

Psychiatric Disorders Among Survivors of the Oklahoma City Bombing

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DISASTERS OFFER UNIQUE opportunities to study mental health effects of traumatic events in unselected populations. Because most disasters strike randomly, studies of disasters circumvent the limitations of research on trauma to individuals in the community, where risk for traumatic events is confounded with vulnerability to psychopathology.¹ The extreme magnitude and intensity of the Oklahoma City, Okla, bombing made it a particularly significant subject for the study of mental health effects of trauma because of the profound effects anticipated among its survivors, including persons with no predisaster psychiatric history.²⁻⁶

The bombing of the Alfred P. Murrah Federal Building in Oklahoma City on April 19, 1995, was the most severe incident of terrorism ever experienced on American soil.^{7,8} The death count totaled 167, including 19 children; the number of persons injured totaled 684. The fatality rate inside the Murrah Building was 46%, and 93% of survivors who were in the building were injured.⁹ The explosion demolished or damaged more than 800 building structures, with an estimated property damage of \$625 million.

We studied direct survivors of the blast. Our research objectives in-

Context Disasters expose unselected populations to traumatic events and can be used to study the mental health effects. The Oklahoma City, Okla, bombing is particularly significant for the study of mental health sequelae of trauma because its extreme magnitude and scope have been predicted to render profound psychiatric effects on survivors.

Objective To measure the psychiatric impact of the bombing of the Alfred P. Murrah Federal Building in Oklahoma City on survivors of the direct blast, specifically examining rates of posttraumatic stress disorder (PTSD), diagnostic comorbidity, functional impairment, and predictors of postdisaster psychopathology.

Design, Setting, and Participants Of 255 eligible adult survivors selected from a confidential registry, 182 (71%) were assessed systematically by interviews approximately 6 months after the disaster, between August and December 1995.

Main Outcome Measures Diagnosis of 8 psychiatric disorders, demographic data, level of functioning, treatment, exposure to the event, involvement of family and friends, and physical injuries, as ascertained by the Diagnostic Interview Schedule/Disaster Supplement.

Results Forty-five percent of the subjects had a postdisaster psychiatric disorder and 34.3% had PTSD. Predictors included disaster exposure, female sex (for any postdisaster diagnosis, 55% vs 34% for men; $\chi^2_1=8.27$; $P=.004$), and predisaster psychiatric disorder (for PTSD, 45% vs 26% for those without predisaster disorder; $\chi^2_1=6.86$; $P=.009$). Onset of PTSD was swift, with 76% reporting same-day onset. The relatively uncommon avoidance and numbing symptoms virtually dictated the diagnosis of PTSD (94% meeting avoidance and numbing criteria had full PTSD diagnosis) and were further associated with psychiatric comorbidity, functional impairment, and treatment received. Intrusive reexperience and hyperarousal symptoms were nearly universal, but by themselves were generally unassociated with other psychopathology or impairment in functioning.

Conclusions Our data suggest that a focus on avoidance and numbing symptoms could have provided an effective screening procedure for PTSD and could have identified most psychiatric cases early in the acute postdisaster period. Psychiatric comorbidity further identified those with functional disability and treatment need. The nearly universal yet distressing intrusive reexperience and hyperarousal symptoms in the majority of nonpsychiatrically ill persons may be addressed by nonmedical interventions of reassurance and support.

JAMA. 1999;282:755-762

www.jama.com

cluded documenting rates of postdisaster psychopathology, examining functional impact, and identifying predictors of these difficulties to help guide mental health intervention workers in future disasters. We anticipated that the scope and severity of this event would elicit higher rates of psychopathology than previous disasters studied using similar research methods.

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METHODS

Subjects

Declaration of all bombing-associated injuries and illnesses as reportable cases by the Oklahoma State Department of Health commissioner led to the development of a confidential registry of survivors, from which the study sample was drawn. The registry contained 1092 names of survivors directly exposed to the blast based on their proximity to the Murrah Building. Persons exposed only indirectly through search and rescue or clean-up efforts or by bereavement alone were not listed. Further detail on the development of the Oklahoma State Department of Health registry is provided in an earlier publication.⁸

Participation in the study was limited to subjects at least 18 years old. Those too severely injured to participate were excluded as ineligible. To commence with interviewing with minimal delay, the first 20 registry members to complete and return a preliminary health department survey of their demographics, exposure to the blast, injuries, and medical treatment were selected for this study. Subsequently, using an SAS computer program (SAS 6.12; SAS Institute Inc, Cary, NC), names of 242 additional eligible registry entries were randomly selected from the registry, which included 1 of the 20 nonrandomized subjects. Of the 261 subjects thus selected, 3 had left the country, 1 did not speak English, and 2 had died in the interim, precluding their participation. Of the 255 remaining subjects, 32 (13%) could not be contacted, 35 (14%) refused to be interviewed, 6 (2%) were not interviewed with no reason available, and 182 (71%) were interviewed.

Thirty-one percent of the study subjects were within 46 m of the bomb (distance selected for 99% of all deaths occurring within this radius) at the instant of detonation. All of these subjects were located in the Murrah building, except for 1 who was in the Athenian building, which stood across the street and was in the direct path of the blast. Another 51% were 46 to 184 m from the point of detonation in heavily damaged (YMCA, Water Resources, and

Journal Record buildings) or in less damaged buildings, or outdoors. The remaining 18% were more than 184 m from the detonation point.

The 35 individuals (16% of those located and eligible) who did not participate did not differ from study participants in age, sex, injury rates, or medical treatment received. Significantly more participants than nonparticipants were in the most heavily damaged buildings (79% vs 55%; $\chi^2_1 = 9.69$, $P = .002$), indicating that persons with less intense exposure may have been less likely to participate in the study.

The sample was representative of the health department's registry population with respect to sex and age. Compared with the registry population, significantly more study subjects had been in the most heavily damaged buildings (79% vs 66%; $\chi^2_1 = 11.25$, $P < .001$) and specifically in the Murrah building (31% vs 18%; $\chi^2_1 = 15.88$, $P < .001$).

The nonrandomly selected subjects did not differ from the 162 selected by randomization in demographics, pre-disaster psychiatric disorder, or any diagnosis made after the disaster. A higher proportion of them, however, were in the Murrah building (50% vs 27% of the others; $\chi^2_1 = 4.45$, $P = .04$). Removal of the 20 nonrandomly selected subjects from the sample effectively reduces the proportion of Murrah building occupancy from 31% to 27%, but the difference from the registry remains significant ($\chi^2_1 = 9.68$, $P = .002$).

Approval for the study was obtained from the Washington University School of Medicine Institutional Review Board, St Louis, Mo. All subjects provided written informed consent prior to participating.

Interviews

An average of 6 months (range, between August and December 1995, 4-8 months for most) after the event, subjects were interviewed using the Diagnostic Interview Schedule (DIS)/Disaster Supplement, which is based on the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition*¹⁰ (DSM-III-R), the operating criteria avail-

able during the design of longitudinal disaster studies.^{11,12} Diagnostic information was obtained for 8 psychiatric disorders: posttraumatic stress disorder (PTSD), major depression, panic disorder, generalized anxiety disorder, somatization disorder, alcohol use disorder, drug use disorder, and anti-social personality disorder. The interview also documented demographic data, level of functioning, and treatment received. The Disaster Supplement elicited subjects' disaster-related experience including exposure to the event, involvement of family and friends, and physical injuries. All interviews were administered by members of the Washington University disaster research team who received formal training to administer the DIS. Sixty-three percent of the interviews were conducted in person, but due to logistics in the field, 25% were conducted by telephone, and another 12% initiated in person were completed by telephone. No associations of any relevant variables with telephone interviews were identified in the data.

Data Analysis

Because individuals could have had PTSD resulting from other traumatic events besides the bombing, diagnoses and symptoms of bombing-associated PTSD were tabulated separately from those associated with other traumas. It is well established that traumatic events experienced by individuals in the community disproportionately strike persons with proclivities to psychopathology, suggesting that PTSD following sporadic traumas to individuals in the community may represent a somewhat different phenomenon from the PTSD arising from a community-wide disaster such as the bombing.¹ Therefore, 4 cases of PTSD unrelated to the bombing were excluded from calculation of postdisaster PTSD prevalence.

Associations between categorical variables were tested using χ^2 analyses, substituting Fisher exact tests when expected numbers in cells were less than 5. Linear regression analyses were performed to compare numeric variables.

For comparisons of means on repeated measures, McNemar tests were performed. Statistical significance was set at $\alpha < .05$.

RESULTS

Demographics and Disaster Experience

TABLE 1 displays the demographics of the sample, which had roughly equal sex representation and was largely white. Eighty-seven percent of study participants reported injuries sustained in the blast, and 77% overall had required medical intervention, including hospitalization (20%) and surgery (15%). The most prevalent injuries were lacerations (76%), followed by contusions (50%), skin-embedded glass or metal shards (46%), hearing loss (34%), and smoke or dust inhalation (23%).

Eighty-two percent of survivors reported witnessing others being injured or killed at the bombing scene, and 46% recalled thinking they were going to die during the event. Forty-three percent reported loss of a family member or friend in the bombing, and 92% personally knew someone injured or killed.

PTSD and Other Psychiatric Diagnoses

TABLE 2 displays rates of predisaster and postdisaster disorders. We deter-

mined incident and recurrent or persistent disorders by assessing whether the individual had met criteria for the same disorder at any time before the bombing. Overall, nearly half the sample met criteria for 1 or more psychiatric diagnoses after the disaster, with more than one third qualifying for a diagnosis of PTSD specific to the bombing. Women had at least twice the rate of PTSD as men (45% vs 23%, respectively; $\chi^2_1 = 9.44$; $P = .002$), major depression (32% vs 13%, respectively; $\chi^2_1 = 9.82$; $P = .002$), and generalized anxiety disorder (9% vs 0%, respectively, $P = .007$). Women were more likely to qualify for any postdisaster diagnosis (55% vs 34% for men; $\chi^2_1 = 8.27$; $P = .004$). No subjects met criteria for somatization disorder or antisocial personality disorder.

Table 2 also shows that 15% of the sample had experienced PTSD at some time before the bombing, and 43% had any predisaster lifetime diagnosis. Seventy-four percent of the subjects who experienced PTSD had not experienced it before the bombing, and 56% of subjects who experienced major depression had no history of it before the bombing. Preexisting major depression was especially likely to persist or recur after the bombing (78% of predisaster cases). Incident postdisaster substance use disorders were not observed. The majority of predisaster al-

cohol and drug use disorders were reported as inactive after the disaster. For all diagnoses except generalized anxiety disorder, postdisaster occurrence of the disorder was statistically associated with predisaster history of the same disorder.

Fifty-seven percent of subjects with bombing-related PTSD had a predisaster lifetime history of psychiatric illness. Subjects with a predisaster disorder were more likely than others to

Table 1. Demographics of Study Participants (N = 182)

Characteristic	No. (%) of Subjects
Sex	
Male	88 (48.4)
Female	94 (51.6)
Age, y	
18-29	19 (10.4)
30-44	84 (46.2)
45-64	74 (40.7)
≥65	5 (2.7)
Mean (SD), y [range]	43.0 (11.5) [19-89]
Race	
Non-Hispanic white	162 (89.0)
Black	16 (8.8)
Hispanic	2 (1.1)
Other	2 (1.1)
Education	
Less than high school	7 (3.8)
High school graduate	97 (53.3)
College graduate	45 (24.7)
Postgraduate	33 (18.1)
Mean (SD), y [range]	14.3 (2.2) [8-17]
Marital status	
Married	115 (63.2)
Widowed	8 (4.4)
Separated	4 (2.2)
Divorced	37 (20.3)
Single (never married)	10 (9.9)

Table 2. Predisaster and Postdisaster Diagnostic Disorders*

No. (%) of Subjects With Predisaster Disorder†	No. (%) of Subjects With Postdisaster Disorder‡								
	PTSD‡ 62 (34.3)	Major Depression 41 (22.5)	Panic Disorder 12 (6.6)	Generalized Anxiety Disorder 8 (4.4)	Alcohol Use Disorder 17 (9.4)	Drug Use Disorder 4 (2.2)	Any Non-PTSD Diagnosis 55 (30.2)	Any Diagnosis‡ 82 (45.1)	No Diagnosis 100 (54.9)
Subjects With Predisaster Disorder and Postdisaster Disorder									
PTSD, 27 (15.0)	16§	10	1	4	4	1	13	23§	4§
Major depression, 23 (12.6)	15	18§	5	4	4	1	18	18§	5§
Panic disorder, 5 (2.8)	4	5	4§	2	1	1	5	5§	0§
Generalized anxiety disorder, 5 (2.8)	4	4	2	3	1	1	4	5§	0§
Alcohol use disorder, 48 (28.7)	18	12	5	1	17§	2	23	30§	18§
Drug use disorder, 17 (9.4)	7	7	2	2	4	4§	10	11§	6§
Any predisaster disorder, 79 (43.4)	35	27	9	5	17	4	39	52	27
No disorder, 103 (56.6)	27	14	3	3	0	0	16	30	73

*Columns and rows do not sum because each subject could have more than 1 diagnosis.

†Percentages represent the total number of the 182 subjects.

‡Includes only cases with bombing-related posttraumatic stress disorder (PTSD).

§ $P < .05$.

experience bombing-related PTSD (45% vs 26% for those without a predisaster disorder; $\chi^2_1 = 6.86$; $P = .009$). All postdisaster disorders were significantly associated with history of predisaster psychopathology. Sixty-three percent of subjects with any active postdisaster psychiatric disorder had a predisaster diagnosis; ie, more than one third of those with a postdisaster disorder had never had a psychiatric disorder before the bombing. Conversely, 66% of subjects who had at least 1 predisaster psychiatric disorder had an active disorder afterward, compared with 29% of those who had no psychiatric history ($\chi^2_1 = 24.32$; $P < .001$).

In 63% of the cases, PTSD was accompanied by postdisaster comorbidity, occurring most often in 55% of the subjects with PTSD who also were diagnosed as having major depression. Only 9% of the sample subjects had a non-PTSD postdisaster diagnosis in the absence of PTSD. Only 4% of subjects without any predisaster disorder and no PTSD after the bombing had any non-PTSD diagnosis afterward compared with 48% of those with no predisaster disorder but who had bombing-related PTSD (Fisher exact $P < .001$). Conversely, 74% of the subjects who had preexisting psychopathology and

who were diagnosed as having postdisaster PTSD also had postdisaster comorbidity vs 30% of those with a predisaster disorder who did not experience PTSD ($\chi^2_1 = 14.98$; $P < .001$). Sixty percent of the bombing survivors had experienced a psychiatric disorder at some time in their lives either before or after the bombing.

Onset of PTSD was acute. Of 62 subjects with bombing-related PTSD, 47 (76%) reported immediate (same day) onset, another 11 (94% cumulative) in the first week, 3 more by the end of the first month (98% cumulative), and only 1 more between 1 and 6 months. Due to the timing of the index interviews, subjects had little or no time to develop delayed PTSD, defined in the *DSM-III-R*¹⁰ as onset more than 6 months after the traumatic event. Comparing onset information with 44 PTSD-producing traumas at some other time in their lives (for which there had been ample opportunity to observe timing of onset well beyond 6 months), 32 (73%) of the cases reportedly began the same day, and another 10 (95% cumulative) the same week. Two delayed-onset cases (5% of the total PTSD) were reported: 1 beginning between 6 and 12 months, and 1 more than 3 years afterward. Even though PTSD onset was very acute af-

ter the bombing, its course was chronic. Eighty-nine percent of subjects with bombing-related PTSD reported that they were still symptomatic during the month before the interview (which was at least 3 months after the bombing), defining their PTSD as chronic.¹⁰ Sixty-three percent of the entire sample, including those not meeting full PTSD criteria, acknowledged having experienced some disaster-related PTSD symptoms within the past month.

Functional Impairment, Coping, and Treatment

The effects of PTSD on occupational and social functioning reported by the subjects suggest the clinical importance of this disorder (TABLE 3). More than half of subjects with PTSD alone and the vast majority of those with comorbid PTSD reported that their PTSD symptoms interfered with their activities; similar numbers in each group were dissatisfied with their work performance after the disaster. Negative changes in personal relationships as a result of the bombing were acknowledged by 75% of subjects with PTSD compared with 27% of those without this diagnosis ($\chi^2_1 = 20.53$; $P < .001$). Diagnostic comorbidity with PTSD was specifically associated with effects on

Table 3. Functional Indicators of Posttraumatic Stress Disorder (PTSD) and Coping Measures by Diagnostic Subgroups*

	No. (%) of Subjects in Diagnostic Groups After Disaster				
	PTSD Only (n = 23)	PTSD and Comorbid Diagnosis (n = 39)	Non-PTSD Diagnosis Only (n = 16)	No Diagnosis (n = 98)	Total Sample (N = 176)
Functional Indicators					
Functional interference	12/23 (52.2)†	34/39 (87.2)†	4/15 (26.7)	14/85 (16.5)‡	64/162 (39.5)
Dissatisfaction with work performance	10/19 (52.6)	21/27 (77.8)†	4/13 (30.8)	34/86 (39.5)§	69/145 (47.6)
Permanently worsened relationships with					
Spouse or significant other	2/22 (9.1)	10/32 (31.3)†	3/14 (21.4)	4/87 (4.6)‡	19/155 (12.3)
Other household members	1/11 (9.1)	7/30 (23.3)	0/12 (0.0)	1/49 (2.0)§	9/102 (8.8)
Other relatives or friends	4/9 (44.4)¶	13/30 (43.3)†	3/12 (25.0)	5/50 (10.0)‡	25/101 (24.8)
Coping Measures					
Took medication	10/23 (43.5)	27/37 (73.0)†	4/15 (26.7)	22/89 (24.7)‡	63/164 (38.4)
Drank alcohol	3/23 (13.0)	12/37 (32.4)†	6/15 (40.0)†	5/89 (5.6)‡	26/164 (15.9)
Turned to family and friends	21/23 (91.3)	34/37 (91.9)	14/15 (93.3)	80/88 (90.9)	149/163 (91.4)

*Subjects with nonbombing specific PTSD and subjects for whom postdisaster diagnosis data were not available are excluded from this analysis. Numerators indicate the number of subjects reporting the presence of each item. Denominators indicate the total number of subjects in the diagnostic grouping who responded to each item.

† $P < .001$, compared with subjects with no diagnosis.

‡ $P < .001$, compared with subjects with a diagnosis.

§ $P < .05$, compared with subjects with a diagnosis.

|| $P < .01$, compared with subjects with no diagnosis.

¶ $P < .05$, compared with subjects with no diagnosis.

relationships with spouses and other household members. Nearly 40% of all the survivors used medication to cope, including about 25% of those who did not experience any postdisaster psychiatric disorder, and 73% of those with comorbid PTSD (Table 3). Only those persons with PTSD that was complicated by comorbidity were using medication or alcohol as a coping mechanism. Regardless of diagnostic status, turning to others for support was a nearly universal response.

Mental health treatment was abundant. Sixty-nine percent of the survivors received some kind of mental health intervention after the disaster; 40% had participated in debriefings and 41% had sought professional mental health treatment, but only 16% had been treated by a psychiatrist. Few individuals had received mental health intervention from their primary care phy-

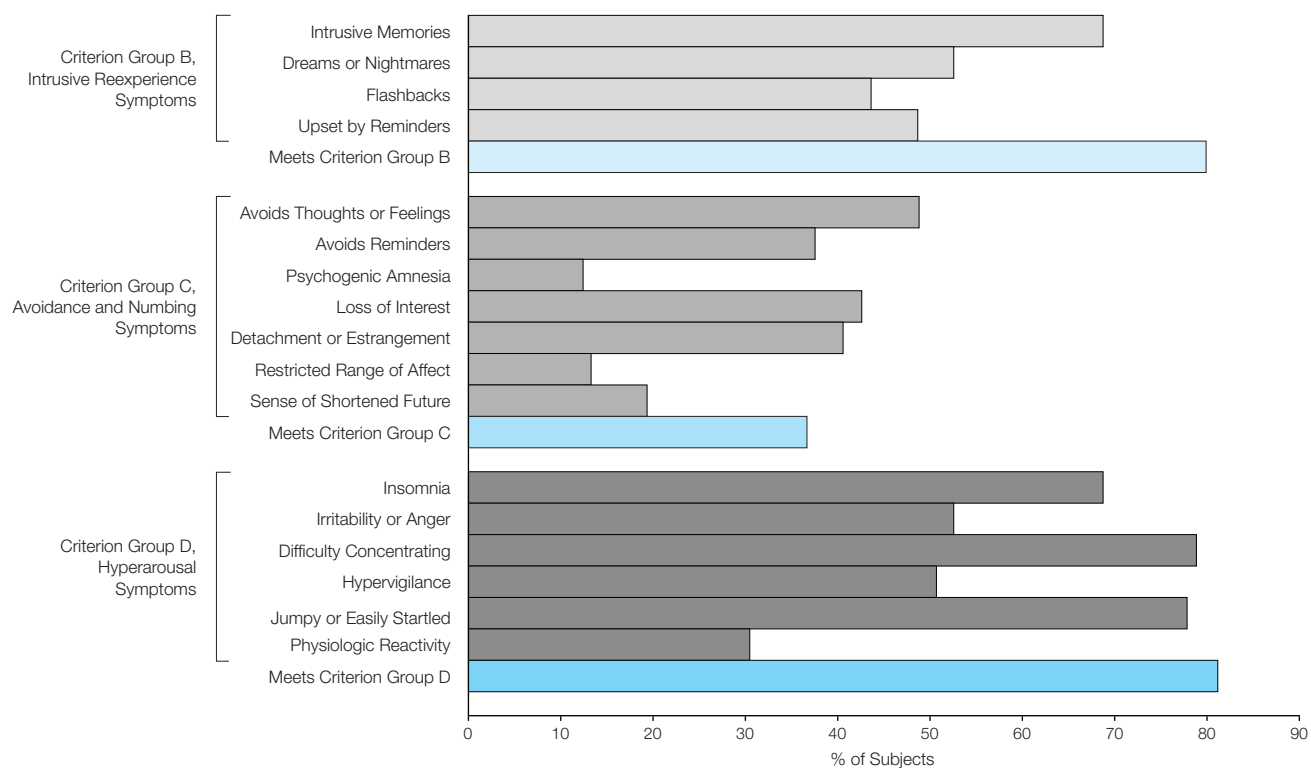
sician (5%) or pastor (3%). The highest rates of professional mental health services utilization were among those with comorbid PTSD (72%). Subjects who had PTSD but who did not have a postdisaster comorbid disorder did not use mental health services more often than those who had a comorbid disorder (39% vs 29%, respectively, $P = .32$; $\chi^2 = 0.978$).

PTSD Symptom Groups

FIGURE 1 shows the rates of each of the PTSD symptoms that are arranged by *DSM-III-R* symptom groups: group B (intrusive reexperience), group C (avoidance and numbing), and group D (hyperarousal). To be diagnosed as having PTSD, according to *DSM-III-R* criteria, a subject must first be exposed to a traumatic stressor, which the *DSM-III-R* defines as criterion A, and were exposed to an “event that is outside the range of

usual human experience and that would be markedly distressing to almost anyone.”¹⁰ The subject must then present with at least 1 of the symptoms from the intrusive and reexperience category (group B), have at least 3 symptoms from the avoidance and numbing category (group C), and at least 2 of the symptoms from the hyperarousal category (group D). These symptoms must last for at least 1 month and must be severe enough to cause subjective distress or functional impairment. PTSD symptoms were nearly universal: only 7 subjects (4%) reported no bombing-related PTSD symptoms. The 2 most commonly experienced symptoms were in the hyperarousal category: difficulty concentrating (78%) and exaggerated startle response (77%). The 3 least experienced symptoms were in the avoidance and numbing category: sense of foreshortened future (19%), restricted

Figure 1. Individual Posttraumatic Stress Disorder (PTSD) Symptoms and Criterion Groups



Because the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition*¹⁰ defines criterion A as exposure to an “event that is outside the range of usual human experience and that would be markedly distressing to almost anyone” as its criterion and does not list symptoms, criterion A was not included in this figure. The criterion groups are delineated with letters B, C, and D. The lighter bar in each group represents the percentage of persons meeting criterion for each group.

range of affect (13%), and psychogenic amnesia (12%).

The vast majority of survivors fulfilled criteria for intrusive reexperience and hyperarousal categories. Only one third of the total subjects fulfilled the avoidance and numbing criteria. The avoidance and numbing criteria were highly specific for the diagnosis of PTSD: 94% of the subjects who had fulfilled avoidance and numbing criteria met full PTSD criteria related to the bombing. By *DSM-III-R* requirement, all subjects meeting criteria for PTSD fulfilled the avoidance and numbing criteria (100% sensitivity).

FIGURE 2 shows that the avoidance and numbing criterion group was significantly associated with predisaster psychopathology and with postdisaster comorbidity, associations generally not observed in conjunction with intrusion and hyperarousal symptom

groups alone (when avoidance and numbing criteria were not met). The avoidance and numbing criterion group was also associated with receiving treatment, whereas intrusion and hyperarousal in its absence were not. As seen in Figure 2, the avoidance and numbing group (and to a much smaller extent, hyperarousal) was associated with reports of functional interference. The avoidance and numbing criterion group was also associated with dissatisfaction with work performance.

Other Predictors

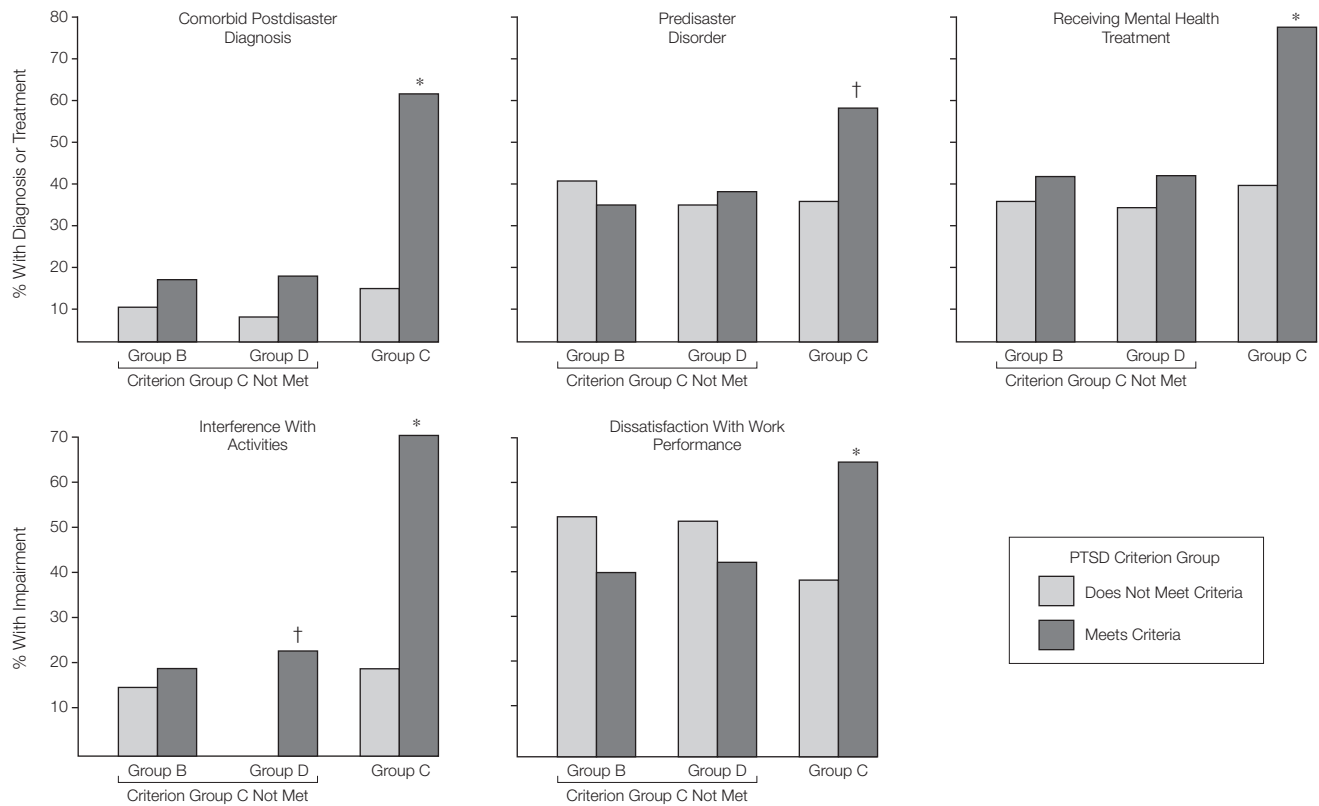
Subjects with postdisaster PTSD reported a mean (SD) of 5.7 (4.2) injuries, compared with 3.1 (2.4) injuries among others (Wilcoxon $z = 3.14$, $P = .002$). Those reporting injury or death of a family member or friend in the bombing had higher rates of PTSD than others (43% vs 25%; $\chi^2_1 = 5.02$, $P = .03$).

Variables associated with a non-PTSD disorder after the bombing included female sex (39% women vs 21% men; $\chi^2_1 = 7.71$, $P = .006$) and number of disaster-related injuries (4.6 [4.2] vs 3.4 [2.7]; $t = 2.35$; $P = .02$). Postdisaster major depression was not more prevalent among those who had lost a friend or relative in the disaster, nor was the number of depressive symptoms higher in this group. Controlling for the confounding effects of sex on education and marital status (women having less education and being more often divorced or separated compared with men), these 2 variables were not associated with PTSD or other postdisaster psychopathology.

COMMENT

The Oklahoma City bombing provided a rare opportunity to study mental health effects resulting from a severely traumatic event in an essentially

Figure 2. Diagnosis, Treatment, and Functional Indicators Associated With Posttraumatic Stress Disorder (PTSD) Criterion Groups



In this figure, criterion group categories are not mutually exclusive, with the exception of categories group B and group D, which exclude those who met criterion group C. An asterisk indicates $P < .001$; a dagger, $P < .01$.

unselected population. This study documented extensive psychopathology in a highly exposed sample of direct victims of the blast.

Postdisaster Psychopathology

Nearly half the bombing survivors studied had an active postdisaster psychiatric disorder, and full criteria for PTSD were met by one third of the survivors. PTSD symptoms were nearly universal, especially symptoms of intrusive reexperience and hyperarousal.

An explosion in a Norwegian paint factory studied by Weisæth^{13,14} represented a similar type of disaster, although it was considerably smaller in scope and magnitude, with far less mortality and morbidity (6 fatalities, 2 incapacitating injuries, and another 21 minor injuries among 125 survivors). The high-exposure group had a 43% rate of PTSD at 10 weeks after the bombing, diminishing to 36% by 7 months. Only a few other disaster studies of nonmilitary populations have reported higher PTSD rates: 44% after the Buffalo Creek Dam break and floods,¹⁵ 53% after Australian bushfires,¹⁶ 54% after an airplane crash landing,¹⁷ and 50% to 100% after a plane crash into a shopping mall.¹⁸ Differences in research methods, such as use of unstructured interviews and self-report scales known to be associated with higher estimates of psychopathology,¹⁹ unfortunately preclude meaningful comparisons.

Comparison across disasters is possible within the Washington University research database on several different disaster events studied using uniform methods. The 34% rate of PTSD after the bombing was the highest of all the disasters studied to date by this team.^{4,20-24} Rates of PTSD in these other studies were 2% following a tornado,²² 28% after a mass shooting episode,²³ and 29% after a plane crash into a hotel.²⁰

The degrees of both occupational and social impairment associated with PTSD after the bombing demonstrate the clinical importance of this disorder. These functional effects of PTSD appeared to be mediated in large part by its psychiatric comorbidity. Major depression was

the most commonly associated disorder, and most preexisting depression recurred or persisted in the period after the bombing. No new cases of substance abuse were observed, consistent with previous findings^{20-23,25} pertaining to new postdisaster alcohol use disorders after other events studied by this team.

This study found several predictors of bombing-related PTSD: degree of disaster exposure (represented by number of injuries), female sex, preexisting psychopathology, and secondary exposure through loved ones (injury and death). Physical injuries and involvement of loved ones may represent specific mechanisms for generation of psychiatric sequelae of disasters. The predominance in postdisaster psychopathology in women has been reported in previous disaster studies^{4,13,14,23,26-29} and was not unexpected because the disorders classically observed after disasters—depression and anxiety disorders—are more prevalent among women in the general population. Preexisting psychopathology has also been identified as a robust predictor of PTSD by previous studies of this team^{4,20-24} and others.^{13,14,30-32} The 43% rate of lifetime pre-disaster psychiatric illness in the Oklahoma sample does not exceed the expected general population lifetime rates of 48% in a large population assessed with structured interviews³³ and is not significantly higher than rates of preexisting illness in other disaster sites studied by this disaster research team.^{20,23,24,34}

Observations on PTSD

This study provided important observations on the character and early course of PTSD following a particularly severe disaster. Symptom onset was rather immediate—usually the same day—and few other cases developed after the first month. This rapidity of onset is consistent with other traumatic events subjects had experienced and with findings of 2 other studies.^{24,34} In the Weisæth^{13,14} paint factory explosion study, 114 of 117 symptomatic subjects reported symptom onset within 5 hours, and the remaining 3 within 32 days.

The relatively uncommon postdisaster avoidance and numbing symptoms were virtually tantamount to the diagnosis. Avoidance and numbing symptoms were associated with preexisting and comorbid postdisaster psychopathology, functional impairment, use of medication and alcohol to cope, and treatment received—unlike the more prevalent intrusive reexperience and hyperarousal symptoms only, which did not show these associations. These observations confirm this team's previously published findings in studies of an earthquake in Northridge, Calif,²⁴ and a mass murder episode at a cafeteria in Killeen, Tex.³⁴

Implications for Mental Health Intervention and Policy in the Postdisaster Setting

Because virtually all the cases of PTSD started acutely after the bombing, the most efficient plan would be to expedite large-scale efforts to identify survivors with psychiatric illness as soon as possible. Because most individuals with any psychiatric disorder had PTSD, focusing on PTSD could identify most cases for triage to psychiatric care. Shortages of resources encountered in acute disaster settings make it important to focus attention on those at greatest risk for PTSD. This study found highest risk among women, individuals with more direct and indirect disaster exposure (defined by the number of personal injuries and secondary exposure through loved ones), and subjects with a pre-disaster psychiatric history. The data indicate that PTSD may be readily and efficiently identifiable with truncated assessment for avoidance and numbing criteria only.

Once PTSD is identified, as suggested by the comorbidity data collected from the Oklahoma bombing, clinicians would be well advised to continue searching for other psychopathology, a finding verified elsewhere in the literature.^{20,24,34} These data suggest that subjects with comorbidity will be significantly more impaired by their psychopathology. The chronicity of PTSD identified in this study (with 9 of 10

cases still symptomatic at interview an average of 6 months after the disaster, fulfilling DSM-IV³⁵ criteria of at least 3 months' duration for chronicity) indicates that availability of ongoing treatment of PTSD is essential.

In the absence of avoidance and numbing, the nearly ubiquitous intrusive reexperience and hyperarousal symptoms were associated with little to no functional impairment or psychiatric comorbidity. This suggests different management strategies for these normative yet distressing symptoms from the professional assessment and intervention generally advised for avoidance and numbing responses. The nonpathological nature of intrusion and hyperarousal symptoms uncomplicated by avoidance and numbing suggests that after major psychiatric illness is ruled out, these symptoms may be managed by nonphysician mental

health professionals with nonmedical interventions such as public and workplace debriefings. The therapeutic tools for these uncomplicated intrusion and hyperarousal syndromes will be education, general support, and reassurance that the symptoms are normal and not evidence of impending psychiatric illness.

Research Limitations and Future Work

Because the study sample was slightly skewed toward proximity to the blast, the findings may reflect a mildly elevated estimate of psychiatric impact of the disaster population as a whole. Two major strengths of the study are its random sampling that maximized the general representativeness of the registry population and the structured research interview that generated psychiatric diagnoses. The cross-sectional nature of

assessment at a single time, however, limits findings to description of only the first 6 months after the event. Further study is needed to chart the course of postdisaster psychiatric disorders over a longer period, to observe for the development of delayed cases of PTSD, and to identify predictors of chronicity vs recovery, including potential effects of treatment. Naturalistic observation studies such as this one suffer from confounding of outcomes with seeking treatment whose benefits cannot be assessed under the available design. Additional study with uniformly applied methods across various disaster events will allow merging the data to generate statistical power for untangling disaster-specific confounders, modeling complex hypotheses, and generalizing across events.³⁶

Funding/Support: This research was supported by research grant MH40025 from the National Institute of Mental Health, Bethesda, Md.

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