Acute Stress Disorder, Posttraumatic Stress Disorder, and Depression in Disaster or Rescue Workers

Carol S. Fullerton, Ph.D.
Robert J. Ursano, M.D.
Leming Wang, M.S.

Objective: The events of Sept. 11, 2001, highlighted the importance of understanding the effects of trauma on disaster workers. To better plan for the health care of disaster workers, this study examined acute stress disorder, posttraumatic stress disorder (PTSD), early dissociative symptoms, depression, and health care utilization in disaster workers.

Method: Exposed disaster workers (N=207) and unexposed comparison subjects (N=421) were examined at 2, 7, and 13 months after an airplane crash.

Results: Exposed disaster workers had significantly higher rates of acute stress disorder, PTSD at 13 months, depression at 7 months, and depression at 13 months than comparison subjects. Those who were younger and single were more likely to develop acute stress disorder. Exposed disaster workers with acute stress disorder were 3.93 times more likely to be depressed at 7 months. Those with high exposure and previous disaster experience or who had acute stress disorder were more likely to develop PTSD. Similarly, those who were depressed at 7 months were 9.5 times more likely to have PTSD. Those who were depressed at 13 months were 7.96 times more likely to also meet PTSD criteria. More exposed disaster workers than comparison subjects obtained medical care for emotional problems at 2, 7, and 13 months. Overall, 40.5% of exposed disaster workers versus 20.4% of comparison subjects had acute stress disorder, depression, at 13 months, or PTSD.

Conclusions: Exposed disaster workers are at increased risk of acute stress disorder, depression, or PTSD and seek care for emotional problems at an increased rate.

Method

The Disaster

A United Airlines DC-10 carrying 355 passengers and crew was forced to crash-land after a midair explosion that caused failure of the plane’s hydraulic system. Upon landing, the plane broke apart and burst into flames. Some victims, still in their seats, were thrown from the aircraft. Others died in the burning fuselage. Of those aboard, 112 people died, 59 were seriously injured, and 184 survived.

Subjects

One month after the disaster, we contacted 440 exposed disaster workers assigned to the airport disaster and the rescue response team. We also contacted 700 disaster and rescue workers at a similar-sized community and airport approximately 90 miles away who were matched for socioeconomic level, geography, and urban/rural location as a potential comparison group. After describing the study, 207 exposed disaster workers (mean age=36.8, SD=9.7) and 421 of the comparison group (mean age=36.2, SD=9.9) agreed to participate, signed informed consent, and completed assessments. Participants in the study were similar to those who did not participate in age and gender. The median date for completion of the time 1 assessment was 2 months postdisaster (90% completed within 16 days of the median), time 2 was 7 months postdisaster (90% completed within 56 days) (exposed disaster workers, N=161; comparison group, N=283), and time 3 was 13 months postdisaster (90% completed within 22 days) (exposed disaster workers, N=116; comparison group, N=217). Within the exposed group and the comparison group, the com-
pleters did not differ from the noncompleters on any demo-
graphic variables.

Assessments

Acute stress disorder and PTSD were assessed for exposure to
this disaster. Acute stress disorder was assessed for the week after
the disaster at the first assessment by using a previously validated
measure that was modified according to the recommendation of
Staab et al. (12) to require at least three of the possible five disso-
ciative symptoms of criterion B (e.g., “feeling numb,” “feeling as if
it hadn’t happened or wasn’t real”) to meet the DSM-IV criteria for
acute stress disorder. In order to measure early dissociative symp-
toms, we created two variables: the presence of any early disso-
ciative symptoms and the number of early dissociative symp-
toms. We identified PTSD at 13 months by using the DSM PTSD-

Statistical Analyses

Comparisons between exposed disaster workers and compari-
sion subjects were made with chi-square analyses and t tests, as
appropriate. Potential risk factors for acute stress disorder, PTSD,
and depression were evaluated by univariable logistic regres-
sions, multivariable logistic regression, and chi-square analyses.
We chose risk factors that were variables of clinical importance in
workers that might be seen in order to identify risk factors for
acute stress disorder, PTSD, and depression. We examined several
multivariable models to address 1) clinical questions relating to
previous disaster experience or disaster exposure.

Results

Rates of Acute Stress Disorder,
PTSD, and Depression

There were no differences between the exposed disaster
workers and the comparison subjects on demographic characteristics at any assessment point (Table 1). There
were no differences between the exposed disaster workers
(N=19, 9.2%) and the comparison subjects (N=51, 12.2%)
on previous disaster experience. The exposed disaster
workers had significantly higher rates of acute stress disor-
der than the comparison subjects (25.6% versus 2.4%) (p=
0.001) (Table 2). The exposed disaster workers had signifi-
cantly higher rates of PTSD at 13 months (16.7% versus
1.9%) (p=0.001) and depression at 7 months (16.4% versus
10.0%) (p=0.05) and at 13 months (21.7% versus 12.6%)
(p<0.03).

Risk Factors for Acute Stress Disorder
in Exposed Disaster Workers

We examined gender, age, education, marital status,
previous disaster experience, and disaster exposure as
risk factors for acute stress disorder. Exposed disaster
workers who were younger were at greater risk of acute
stress disorder (odds ratio=0.35, 95% CI=0.18–0.68, p=
0.002). Of the married subjects, 30 (20.7%) had acute
stress disorder, while 23 (37.1%) of the unmarried sub-
jects had acute stress disorder (χ²=6.14, df=1, p=0.01). Un-
married subjects were 2.26 times more likely to develop
acute stress disorder than those who were married (95%
CI=1.18–4.34, p<0.02). Acute stress disorder was not re-
lated to any other demographic characteristic nor to pre-
vious disaster experience or disaster exposure.

Risk Factors for PTSD
in Exposed Disaster Workers

PTSD was not related to any demographic factors. Ex-
posed disaster workers with previous disaster experience
were 6.77 times more likely to develop PTSD at 13 months (95% CI=1.90–24.17, p<0.003) (Table 3). Because exposure may increase the risk for PTSD and was significant here, we adjusted for disaster exposure. Even after adjusting for exposure, previous disaster experience remained a significant risk factor for PTSD (odds ratio=6.34, 95% CI=1.70–23.61, p=0.006).

Exposed disaster workers with acute stress disorder were 7.33 times more likely to develop PTSD (95% CI=2.53–21.27, p<0.001). Exposed disaster workers who experienced early dissociative symptoms were no more likely to have PTSD at 13 months. However, the mean number of early dissociative symptoms of the 19 exposed disaster workers with PTSD was 2.95 (SD=1.7) compared to 1.77 (SD=1.3) in the 95 exposed disaster workers without PTSD (t=−3.43, df=112, p<0.001; odds ratio=1.82, 95% CI=1.25–2.66, p=0.002).

Exposed disaster workers who were depressed at 7 months were 9.5 times more likely to have PTSD at 13 months than those who were not depressed (95% CI=2.93–30.81, p<0.001). Of those exposed disaster workers with PTSD, slightly less than 50% also had comorbid depression. Exposed disaster workers who were depressed at 13 months were 7.96 times more likely to meet PTSD criteria (95% CI=2.72–23.26, p<0.001).

Exposed disaster workers with high exposure were more likely to have PTSD at 13 months (odds ratio=3.92, 95% CI=1.22–12.62, p=0.02). In particular, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Because PTSD and depression are often comorbid and previous disaster experience may theoretically sensitize to future acute stress disorder (and was a risk factor here), we adjusted for previous disaster experience and depression at 7 months. Of importance, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Exposed disaster workers with high exposure were more likely to have PTSD at 13 months (odds ratio=3.92, 95% CI=1.22–12.62, p<0.02). In particular, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Because PTSD and depression are often comorbid and previous disaster experience may theoretically sensitize to future acute stress disorder (and was a risk factor here), we adjusted for previous disaster experience and depression at 7 months. Of importance, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Exposed disaster workers with high exposure were more likely to have PTSD at 13 months (odds ratio=3.92, 95% CI=1.22–12.62, p<0.02). In particular, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Because PTSD and depression are often comorbid and previous disaster experience may theoretically sensitize to future acute stress disorder (and was a risk factor here), we adjusted for previous disaster experience and depression at 7 months. Of importance, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Exposed disaster workers with high exposure were more likely to have PTSD at 13 months (odds ratio=3.92, 95% CI=1.22–12.62, p<0.02). In particular, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).

Because PTSD and depression are often comorbid and previous disaster experience may theoretically sensitize to future acute stress disorder (and was a risk factor here), we adjusted for previous disaster experience and depression at 7 months. Of importance, exposed disaster workers who assisted survivors were 2.98 times more likely to have PTSD than those who did not assist survivors (95% CI=1.04–8.51, p<0.05).
experience (95% CI=1.39–20.96, p<0.02). Previous experience also remained a significant risk factor for PTSD (odds ratio=10.68, 95% CI=2.08–54.80, p=0.004) after adjustment for acute stress disorder and depression at 7 months.

**Risk Factors for Depression in Exposed Disaster Workers**

Depression at 7 months was not related to any demographic characteristic, previous disaster experience, or high exposure (Table 4). Exposed disaster workers who had acute stress disorder were 3.93 times more likely to be depressed at 7 months than those without acute stress disorder (95% CI=1.63–9.44, p=0.002). Exposed disaster workers who experienced early dissociative symptoms were no more likely to have depression at 7 or 13 months than those who did not experience early dissociative symptoms. However, the greater the number of early dissociative symptoms, the greater the risk for depression at 7 months (odds ratio=1.36, 95% CI=1.02–1.82, p=0.04). The mean number of early dissociative symptoms of the 26 exposed disaster workers with depression at 7 months was 2.69 (SD=1.4) compared to 2.02 (SD=1.5) in the 133 exposed disaster workers without depression at 7 months (t=−2.15, df=157, p=0.03). Exposed disaster workers with high exposure were more likely to develop depression at 13 months (odds ratio=3.50, 95% CI=1.15–10.64, p=0.03).

The risk for depression at 13 months was 3.16 times greater for those who were single compared to those who were married (95% CI=1.26–7.89, p<0.02) (Table 5). Exposed disaster workers with depression at 7 months were 24.38 times more likely to have depression at 13 months than those without 7-month depression (odds ratio=24.38, 95% CI=6.64–89.48, p<0.001). Because marital status was significantly related to depression at 13 months, we also adjusted for marital status in analysis for risk factors for depression at 13 months.

---

### TABLE 4. Relation of Possible Risk Factors to Depression 7 Months After Disaster Workers’ Exposure to Trauma

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Exposed Workers With Risk Factor</th>
<th>Exposed Workers Without Risk Factor</th>
<th>Analysis</th>
<th>Likelihood of Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N %</td>
<td>N %</td>
<td>Wald χ² (df=1) p</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>Demographic characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woman</td>
<td>4 19.0</td>
<td>22 15.9</td>
<td>0.13</td>
<td>0.72</td>
</tr>
<tr>
<td>Age ≤37 (years)</td>
<td>14 17.7</td>
<td>12 15.0</td>
<td>0.21</td>
<td>0.64</td>
</tr>
<tr>
<td>High school or less education</td>
<td>6 17.1</td>
<td>20 16.1</td>
<td>0.01</td>
<td>0.92</td>
</tr>
<tr>
<td>Single</td>
<td>10 20.4</td>
<td>16 14.5</td>
<td>0.84</td>
<td>0.36</td>
</tr>
<tr>
<td>Previous disaster experience</td>
<td>5 29.4</td>
<td>21 14.9</td>
<td>2.22</td>
<td>0.14</td>
</tr>
<tr>
<td>Disaster exposure (high)</td>
<td>6 26.1</td>
<td>20 14.7</td>
<td>1.81</td>
<td>0.18</td>
</tr>
<tr>
<td>Disaster exposure type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed to dead bodies</td>
<td>22 21.8</td>
<td>4 6.9</td>
<td>5.37</td>
<td>0.02</td>
</tr>
<tr>
<td>Assisted survivors</td>
<td>15 19.5</td>
<td>11 13.4</td>
<td>1.06</td>
<td>0.30</td>
</tr>
<tr>
<td>Put in physical danger</td>
<td>7 21.9</td>
<td>19 15.0</td>
<td>0.88</td>
<td>0.35</td>
</tr>
<tr>
<td>Early dissociative symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any symptoms</td>
<td>24 18.0</td>
<td>2 7.7</td>
<td>1.59</td>
<td>0.21</td>
</tr>
<tr>
<td>Number of symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute stress disorder</td>
<td>13 32.5</td>
<td>13 10.9</td>
<td>9.34</td>
<td>0.002</td>
</tr>
</tbody>
</table>

a 7 months, N=161. Ns vary slightly owing to missing data.

### TABLE 5. Relation of Possible Risk Factors to Depression 13 Months After Disaster Workers’ Exposure to Trauma

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Exposed Workers With Risk Factor</th>
<th>Exposed Workers Without Risk Factor</th>
<th>Analysis</th>
<th>Likelihood of Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N %</td>
<td>N %</td>
<td>Wald χ² (df=1) p</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>Demographic characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woman</td>
<td>6 31.6</td>
<td>19 19.8</td>
<td>1.27</td>
<td>0.26</td>
</tr>
<tr>
<td>Age ≤37 (years)</td>
<td>11 22.9</td>
<td>14 20.9</td>
<td>0.07</td>
<td>0.80</td>
</tr>
<tr>
<td>High school or less education</td>
<td>8 40.0</td>
<td>17 19.5</td>
<td>0.21</td>
<td>0.65</td>
</tr>
<tr>
<td>Single</td>
<td>13 36.0</td>
<td>12 15.0</td>
<td>6.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Previous disaster experience</td>
<td>3 25.0</td>
<td>22 21.6</td>
<td>0.07</td>
<td>0.79</td>
</tr>
<tr>
<td>Disaster exposure (high)</td>
<td>7 43.8</td>
<td>18 18.2</td>
<td>4.88</td>
<td>0.03</td>
</tr>
<tr>
<td>Disaster exposure type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed to dead bodies</td>
<td>19 25.3</td>
<td>6 15.0</td>
<td>1.60</td>
<td>0.21</td>
</tr>
<tr>
<td>Assisted survivors</td>
<td>15 28.3</td>
<td>10 16.1</td>
<td>2.44</td>
<td>0.12</td>
</tr>
<tr>
<td>Put in physical danger</td>
<td>7 30.4</td>
<td>18 19.6</td>
<td>1.26</td>
<td>0.26</td>
</tr>
<tr>
<td>Early dissociative symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any symptoms</td>
<td>20 21.5</td>
<td>5 22.7</td>
<td>0.02</td>
<td>0.90</td>
</tr>
<tr>
<td>Number of symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute stress disorder</td>
<td>8 32.0</td>
<td>18 20.0</td>
<td>1.58</td>
<td>0.21</td>
</tr>
<tr>
<td>Depression at 7 months</td>
<td>13 76.5</td>
<td>10 11.8</td>
<td>23.17</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

a 7 months, N=161; 13 months, N=116. Ns vary slightly owing to missing data.
depression at 13 months. Reanalysis of risk factors for depression at 13 months after adjustment for marital status did not alter any results.

**Health Care Utilization in Disaster Workers**

During the 13 months after the crash, 15.1% (N=15) of exposed disaster workers compared to 4.0% (N=7) of the unexposed comparison subjects obtained medical care for emotional problems ($\chi^2=10.45, df=1, p=0.001$). Of the exposed disaster workers, 17.2% (N=17) reported needing any type of medical care (emotional or physical) but not obtaining any compared to 5.8% (N=10) of the comparison subjects ($\chi^2=8.93, df=1, p=0.003$). There were no differences between the exposed disaster workers and the unexposed comparison subjects on obtaining medical care for physical problems or annual physicals. Specifically, the exposed disaster workers were more likely to obtain medical care for emotional problems at each assessment point: at 2 months (N=13, 6.4%, versus N=5, 1.2%) ($\chi^2=12.9, df=1, p<0.001$), at 7 months (N=14, 9.0%, versus N=5, 1.8%) ($\chi^2=11.84, df=1, p=0.001$), and at 13 months (N=5, 4.4%, versus N=2, 1.0%) ($\chi^2=3.86, df=1, p=0.05$). More exposed disaster workers felt they needed medical care at 2 months (N=7, 3.5%, versus N=4, 1.0%) ($\chi^2=4.75, df=1, p<0.03$), but not at any other time.

**Discussion**

Disaster workers have infrequently been studied empirically (19–22). To our knowledge, there are no other large-scale longitudinal prospective studies of rescue and exposed disaster workers with a comparison sample that have examined acute stress disorder, PTSD, and depression. Our study indicates that exposed disaster workers are at an increased risk of acute stress disorder, PTSD, and depression. In addition, exposed disaster workers seek care for emotional problems at a rate nearly four times that of the comparison group. Nearly 40.5% of the exposed disaster workers in this 13-month study met criteria for at least one diagnosis.

Acute stress disorder has not previously been examined in disaster workers. The rates of acute stress disorder we found (25.6%) compare to the rates of acute stress disorder in motor vehicle accident survivors (13%) (19) and in survivors of typhoons (7.2%) (12). Although several studies of disaster workers have found that acute symptoms are predictive of posttraumatic stress symptoms (10, 11), none has examined the association of acute stress disorder and PTSD. We found that exposed disaster workers with acute stress disorder were 7.33 times more likely to meet PTSD diagnostic criteria at 13 months. Approximately 42% of those with acute stress disorder developed PTSD. This compares with reports that 30.4% of those with acute stress disorder after a typhoon developed PTSD at 8 months (12), and 78% of motor vehicle accident survivors diagnosed with acute stress disorder met criteria for PTSD 6 months after their accident (23).

The rates of PTSD we found (16.7%) are similar to the rates of PTSD found by McFarlane and Papay (24) in firefighters exposed to a bushfire (12.5%). Approximately 34% of the people exposed to the Oklahoma City bombing developed PTSD 6 months after the disaster (25), while the rates of PTSD after a tornado and a flood were 15% at 4 months and 21% at 16 months (26). Women have generally been found to have higher rates of PTSD (27, 28). However, our sample had a relatively small number of women, which may explain why we found no gender differences in the rates of PTSD.

The increased rate of depression at 7 months (16%) and the even higher rate at 13 months (21.7%) indicate the importance of this diagnosis to health care planning for disaster workers. Few well-designed studies have examined depression after a traumatic event, particularly in rescue or disaster workers. Approximately 8.5% of firefighters exposed to a bush fire met criteria for depression at 42 months (24). Nearly 23% of the individuals directly exposed to the Oklahoma City terrorist bombing had major depression at 6 months (25).

Exposed disaster workers with more early dissociative symptoms were at greater risk for PTSD and depression at 7 months. Early dissociative symptoms have been found to be predictive of PTSD (10, 29) but have not previously been reported as a predictor of depression. Identification of early dissociative symptoms may identify individuals for early pharmacological or behavioral interventions. The neurobiology of early dissociative symptoms and their relationship to depression and PTSD require further study (30, 31).

The contribution of previous experience with disasters to future risk is of particular importance for occupational groups repeatedly exposed to disasters (e.g., police, firefighters). Whether previous disaster experience sensitizes or inoculates against future risk is a complex issue that has implications for training. In addition, sensitization versus inoculation may be important to unsuccessful versus successful coping after trauma and to the possible development of PTSD. Further study is needed. Our results indicate that exposed disaster workers with previous disaster experience are 6.77 times more likely to develop PTSD. Previous disaster experience is a complex variable that includes previous trauma exposure, training opportunities, and the possibility of past PTSD (32). Our findings are consistent with other evidence that previous disaster exposure predisposes to the development of acute stress disorder (33) and PTSD (34, 35). Several recent studies of nonprofessionals exposed to traumatic events have shown that previous PTSD, but not past trauma alone, may be the critical variable predicting PTSD after a new trauma exposure (36, 37).

Several important limitations should be considered in interpreting the results of our study. A larger number of
subjects would have been preferable in order to increase confidence in our results. Although we used self-reports to assess both predictor and outcome variables and did not have lifetime diagnoses, we used validated scales and scale items and a well-matched comparison group. Recall is a difficulty for the measure of acute stress disorder and early dissociative symptoms. Rates may have been influenced by recall bias. However, the direction of any possible recall bias is not known. Those with higher symptoms at 2 months may recall more symptoms, and alternatively, exposed disaster workers may minimize recall of symptoms. In order to generalize our findings to other disaster populations, a more diverse sample allowing for examination of other possible contributions of demographic variables would also have been preferable. With these limitations in mind, health care planning for disaster workers should address the exposed disaster workers’ increased risk of acute stress disorder, PTSD, and depression. Further study of mental health care needs of disaster workers and other first responders is needed.

Received Aug. 21, 2002; revisions received March 27 and Nov. 10, 2003; accepted Nov. 18, 2003. From the Center for the Study of Traumatic Stress, Department of Psychiatry, Uniformed Services University of the Health Sciences. Address reprint requests to Dr. Fullerton, Center for the Study of Traumatic Stress, Department of Psychiatry, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Rd., Bethesda, MD 20814–4799; cf ullerton@erols.com.

References


Am J Psychiatry 161:8, August 2004

http://ajp.psychiatryonline.org 1375
31. Ursano RJ, Fullerton CS: Posttraumatic stress disorder: cerebro-
lar regulation of psychological, interpersonal, and biological
responses to trauma? Psychiatry 2000; 62:325–328
32. Raphael B: When Disaster Strikes: How Individuals and Com-
munities Cope With Catastrophe. New York, Basic Books, 1986
33. Barton A, Blanchard EB, Hickling EJ: Antecedents and conse-
quences of acute stress disorder among motor vehicle accident
34. Breslau N, Davis GC, Andreski P, Peterson E: Traumatic events
and posttraumatic stress disorder in a urban population of
young adults. Arch Gen Psychiatry 1991; 48:216–222
35. North CS, Smith EM, Spitznagel EL: Posttraumatic stress disor-
der in survivors of a mass shooting. Am J Psychiatry 1994; 151:
82–88
trauma exposure on the symptomatic response to a subse-
37. Ursano RJ, Fullerton CS, Epstein RS, Crowley B, Kao T-C, Vance
K, Craig KJ, Dougall AL, Baum A: Acute and chronic posttrau-
matic stress disorder in motor vehicle accident victims. Am J
Psychiatry 1999; 156:589–595