-I diagnoses; and 3) the role of trauma exposure in the development of the comorbid disorders.

Subjects and methods

Subjects

Subjects were victims of two major traumatic events which had occurred in Vlaanderen, Belgium since 1994 (Maes et al. 1998a; 1998b). 1) On December 31, 1994, around midnight, a fire destroyed the ballroom of the Switel Hotel (Antwerp, Belgium) where about 450 guests were celebrating New Year's Eve. More than 120 subjects were injured or burned; 10 people died on the scene or later. Within a few seconds of the fire starting, the room temperature increased quite abruptly to ±100°C. Many guests were trapped, could not find the exit and most were terrified that they would be incinerated, crushed or burned to death. 2) On February 27, 1996, 9.00 a. m. on the E17 highway (Deinze, Belgium) a sudden heavy fog bank surprised the drivers resulting in a pile-up involving more than 150 cars. Many cars were crushed with explosions and fire as a consequence. Ten people died on the scene and more than 50 were injured. All victims who were registered by the "Red Cross" or "Slachtofferhulp" (Switel fire: about 200 victims; E17 pile-up: about 100 victims) were invited to take part in this study. In the end, 128 fire victims and 55 motor vehicle accident (MVA) victims participated. The others refused to participate or could not be located. Not one of the subjects included had suffered from PTSD, psychotic disorders or bipolar disorders prior to the traumatic event. All subjects were Caucasians, most of them were Flemish and a few were Dutch. The study design was approved by the local ethical committee and the subjects gave written informed consent after the study protocol had been fully explained.

Methods

The interviews were completed 7–9 months after the traumatic events. We used the Composite International Diagnostic Interview (CIDI), PTSD module, in a validated Dutch translation (Janca et al. 1994; Peters et al. 1996; Smeets and Dingemans 1993). The CIDI, PTSD module, is a fully structured diagnostic interview covering the DSM-III-R criteria for PTSD (Janca et al. 1994; Peters et al. 1996). The CIDI, PTSD module, scores also criterion F of the DSM-III-R, i. e. "the disturbance causes clinically significant distress or impairment in functioning".

Unsupervised and supervised multivariate statistical analyses did not enable us to validate the DSM three factorial structure and, consequently, the diagnostic criteria as well as the diagnosis of PTSD in a study group of 130 fire and 55 MVA victims (Maes et al. 1998a; 1998b). Since the DSM-III-R diagnosis of PTSD could not be validated in the present study group (Maes et al. 1998a), we used a cluster analysis in order to classify the victims in PTSD cases and non-cases (Maes et al. 1998b). There was a significant association between the diagnoses according to the DSM and our cluster analysis. The incidence of PTSD according to the cluster analysis was 46.5 %; 48.8 % of these subjects were classified as PTSD according to DSM-III-R criteria. The cluster analysis classified 53.5 % of the victims as non-cases, of whom only one was classified as having PTSD according to DSM-III-R criteria. Thus, the cluster analytically generated criteria for PTSD were less restrictive than the DSM-III-R diagnostic criteria. Since we have found that the three-dimensional symptom structure (criteria B, C and D) of the DSM could not be validated, we have used exploratory and confirmatory factor analysis and found that two symptom dimensions (factors) of CIDI items best reflected the data structure (Maes et al. 1998a; 1998b). The first factor, called the "depression-avoidance (DAV) dimension", contains the following items: restricted range of affect; markedly diminished interest; feelings of detachment; sense of a foreshortened future; inability to recall an important aspect of the trauma; acting or feeling as if the traumatic event is recurring; and efforts to avoid activities, places or people that arouse recollections of the trauma, and the disturbance causes clinically significant distress or impairment in functioning. The second factor, the "arousal-anxiety (AA) dimension", contains the following items: physiological symptoms of anxiety; sleep disorders; recurrent distressing dreams; recurrent and intrusive distressing recollections of the event; efforts to avoid thoughts, feelings or conversations associated with the trauma; hypervigilance; intense physiological distress at exposure to cues that symbolise the traumatic event; and exaggerated startle response. Severity of the DAV and AA dimensions was computed by subtracting the first principal component from the DAV and AA (CIDI) items described above.

The Semistructured Interview for the DSM-III-R (Spitzer et al. 1990) was employed to make the life-time (before the traumatic event) and present (since the traumatic event) diagnoses of other axis-I diagnoses, i. e. unipolar major depression, bipolar disorder, GAD, agoraphobia, panic disorder, simple and social phobia, OCD, psychotic disorders and psychoactive substance use disorders. Subjects who had previously suffered from unipolar major depression and anxiety disorders were excluded from the analyses concerning the incidence and predictors of the disorder under consideration. Thus, only subjects with new-onset psychiatric disorders were considered for the statistical analyses. The incident cases (new onsets) of psychiatric disorders had to develop all symptoms required to meet the criteria within 7–9 months following the traumatic event.

Moreover, we carried out a structured interview to assess trauma-related variables. These variables are known risk factors in the development of PTSD. In the total study group we asked for the following: 1) the traumatic event entailed a serious threat to one's life or physical integrity (scored as yes/no); 2) the victim saw someone being seriously injured or someone being killed during the trauma (both scored as 0: nobody; 1: a stranger; 2: close relative/friend); 3) loss of control during the traumatic event (scored on a four-point scale; 0: no loss of control; 1: some loss; 2: severe loss; 3: total loss). In the fire victims we were able to register, through a structured interview, specific fire-related variables, i. e. 1) having seen the fire; 2)

having inhaled the smoke; 3) having felt the heat in the ball room (all scored as yes/no); 4) burn stage (scored as 0: no burns and 1–3 for stages 1–3); and 5) the number of days hospitalised in the intensive care or burn units (dichotomised as <14 days versus ≥ 14 days).

Statistics

The independence between classification systems was checked with the analysis of contingence tables (χ^2test) or Fisher's exact probability test. Group mean differences were ascertained by means of analysis of variance (ANOVA). Multiple comparisons among treatment means were checked with Scheffe's test. Automatic backward logistic regression analysis (with p-to remove=0.01) was used to delineate the most significant factors predicting the occurrence of the comorbid disorders. We used those risk factors which are known to be involved in the development of PTSD. The following statistical programmes were employed: SYSTAT, SPSS 8.0, STATISTICA, and MAESSTAT (© Maes).

Results

1. Incidences

Table 1 shows the incidences of the psychiatric disorders within 7–9 months after the traumatic event. The incidence of PTSD in the present study group was 45.9 %. Victims with a history of a specific disorder were excluded from the analyses of the incidence of that disorder. The sample sizes used in these analyses (between parentheses: the prevalence estimates of these disorders prior to the event) were major depression 179 (2.2 %); GAD 175 (4.4 %); agoraphobia 167 (8.2 %); psychoactive substance abuse disorder 179 (2.2 %); OCD 177 (3.3 %); simple phobia 154 (15.8 %); social phobia 177 (3.3 %); panic disorder 180 (1.6 %); and psychotic and bipolar disorders 183 (each 0.0 %). The three most common new-onset disorders were major depression, GAD and agoraphobia. The incidence of new-onset psychoactive substance use disorders was lower, i. e. 6.0 % (alcohol dependence: 2.7 %; alcohol abuse: 0.5 % and benzodiazepine dependence: 2.7 %). OCD, panic disorder and simple phobia occurred less frequently. No cases with social phobia, bipolar disorder or psychotic disorders were recorded.

Table 2 shows the differences in the DAV and AA scores between victims with and without psychiatric disorders other than PTSD. The DAV scores were significantly higher in victims with major depression, agoraphobia and GAD than in victims without these disorders. The DAV scores were significantly higher in victims who suffered from an anxiety disorder other than PTSD and in victims with a disorder other than PTSD (depression, anxiety disorders or psychoactive substance use disorders) than in victims without those disorders. The AA scores were significantly higher in victims with major depression, agoraphobia, GAD, an anxiety disorder other that PTSD and in victims with a psychiatric disorder other than PTSD than in victims without these disorders.

Significantly more victims with a psychiatric disorder other than PTSD suffered from clinical significant distress (i. e. criterion F) than victims without these disorders, i. e. major depression: 79.2 % versus 37.4 % (χ^2=14.8, df=1, p=0.0001), agoraphobia: 82.3 % versus 39.3 % (χ^2=11.5, df=1, p=0.0007), GAD: 81.8 % versus 37.9 % (χ^2=15.1, df=1, p=0.0001), and any anxiety disorder other than PTSD: 84.4 % versus 35.8 % (χ^2=25.3, df=1, p<10^{-4}).

2. Comorbidity

Table 1 shows the incidences of the psychiatric disorders in victims with and without PTSD. The incidences of major depression, GAD, agoraphobia, anxiety disorders other

Table 1 Incidences of psychiatric disorders within 7–9 months after the traumatic events

Diagnoses	Incidence (%)	Victims with PTSD (%)	Victims without PTSD (%)	χ^2 (p-value)
Major depression	13.4	26.2	3	20.5 (<10^{-4})
Generalised anxiety disorder (GAD)	12.6	24.6	3.1	18.3 (<10^{-4})
Agoraphobia without panic	10.2	21	1.1	18.0 (<10^{-4})
Psychoactive substance use disorder	6	7.1	5.1	3.0 (0.6)
Obsessive compulsive disorder (OCD)	1.1	2.5	0	–
Simple phobia	1.9	4.8	0	–
Social phobia	0	0	0	–
Panic disorder	1.7	3.7	0	–
Psychotic disorders	0	0	0	–
Bipolar disorder	0	0	0	–
An anxiety disorder other than PTSD*	17.5	33.3	4	27.0 (<10^{-4})
An anxiety disorder other than PTSD or major depression	24.6	46.2	7	34.0 (<10^{-4})
Any disorder other than PTSD**	29.6	51.2	12.1	12 (<10^{-4})

* GAD, agoraphobia, panic disorder, simple phobia or OCD, ** The anxiety disorders listed under *, major depression or psychoactive substance use disorders

Table 2 Differences in the depression-avoidance (DAV) and anxiety-arousal (AA) scores between victims with and without psychiatric disorders other than PTSD

Diagnoses	Score	Numbers	Without	With	F	df	p
Major depression	DAV	155/24	–0.221 (0.836)	1.103 (0.975)	49.9	1/177	$<10^{-4}$
	AA		–0.111 (0.994)	0.574 (0.825)	10.3		0.002
Generalised anxiety disorder	DAV	153/22	–0.203 (0.882)	1.098 (0.924)	41.3	1/173	$<10^{-4}$
	AA		–0.170 (0.938)	0.802 (0.884)	20.9		$<10^{-4}$
Agoraphobia without panic attacks	DAV	150/17	–0.123 (0.928)	1.009 (1.009)	22.2	1/165	$<10^{-4}$
	AA		–0.109 (0.982)	0.935 (0.688)	18.2		$<10^{-4}$
Any anxiety disorder, other than PTSD	DAV	151/32	–0.202 (0.890)	0.954 (0.947)	43.5	1/181	$<10^{-4}$
	AA		–0.160 (0.961)	0.757 (0.825)	25.2		$<10^{-4}$
Any anxiety disorder or major depression	DAV	135/44	–0.350 (0.749)	0.897 (0.954)	79.9	1/177	$<10^{-4}$
	AA		–0.218 (0.959)	0.590 (0.873)	24.6		$<10^{-4}$
Any disorder, other than PTSD	DAV	126/53	–0.366 (0.727)	0.722 (1.035)	64.1	1/177	$<10^{-4}$
	AA		–0.250 (0.940)	0.529 (0.927)	25.8		$<10^{-4}$

All results are shown as mean (SD). All results of ANOVAs (regression method)

than PTSD (i. e. GAD, agoraphobia, OCD, simple phobia or panic disorder), anxiety disorders other than PTSD or major depression, and major depression and anxiety disorders other than PTSD were significantly higher in subjects with than without PTSD. The incidence of psychoactive substance use disorders was not significantly different between subjects with and without PTSD.

Victims with PTSD and comorbid major depression (mean=1.315 ±0.822, n=21) had significantly higher DAV scores (F=105, df=2/176, $p<10^{-4}$) than victims with only one of these disorders (mean=0.452 ±0.832, n=62) and victims without any (mean=–0.661 ±0.454, n=96). Victims with PTSD and comorbid anxiety disorders (mean=1.132 ±0.865, n=28) had significantly higher DAV scores (F=98, df=2/180, $p<10^{-4}$) than victims with only one of these disorders (mean=0.529 ±0.895, n=60) and victims without any (mean=–0.668 ±0.456, n=95). The number of subjects suffering from clinical significant distress (criterion F) was significantly greater (χ^2=44.8, df=1, $p<10^{-4}$) in patients with comorbid major depression and PTSD (90.5 %) than in victims with one of these disorders (67.7 %; χ^2=4.2, df=1, p=0.041), and subjects without depression or PTSD (16.7 %).

3. Predictors

First, we examined whether there are significant differences in the incidence of the psychiatric disorders between fire versus MVA victims. There were no significant differences in the prevalence of depression (fire: 16.1 % versus MVA: 9.1 %; χ^2=2.6, df=1, p=0.1) and GAD (14.0 % versus 9.1 %; χ^2=0.8, df=1, p=0.4) between both victim groups. The incidences of agoraphobia (15.0 % versus 0 %; Fisher's exact probability test: p=0.0008), psychoactive substance use disorder (8.7 % versus 0 %, Fisher's exact probability test: p=0.017), and any psychiatric disorder (i. e. PTSD, other anxiety disorders, major depression or psychoactive substance use disorders) (54 % versus 36.4 %; χ^2= 4.8 df=1, p=0.029) were significantly higher in fire than in MVA victims.

Table 3 shows the results of automatic, backward logistic regression analyses with, as grouping variable, the psychiatric disorders other than PTSD and, as independent variables, gender, age, loss of control, type of trauma (fire versus MVA), a serious threat to one's life or physical integrity during the trauma, and seeing a close relative or friend being seriously injured or killed as the result of the trauma. In the total study group, no risk variables significantly predicted major depression. The best predictors for GAD were younger age and loss of control during the traumatic event; agoraphobia: gender (higher in females); anxiety disorders other than PTSD: type of trauma, younger age and loss of control. The occurrence of any diagnosis (PTSD, other anxiety disorders, depression or substance abuse) was best predicted by loss of control, type of trauma, seeing a close relative or friend being injured and female sex.

The above relationships were reanalysed in the study group of fire victims taking into account the fire-related variables. Table 3 shows that the only significant predictor for major depression was burn stage. Five predictors were found for GAD: burn stage, female gender, having seen a close friend/relative being injured, younger age and having felt the heat. There are two items that predicted agoraphobia: burn stage and having seen a close relative/friend being injured. The best predictors for any anxiety disorder other than PTSD were: burn stage, female gender, having seen a close relative/friend being injured and younger age. The variables that predicted the presence of any psychiatric disorder (PTSD, anxiety, major depression or psychoactive substance use disorder) were: loss of control, threat to one's life, female gender and having seen a close relative/friend being injured.

Table 3 Results of automatic stepwise logistic regression analyses with new-onset major depression, generalised anxiety disorder (GAD), agoraphobia, anxiety disorders other than PTSD and any psychiatric disorder as grouping variables and trauma-related variables as independent variables. The regressions were performed in all subjects and in the fire victims only

Diagnosis	Study group	variables (with exact p-value between brackets)	χ^2	df	p
Major depression	Fire	Burn stage [0.02]	5.2	1	0.02
GAD	All	Loss [0.01]; –Age [0.05]	9.6	2	0.01
	Fire	Burn stage [0.004]; Gender [0.005]; –Age [0.04]; Horror [0.049]; Heat [0.05]	33.3	5	$<10^{-4}$
Agoraphobia	All	Gender [0.006]	8.9	1	0.006
	Fire	Burn stage [0.009]; Horror [0.03]	9	2	0.01
Any anxiety disorder	All	Type [0.01]; Loss [0.04]; –Age [0.04]	12.8	3	0.01
	Fire	Burn stage [$<10^{-4}$]; Gender [0.01]; Horror [0.03]; –Age [0.03]	31.2	4	$<10^{-4}$
Any disorders	All	Loss [0.002]; Type [0.02]; Horror [0.04]; Gender [0.03]	28.9	4	$<10^{-4}$
	Fire	Loss [0.01]; Threat [0.01]; Gender [0.01]; Horror [0.05]	26.2	4	$<10^{-4}$

–Age: denotes that age is inversely related to the grouping variable. Loss: loss of control. Type: fire versus motor vehicle accident (incidence higher in fire victims). Horror: saw a close relative or friend being seriously injured as the result of the trauma. Heat: has felt the abrupt increase in temperature in the ball room. Gender: the incidence is higher in females. Threat: the traumatic event entailed a serious treat to one's life or physical integrity

Discussion

This study allowed us to examine the new occurrences of psychiatric disorders, other than PTSD, within some months after the exposure to two different traumatic events. This study used retrospective reports of the onset of each of the psychiatric disorders under study in order to separate incident cases of disorder from those that were present before exposure to the traumas under study. Based on responses to the SCID, subjects with a history of a specific disorder were excluded from the analyses of the incidence of that disorder. Since only non-cases were considered for detection of these disorders within a fixed time frame (7–9 months), we were able to compute the incidence or the instantaneous risk of these disorders (Kleinbaum et al. 1982).

We found that 29.6 % of the victims met criteria for a new-onset disorder, with major depression (13.4 %), GAD (12.6 %) and agoraphobia (10.2 %) being the most common. Psychoactive substance use disorder (6 %), simple phobia (1.9 %), panic disorder (1.7 %) and OCD (1.1 %) had a much lower incidence. No cases with new-onset social phobia, bipolar or psychotic disorders could be found. These results extend those of previous reports showing a high incidence of these disorders in survivors of other man-made and natural traumatic events. David et al. (1996) reported that 51 % of hurricane victims met criteria for a new onset psychiatric disorder, including PTSD (36 %), major depression (30 %) and other anxiety disorders (20 %). Shalev et al. (1998) found that 19.0 % of trauma survivors recruited from a general hospital's emergency room met criteria for major depression. In heart recipients, major depression was the most prevalent disorder post-transplant with a one year rate of 17.3 %, although no cases with GAD were found (Dew et al. 1996). In WO II prisoners of war, a lifetime diagnosis of GAD was found in 42 % of the subjects who never had PTSD (Engdahl et al. 1991). In battered women a high prevalence was found for PTSD, major depression, GAD and OCD (Gleason 1993).

In this study we found that 51.2 % of the victims with PTSD presented with another psychiatric disorder, whereas only 12.1 % of the victims without PTSD had one or more of these disorders. Major depression (26.2 %), GAD (24.6 %), and agoraphobia (21.0 %) were the most common comorbid disorders. The few cases with new-onset simple phobia, panic disorder and OCD occurred in PTSD victims only. It has been reported previously that up to 80 % of individuals with PTSD met criteria for at least one other psychiatric diagnosis (Brady 1997). In another study, only 23 % of 70 fighters exposed to a natural disaster and who had developed a PTSD did not attract a further diagnosis, with depression being the most common (McFarlane and Papay 1992). Shalev et al. (1998) reported that comorbid major depression occurred in 43.2 % of trauma survivors with PTSD at four months. A significant number (59 %) of survivors of childhood trauma with PTSD had one or more additional axis-I diagnoses, major depression and GAD being the most common (Hubbard et al. 1995). Other studies showed that comorbid major depression occurred in trauma survivors with PTSD, e. g. 53.2 % of motor vehicle accident victims (Hubbard et al. 1995) and 25 % and 50 % of the male and female victims, respectively, of mass shooting (North et al. 1994). Bleich et al. (1994) found that comorbidity includes major depression with a high prevalence (50 %) and anxiety disorders, such as panic disorder, GAD, phobic disorder and OCD (8–18 %). In agreement with our findings, Bleich et al. (1994) reported that the prevalence of psychoactive substance use disorders (alcoholism and drug abuse) was considerably less than that of depression and anxiety disorders. Others, however, found a high comorbidity between PTSD and psychoactive substance use disorders (Brown and Wolfe 1994; Chilcoat and Breslau 1998). We could not find any occurrence of psychotic disorders in the study population. Several studies have documented psychotic symptoms in patients with PTSD, although the presence of such symptoms was not tantamount to having a psychotic disorder (Hamner 1997). Finally, it should be stressed that the results of our study

and studies of psychiatric disorders which emerge following a traumatic event may be expected to yield very different findings than studies which look at comorbid disorders regardless of when they developed.

Another finding of this study is that victims with comorbid PTSD and major depression or any other anxiety disorder suffer more clinical distress and present with more severe symptoms of PTSD than victims with one of these disorders only. These findings extend previous reports that comorbidity is associated with greater symptom severity and lower levels of functioning and more major role impairments (Shalev et al. 1998; Blanchard et al. 1998). Thus, a diagnosis of PTSD together with another axis-I diagnosis can be seen as a marker of more severe cases of mental health problems following major life events.

Another major finding of this study is that victims who developed major depression or one or more of the anxiety disorders other than PTSD appeared to have had a higher exposure to the disaster and a greater extent of physical injury caused by the accident. Thus, the extent of physical injury (burn stage) was the single best predictor for major depression. Anxiety disorders were best predicted by a younger age, female gender, type of trauma (higher in fire victims), the extent of physical injury (burn stage), the horror of the traumatic event (having seen a close relative or friend being injured), loss of control, and – in fire victims – a specific fire-related variable, i. e. having felt the abrupt increase in temperature in the ball room. The latter could be the contextual stimulus which may have resulted in generalised fear (PTSD and GAD) and avoidance behaviour (PTSD and agoraphobia). Previously, it has been shown that the nature and power of the stressor may determine the development of PTSD (Tomb 1994; McFarlane and Papay 1992; Blanchard et al. 1995 a).

One limitation of the present study is that incidence was estimated synthetically using retrospective reports and temporal relationships not as clearly defined as in a prospective study. Thus, data are best collected prospectively in order to ascertain subjects at risk for a disorder at a specific point in time and then they are followed forward to determine the number of new onset cases. Exposure to risk factors is determined prior to the follow-up period. However, such a prospective study is difficult to carry out on victims of unpredictable accidents. Since subjects were interviewed only once, 7–9 months after the trauma, possible assessment biases, such as recall biases, may have influenced the results. Another factor which could have influenced the incidence of psychiatric disorders in our study is the unwillingness to participate in the study. For example, in a longitudinal study, it was found that the estimation of the incidence of PTSD could be affected by the degree of unwillingness to undergo a primary examination and that resistance to examination was related to severity of exposure (Weisaeth 1989).

In conclusion, this study shows that 1) major depression and anxiety disorders, such as GAD and agoraphobia, commonly occur in response to accidental man-made traumatic events; 2) PTSD commonly occurs with comorbid disorders, such as major depression, GAD and agoraphobia; and 3) the extent of physical injury, gender, age, loss of control, type of trauma, and the degree of exposure to the traumatic event determine, in part, the occurrence of these comorbid disorders.

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