Sequelae of traumatic stress: psychopathology, cortisol, and attentional function in the aftermath of a disaster
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Chapter 2

The course of mental disorders after a disaster: predictors and co-morbidity

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Summary

In current longitudinal disaster-studies they usually only focus on posttraumatic stress disorder (PTSD), while several other mental disorders showed increased risks and comorbidity between disorders is common. To obtain an insight into the course of post-disaster psychopathology a community sample of survivors of the Enschede fireworks disaster was followed from two-three weeks to four years post-disaster. Diagnostic interviews (CIDI) and childhood stressor interviews were administered at two years post-disaster ($n = 260$), the CIDI was repeated at four years post-disaster ($n = 201$, response rate 77.3%). At two years post-disaster many survivors (40.6%) suffered from PTSD (21.8%), specific phobia (21.5%) and/or depression (16.1%). These disorders were highly comorbid. At four years post-disaster prevalence significantly diminished. Instead of full recovery, diagnostic classifications shifted in several survivors over time. This resulted in low PTSD rates but still elevated rates for depression and specific phobia. The course of the three entangled disorders PTSD, depression and specific phobia was further studied by constructing four groups of survivors based on the diagnostic status at two and four years post-disaster: healthy, recovered, chronic and delayed-onset. Initial depressive symptoms, maternal dysfunction, childhood physical abuse, and disaster exposure were found to discriminate between the groups, predicting long-term psychopathology.
THE COURSE OF MENTAL DISORDERS AFTER A DISASTER: PREDICTORS AND CO-MORBIDITY

Introduction

Disasters are collectively experienced traumatic events with a severe impact which affect large numbers of people. They are characterised by a loss of personal, community, and physical resources for survivors. Following a disaster, survivors may start to suffer from mental health disturbances, such as PTSD and depressive disorders. Depending on the origin of the disaster, prevalence of PTSD in the community varied between 4 - 17% for man-made disasters (e.g. bombing, terrorist attack), 0.4% - 44.6% for technological disasters (e.g. mining disaster, industrial explosion), and 5 - 23% for natural disasters (e.g. earthquake, tsunami, flood) (Neria, Nandi, & Galea, 2008). Post-disaster prevalence of depression is assessed to a lesser extent. However, six months post-disaster rates appear consistent across populations: 12.4% World Trade Centre attacks in New York City (Ahern & Galea, 2006), and 14.8% Mexican flood and mudslides of 1999 (Norris, Murphy, Baker, & Perilla, 2004). Yet, in addition to PTSD and depression, the genesis of other mental health disorders such as substance abuse disorders (e.g. alcoholism (Zucker & Gomberg, 1986), and anxiety disorders (e.g. specific phobia (Onder, Tural, Aker, Kilic, & Erdogan, 2006) is widely recognised. In the latter study the prevalence of psychopathology at three years was similar for PTSD (11.7%), depression (10.5%), and specific phobia (10.0%).

The course of psychopathology post-disaster appears to takes four forms (Bonanno, 2004; Wadsworth, Santiago, & Einhorn, 2009). Some individuals are resilient in the face of disaster and do not have clinical levels of mental health symptoms. Another group, termed chronic, meets criteria for clinical psychological problems at multiple assessments. A third group shows symptoms initially that recover over time, and a fourth group emerges, where clinical symptoms have a delayed-onset, showing up only at a subsequent re-assessment.

In current longitudinal trauma-studies, however, it is common to refer to groups of survivors as ‘recovered’ or ‘delayed-onset’ while only PTSD is addressed, even though comorbidity between mental health disorders is very common, particularly in PTSD. Population based samples reported comorbidity rates of PTSD and at least one other mental health disorder of 79% for women and 88% for men (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). High comorbidity seems to logically ensue from the current PTSD classification, since it is composed of symptoms that characterizes both major
depression (e.g. sleeping problems), and anxiety disorders (e.g., avoidance) (Brown, Chorpita, & Barlow, 1998; Mineka, Watson, & Clark, 1998). Recent trends in the field of psychopathology attempt to deal with the overlap in constructs of mental health disorders in the current diagnostic classes of DSM-IV. Since the mood and anxiety disorders may be described by an overarching set of three temperamental factors, negative affect, positive affect, and physiological hyperarousal, it is suggested that these disorders should be subsumed together in an overarching class of emotional disorders (Watson, 2005).

This study aimed to investigate the prevalence, course and comorbidity of a comprehensive picture of psychopathology in disaster survivors. Furthermore, we searched for determinants that discriminated between groups of survivors that were mentally healthy, recovered, had a chronic or a delayed-onset of prevalent mood and anxiety disorders post-disaster. We specifically chose to study the course of groups with PTSD, depression and specific phobia, because of their overlap in symptoms. The following variables known to predict PTSD were studied for their influence on the course of psychopathology: socio-demographics, exposure to trauma in childhood, dysfunctional parent-child relationships, magnitude of disaster-exposure, and comorbidity of mental health disorders (Brewin, Andrews, & Valentine, 2000; Neria et al., 2008; Onder et al., 2006; Weich, Patterson, Shaw, & Stewart-Brown, 2009).

**Method**

*Participants / Procedure*

On May 13, 2000 a huge explosion in a central storage facility of a fireworks factory occurred in the city of Enschede, the Netherlands. The facility was situated in the middle of a residential area and severely damaged or destroyed 500 homes. Twenty-three people died and 1,000 people were injured. Approximately 4,500 adult residents were directly affected. The Dutch government declared it a national disaster (van der Velden, Yzermans, Kleber, & Gersons, 2007).

The health of affected residents 18 years and older living in the area at the time of the disaster was monitored in a longitudinal health survey. The study consisted of three waves of self-report questionnaires (T1, two–three weeks post-disaster; T2, 18 months post-disaster; and T3, almost four years post-disaster). Survivors were recruited by mail and announcements in the media. At T1, T2, and T3, respectively, 1567, 1116, and
995 affected residents participated (estimated response at T1 = 30%, T1 – T2 = 71% and T1 – T3 = 65%) (van der Velden et al., 2007). Following T2, the present study concerning the prevalence of psychopathology was launched. Of those survivors who participated in T1 and T2 and completed a questionnaires in Dutch (n = 859), a random sample of 602 cases was selected for this additional study. Of these 602 survivors 507 were recruited by telephone, and 266 (52.5%) completed a diagnostic (CIDI) and childhood stressor interviews face-to-face by trained interviewers at two years post-disaster. Six participants were unreliable, leaving 260 survivors. Reasons for non-participation were: unknown (n = 80; 15.8%), no contact (n = 54; 10.7%), unable/refused (n = 65; 12.8%), wanting to avoid remembering the disaster (n = 21; 4.1%); insufficient mastery of Dutch (n = 12; 2.4%); severely ill (n = 5; 1.0%); deceased (n = 2; .4%), moved abroad/to another part of the country (n = 2; .4%). The CIDI was repeated at four years (n = 201, response rate 77.3%). For this study three time points were included: two-three weeks, two and four years. Between two and four years Chi-square test and independent t-tests showed no selective drop-out either in terms of gender, age, education, or in PTSD, specific phobia, depressive disorder, depressive and PTSD symptom severity, or traumatic exposure (childhood abuse and disaster exposure).

Medical Ethics Committees (AMC, Amsterdam and TNO Zeist) approved the study protocols. All participants had supplied written informed consent. An incentive of €12 was given for participation in each phase.

Measures

The Computerized Dutch version of the Composite International Diagnostic Interview (CIDI; (World Health Organisation, 1997)) was used to determine mental health disorders in accordance with DSM-IV criteria (APA, 1994) and demographic data. The following modules were administered: mood, anxiety, substance-related disorder and somatoform disorder. In the PTSD section we inquired about PTSD symptoms associated with the fireworks disaster and an additional other event if survivors indicated that the latter was worse. This allowed us to identify all persons with PTSD (Breslau, Peterson, Poisson, Schultz, & Lucia, 2004) and compare the prevalence to the Dutch population. The CIDI has an excellent inter-rater reliability, good test–retest reliability and adequate validity (Andrews & Peters, 1998).
Childhood stressors were indexed by the Structured Trauma Interview (STI; (Draijer & Langeland, 1999)). Definitions for stressors before age 16 are (1) child physical abuse: recurrent and severe parental aggression; (2) child sexual abuse: pressured or forced sexual contact; (3) child witness of domestic violence; (4) early loss, including loss of a natural parent or caretaker by death, divorce, or prolonged separations before age 12; and (5) degree of parental dysfunction for each parent, which were composites of the following 7 items: dysfunction resulting from recurrent illness, nervousness, depression, use of sedatives, drugs, alcohol problems, and hospitalizations. The internal consistency of degree of dysfunction was reasonable (Cronbach’s \( \alpha \): dysfunction of mother, 0.64; dysfunction of father, 0.65). Concurrent validity of the STI was shown by comparisons with other instruments for the assessment of childhood trauma (Kooiman, Ouwehand, & ter Kuile, 2002) or childhood neglect (Draijer et al., 1999).

Severity of disaster exposure was measured at two-three weeks post-disaster. Survivors reported sensory exposure by using a list of 21 experiences (0 = no, 1 = yes) specifying what participants had seen, felt, heard, or smelled during or immediately after the disaster. Degree of exposure was based on the sum score (range 0 - 21) (van Kamp et al., 2006).

To determine the severity of PTSD, and depressive symptoms, participants completed three self-report measures at multiple time points.

The Dutch 15-item version of the Impact of Event Scale (IES) (van der Ploeg, Mooren, Kleber, van der Velden, & Brom, 2004) was administered to obtain scores for subscales of intrusive (7 items) and avoidance (8 items) symptoms that are rated 0 = not at all, 1 = seldom, 3 = sometimes or 5 = often, reflecting their occurrence in the past week (range 0-75). The reliability and structure of the Dutch IES proved to be adequate across various traumatic stressors. It has a robust structure, supporting the composition (Intrusions and Avoidance scale) of the original IES. At all measurement points of the survey, the internal consistency was excellent, Cronbach’s \( \alpha \geq .94 \).

As the 15-item IES has no information on the PTSD cluster hyperarousal the Self-Rating Scale for PTSD (SRS-PTSD) (Carlier, Lamberts, Van Uchelen, & Gersons, 1998) was added after the first wave of data collection to obtain a severity score for PTSD symptoms based on DSM-IV criteria. The internal consistency (Cronbach’s \( \alpha .96 \)) and inter-rater reliability of this self-report are found to be satisfactory. Participants were
asked specifically to consider the fireworks disaster when completing this measure and the IES.

The Dutch version of the Symptom Check List-90 (SCL-90) (Arrindell & Ettema, 2003) was administered to measure the severity of depressive symptoms (16 items). These items are scored on a 5-point Likert scale. At all measurement points of the survey, the internal consistency of the scale was excellent, Cronbach’s α ≥ .94.

Data Analysis

Four groups of survivors were constructed based on the course of PTSD, depression and specific phobia in the past 12 months. The groups consisted of survivors who were:

- **Healthy**: No psychopathology at both two and four years post-disaster \( (n = 98) \);
- **Recovered**: PTSD, depression and/or specific phobia at two years post-disaster, but no psychopathology at four years post-disaster \( (n = 38) \);
- **Chronic**: PTSD, depression and/or specific phobia at two and four years post-disaster \( (n = 27) \);
- **Delayed-onset**: No psychopathology at two years post-disaster and PTSD, depression and/or specific phobia at four years post-disaster \( (n = 10) \).

To ensure that the main psychological problems originated from the disaster, we excluded participants that had psychological problems preceding the disaster and did not subscribe their current problems to the event \( (n = 2) \).

Analysis of variance (ANOVA) with Bonferroni correction was used to examine whether groups differed in numeric variables. Discriminant analysis (DA) was used to build a predictive model of group membership for the course of psychopathology based on differences in characteristics of the groups observed with ANOVA \( (p < .10) \). We specifically chose a DA model with equal prior probabilities as this performs better than logistic regression for classifying groups when the outcome variable has more than two groups of unequal size (Hossain, Wright, & Petersen, 2002). All statistical tests were two-tailed, and \( p \)-value of less than .05 was considered statistically significant.
Results

Sample characteristics

At two years post-disaster participants had an average age of 48.1 years ($SD = 14.4$), and 58.6% were of the female gender. The mean number of years of education was 12.6 ($SD = 4.0$), and 78.5% of survivors were married or cohabiting.

Traumatic exposure and symptom severity

Survivors reported an average severity of disaster-exposure of 11.0 ($SD = 5.1$). Childhood physical and sexual abuse was reported by 6.8% and 14.1%, respectively. All symptom severity scores significantly declined over time (IES: 36.9 ($SD = 16.9$) at two-three weeks, 24.0 ($SD = 19.8$) at two years, 16.4 ($SD = 17.8$) at four years, $F = 155.32$, $df = 1.961$, $p < .001$; depressive symptoms: 29.8 ($SD = 12.2$) at two-three weeks, 24.1 ($SD = 10.3$) at two years, 23.2 ($SD = 9.3$) at four years: $F = 48.61$, $df = 1.514$, $p < .001$). Since SRS-PTSD and IES scores were highly correlated at two and four years post-disaster ($r = .85$ and $r = .83$, respectively), we chose to limit our analyses to the IES which was also administered at two-three weeks.

Prevalence of psychopathology at two and four years post-disaster

Figure 1 shows 12-month prevalence of psychopathology in survivors at two and four years post-disaster. Panic disorder (two year: $n = 3$; four year: $n = 2$), obsessive compulsive disorder (two year: $n = 6$; four year: $n = 6$), generalised anxiety disorder (two year: $n = 1$; four year: $n = 2$) and agoraphobia (two year: $n = 2$; four year: $n = 0$) were combined to the group ‘other anxiety disorders’. Alcohol (two year: $n = 7$; four year: $n = 5$) and drug (two years: $n = 1$; four years: $n = 0$) abuse and dependence were also merged. Somatoform disorder consisted of conversion disorder, pain disorder, and somatisation disorder.

At two years post-disaster PTSD (21.9%), specific phobia (21.5%), and depression (16.2%) were dominant (see Figure 1). Specific phobia consisted of the following subtypes: nature ($n = 34$), blood-injection ($n = 10$), animal ($n = 3$), and situational ($n = 21$). PTSD was solely disaster-related in 51 out of 57 subjects (89.5%). Although in the total
group of subjects with PTSD, depression and/or specific phobia 8 survivors reported psychological problems preceding the disaster, as many as 6 out of these 8 subjects still attributed their current problems to the disaster.

There were no statistically significant differences in PTSD, depression and specific phobia prevalence rates for men and women.

**Figure 1.** Twelve-Month Prevalence of Psychopathology Two and Four Years Post-disaster

![Graph showing prevalence of mental disorders](image-url)

* *p < .05, **p < .001

The percentage of survivors with PTSD, depression, specific phobia, social phobia, and somatoform disorders dropped significantly from two to four years, and the percentage of survivors without psychopathology in the past 12 months increased from 51.9% to 70.5%.

**Comorbidity rates at two years post-disaster**

At two years 62 out of 260 survivors (23.8%) suffered from one single 12-month mental disorder, while 31 (11.9%) had two, 22 (8.4%) had three, and 10 survivors (3.8%) had multiple co-existing disorders. Many survivors (40.6%) suffered from PTSD, depression and/or specific phobia. Comorbidity between two disorders was highest in PTSD with depression ($n = 25, 43.8\%$) and in PTSD with specific phobia ($n = 30, 52.6\%$). After taking all axis I disorders into account, 63.2% of survivors with PTSD had one or
more co-existing disorders, and 73.8% and 76.8% survivors with depression and specific phobia, respectively had at least one other mental health disorder.

*Shift in psychopathology from two to four years post-disaster*

An in-depth look at 12-month psychopathology in survivors who were healthy or suffered from PTSD, depression and/or specific phobia was performed to get insight into the course of psychopathology from two to four years \((n = 201)\). Survivors without PTSD, specific phobia, or depression who, however, suffered from other psychopathology were excluded from analysis. When survivors were healthy at two years, this was usually sustained over time (90.7%). In total 58.2% of survivors with PTSD, specific phobia, and/or depression at two years no longer met full diagnostic criteria of any mental health disorder at four years post-disaster. Nonetheless, although most survivors recovered from depression and specific phobia, approximately half as many developed a new onset of these disorders. Delayed-onset of one disorder was preceded in 18 out of 28 (64.3%) by another disorder. This regularly resulted in a shift in diagnostic classification. Over 10% of survivors with PTSD or specific phobia went on to be diagnosed with a delayed-onset of depression, while on the contrary survivors with depression at two years were hardly ever diagnosed with delayed-onset PTSD or specific phobia. Delayed-onset of PTSD without any mental health disorder in the participant’s history was unusual. Of all psychopathology, specific phobia often appeared to be a chronic disorder.

*Four groups based on the course of psychopathology*

Table 1 displays the four groups based on the course of PTSD, depression, and specific phobia \((n = 173)\). Due to incomplete data we lost 28 participants for analysis. Post-hoc analyses demonstrated that on all time points the IES and depressive symptom severity of healthy survivors were significantly lower than those in groups of recovered and chronic survivors. At two-three weeks and at four years post-disaster healthy survivors also had lower IES scores than survivors in the delayed-onset-group. Less severe depressive symptoms in the healthy versus the delayed-onset group was only seen at four years. Healthy survivors reported the least disaster exposure in comparison to recovered and chronic survivor groups. In contrast to the chronic group, healthy survivors had lower maternal dysfunction scores. Survivors in the chronic group had
more comorbid disorders, were more prone to have experienced childhood physical abuse and had higher IES scores at two years and higher depressive symptom severity scores at two and four years than recovered survivors.

**Prediction of the course of psychopathology**

Discriminant analysis showed that a model including the following variables was able to significantly discriminate the groups: disaster exposure severity, childhood sexual and physical abuse, maternal dysfunction, intrusions, avoidance and depressive symptoms at two-three weeks ($\lambda_r = .64, \chi^2 = 64.65, p < .001$). We specifically used symptom severity measures at two-three weeks post-disaster in the model instead of later measures, since these are more interesting in forecasting later functioning. The standardized function coefficients of depressive symptoms, maternal dysfunction, childhood physical abuse, and disaster exposure severity contributed most to distinguishing between the groups (.77, .39, .38, and .34, respectively). Childhood sexual abuse contributed to a lesser extent to the discriminant function (.13). Although, intrusions and avoidance at two-three weeks (-.11) did not contribute to the model, it was highly correlated with the overall discriminant function ($r = .56$). The classification results showed that the model correctly predicted 64.4% of healthy survivors, 36.1% of survivors who recover, 54.5% of survivors in the chronic group, and 50% of survivors with a delayed-onset, while by chance only 25% of survivors would be correctly appointed to each of the four groups.
Table 1. ANOVA of Socio-Demographics, Symptom Severity, and Traumatic Exposure in Groups of Survivors based on the Course of Psychopathology (PTSD, Depression, and Specific Phobia) from Two to Four Years Post-disaster ($n = 173$) \(^a\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Healthy ($n=98$)</th>
<th>Recovered ($n=38$)</th>
<th>Chronic ($n=27$)</th>
<th>Late-onset ($n=10$)</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females N (%)</td>
<td>58 (59.2%)</td>
<td>18 (47.4%)</td>
<td>16 (59.3%)</td>
<td>4 (40.0%)</td>
<td>2.70(b)</td>
</tr>
<tr>
<td>Males N (%)</td>
<td>40 (40.8%)</td>
<td>20 (52.6%)</td>
<td>11 (40.7%)</td>
<td>6 (60.0%)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>49.21 (14.86)</td>
<td>45.08 (12.24)</td>
<td>48.80 (11.82)</td>
<td>48.10 (18.16)</td>
<td>.81</td>
</tr>
<tr>
<td>Education yrs</td>
<td>12.96 (3.56)</td>
<td>13.08 (3.23)</td>
<td>11.89 (4.93)</td>
<td>10.70 (4.81)</td>
<td>1.60</td>
</tr>
<tr>
<td>Number of disorders at 2 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>16 (42.1%)</td>
<td>14 (51.9%)</td>
<td>-</td>
<td>11.37(**)</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>19 (50.0%)</td>
<td>4 (14.8%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>2 (5.3%)</td>
<td>5 (18.5%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>1 (2.6%)</td>
<td>4 (14.8%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Symptom severity scores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3 wks Intrusions and avoidance(^1)</td>
<td>31.05 (16.21)</td>
<td>40.24 (14.19)</td>
<td>45.76 (16.58)</td>
<td>49.33 (14.31)</td>
<td>9.32(***)</td>
</tr>
<tr>
<td>Depressive symptoms (^2)</td>
<td>24.78 (7.94)</td>
<td>32.14 (11.64)</td>
<td>38.80 (16.37)</td>
<td>31.38 (9.60)</td>
<td>13.34(***)</td>
</tr>
<tr>
<td>2 yrs Intrusions and avoidance(^3)</td>
<td>15.61 (15.53)</td>
<td>30.42 (17.49)</td>
<td>41.45 (17.51)</td>
<td>28.80 (20.33)</td>
<td>17.87(***)</td>
</tr>
<tr>
<td>Depressive symptoms (^4)</td>
<td>19.50 (4.69)</td>
<td>27.41 (9.48)</td>
<td>33.91 (16.77)</td>
<td>27.00 (10.25)</td>
<td>19.30(***)</td>
</tr>
<tr>
<td>4 yrs Intrusions and avoidance(^5)</td>
<td>8.88 (12.83)</td>
<td>20.47 (19.10)</td>
<td>31.16 (17.64)</td>
<td>30.55 (22.98)</td>
<td>17.22(***)</td>
</tr>
<tr>
<td>Depressive symptoms (^6)</td>
<td>19.25 (4.57)</td>
<td>23.65 (6.81)</td>
<td>30.69 (12.98)</td>
<td>27.61 (10.40)</td>
<td>18.37(***)</td>
</tr>
<tr>
<td>Traumatic exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>----</td>
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<td>----</td>
</tr>
<tr>
<td>Disaster exposure severity</td>
<td>9.97 (4.93)</td>
<td>12.52 (4.23)</td>
<td>13.56 (4.38)</td>
<td>12.10 (6.10)</td>
<td>5.44**</td>
</tr>
<tr>
<td>Childhood physical abuse N (%)</td>
<td>4 (4.2%)</td>
<td>1 (2.6%)</td>
<td>7 (25.9%)</td>
<td>0</td>
<td>12.42**</td>
</tr>
<tr>
<td>Childhood sexual abuse N (%)</td>
<td>11 (11.3%)</td>
<td>9 (23.7%)</td>
<td>7 (25.9%)</td>
<td>2 (20.0%)</td>
<td>5.71 b</td>
</tr>
<tr>
<td>Childhood adversities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early parental loss N (%)</td>
<td>13 (13.4%)</td>
<td>7 (18.4%)</td>
<td>5 (18.5%)</td>
<td>1 (11.1%)</td>
<td>1.19 b</td>
</tr>
<tr>
<td>Witness domestic violence N (%)</td>
<td>8 (8.4%)</td>
<td>3 (7.9%)</td>
<td>6 (22.2%)</td>
<td>1 (11.1%)</td>
<td>4.45 b</td>
</tr>
<tr>
<td>Maternal dysfunction</td>
<td>.55 (.108)</td>
<td>.74 (1.18)</td>
<td>1.42 (1.50)</td>
<td>1.10 (2.08)</td>
<td>3.59*</td>
</tr>
<tr>
<td>Paternal dysfunction</td>
<td>.34 (.68)</td>
<td>.47 (1.08)</td>
<td>.76 (.97)</td>
<td>.30 (.48)</td>
<td>1.84</td>
</tr>
</tbody>
</table>

a Survivors without PTSD, specific phobia, or depression who however had another mental health disorder were excluded from analysis.
b Fisher exact test; *p < .05. **p < .01. ***p < .001, two-tailed.

Post-hoc analyses (Bonferroni correction):
1 healthy vs recovered*; healthy vs chronic***; healthy vs late-onset**
2 healthy vs recovered**; healthy vs chronic***
3 healthy vs recovered**; healthy vs chronic***; recovered vs chronic*
4 healthy vs recovered**; healthy vs chronic***; recovered vs chronic*
5 healthy vs recovered**; healthy vs chronic***; healthy vs late-onset ***
6 healthy vs recovered*; healthy vs chronic***; healthy vs late-onset **; recovered vs chronic**
7 healthy vs recovered*; healthy vs chronic**
8 healthy vs chronic**; recovered vs chronic**
9 healthy vs chronic*
Discussion

This longitudinal study investigated the prevalence, course and comorbidity of psychopathology in a community sample of survivors after a devastating fireworks disaster in their residential area.

Prevalence of mental disorders

At two years post-disaster nearly half (48.3%) of survivors in our sample fulfilled criteria of a mental health disorder in the past 12 months. The most common disorders, PTSD (21.8%), specific phobia (21.5%), and depression (16.1%), were apparent in 40% of survivors. High 12-month comorbidity rates between these three disorders were found, and more than half of these survivors suffered from two or more co-existing disorders. Except for two cases PTSD was disaster-related. Interviewers orally reported that specific phobia consisted to a large extent of a fear of thunder storms, with an obvious sensory association to the fireworks explosions. In accord with previous findings (North, Kawasaki, Spitznagel, & Hong, 2004) substance abuse had not developed in response to the disaster or as part of coping with its aftermath. At four years post-disaster psychological problems significantly diminished, and 12-month prevalence rates had dropped to 4.5 % PTSD, 9.5% depression, and 12.4% specific phobia. In comparison to the Dutch population, PTSD was no longer elevated at four years (de Vries & Olff, 2009) (3.3%; CI: 2.2 - 4.5%), while rates for depression and specific phobia were still increased (Bijl, De, Ravelli, Smit, & Vollebergh, 2002) (depression 5.65% (CI:4.7% - 6.5%); specific phobia 6.88% (CI: 6.0 - 7.8%)). Although PTSD is most commonly studied in the aftermath of disasters, our study shows that it is not the central psychopathology after such events, at least in the long-term.

More than half of survivors with PTSD, depression and specific phobia at two years post-disaster no longer met full diagnostic criteria of any disorder at four years. Others also recovered of one of these disorders but went onto develop a new onset. Thus, in line with the literature (Rosen, Spitzer, & McHugh, 2008) PTSD, depression and specific phobia appeared to be highly intertwined: not only were these disorders the three most prevalent and highly comorbid, survivors also shifted between these disorders over the course of time. These findings add additional merit to the overarching
class of emotional disorders proposed by Watson (Watson, 2005) in which anxiety and mood disorders are incorporated.

Course of psychopathology

In order to follow the course over time of these three entangled disorders (PTSD, depression and specific phobia) in survivors whose main psychological problems originated from the fireworks disaster, we constructed four groups to enable comparison between healthy survivors to groups who recovered, had chronic, or a delayed-onset of disorders. Our healthy group appeared to be resilient individuals (see (Bonanno, 2004)). Although psychopathology was absent, survivors did experience transient disturbance in normal functioning across time.

We found that severe depressive symptoms in the early aftermath were more relevant in our model for predicting an unfavourable course of mental health between two and four years post-disaster than severity of PTSD symptoms. It appears that intrusions, avoidance and hyperarousal-symptoms usually show a natural recovery which is suppressed by having additional depressive symptoms. This result was previously found in a cross-sectional study (Onder et al., 2006). Findings showed a better recovery rate of PTSD in those survivors of the Marmara earthquake with a single diagnosis in comparison to survivors with comorbid PTSD and depression. Furthermore several treatment studies showed that comorbid depression to PTSD predicted a greater resistance to treatment e.g. (Brady, Killeen, Brewerton, & Lucerini, 2000). In our study survivors who recovered had fewer comorbid disorders than those with a chronic course. Findings suggest that screening for trauma-survivors at risk for long-term mental health problems appears more effective by using depressive instead of PTSD symptom severity measures.

Survivors with delayed-onset of psychopathology had only slightly higher symptom severity scores at four than at two years post-disaster. Although delayed-onset of PTSD, depression and/or specific phobia could refer to none or only few initial symptoms that lead to the disorder, our findings indicate prodromal symptoms prior to developing a full-blown mental health disorder. These findings are in-line with a recent meta-analysis (Smid, Mooren, van der Mast, Gersons, & Kleber, 2009) which reported that survivors with initial sub-threshold PTSD were at risk of developing delayed PTSD. Mental illness thus appears more a continuous instead of a dichotomous process.
**Trauma exposure and course of mental disorders**

Both the magnitude of traumatic exposure and absence of maternal care during childhood were predictive for the course of psychopathology. Healthy survivors reported the least traumatic exposure and maternal dysfunction. While one out of four survivors in the chronic group reported childhood physical abuse, it was rarely reported in the other groups. Hence, dose-response characterized the relationship between severity of trauma exposure and the degree of disruption in normal functioning. Findings are in-line with earlier reports showing an association between childhood abuse and dysfunctional mother-child relationship on the one hand and a higher incidence of psychopathology in adulthood on the other (e.g. (Langeland, Draijer, & van den Brink, 2004)). A meta-analysis by (Brewin et al., 2000) showed that the severity of the focal trauma conveyed the strongest risk for PTSD. The current study demonstrated that the course of a combination of anxious-depressive disorders is also well predicted by the exposure severity of the focal trauma, however maternal dysfunction was a slightly better predictor. Interestingly, maternal dysfunction contributed more to an unfavourable course of disorders than childhood sexual abuse. The effects of trauma on children can be mitigated by the presence of a supportive caregiver, even if that caregiver is unable to alter the outcome of events (Luthar & Zigler, 1991). Van der Kolk (van der Kolk & Fisler, 1994) stated that only when caregivers adequately tune into their infants they will help infants change their psychological state from distressed to contented. One of the key problems of dysfunction of the primary caregiver is that a child might not learn how to regulate the intensity of feelings and impulses.

**Demographics and course of psychopathology**

None of the studied demographics including gender, age, and years of education conveyed risk factors for the course of psychopathology. Within the scientific trauma literature it is debated whether gender and specific age-groups foster a higher risk for trauma in itself instead of PTSD (e.g. (Olff, Langeland, Draijer, & Gersons, 2007)). Women, for instance, are at higher risk for sexual assault/rape and are more often traumatized at a younger age, both are associated with higher risks for developing PTSD. Therefore in our sample in which survivors all experienced the same trauma and we only included adult patients, we may not have found demographic risk factors.
Strengths and limitations

The strengths of the current study were the longitudinal design and the face-to-face administered structured clinical interviews. Nevertheless, there are several limitations. Although we could not find selective drop-out in survivors between waves of data collection, we are hesitant to state that our community sample is representative for the affected community. Furthermore, since data on childhood experiences are collected retrospectively, we are uncertain whether there are actual increases in childhood traumatic exposure and adversities, or a recollection bias. There is reassuring evidence, however, that some types of psychopathology (such as depression) do not typically bias reports of childhood experience (Brewin, Andrews, & Gotlib, 1993), and furthermore our findings are supported by a recent systematic review (Weich et al., 2009) which demonstrated prospective evidence of associations between poor parent-child relationships and common psychiatric disorders in later life.

In conclusion

This study illustrated the course of psychopathology in a community of disaster survivors. It showed that the most prevalent disorders of PTSD, specific phobia and depression are highly intertwined: they frequently co-occurred, and a shift in diagnostic classification over time was common. Our findings question whether the DSM-IV adequately classifies PTSD, depression and specific phobia as separate disorders. Future studies should focus on possible clusters of anxious-depressive symptoms for more comprehensive descriptions of the whole spectrum of trauma-induced psychopathology. Since patients are often appointed to treatment programs based on a specific diagnosis, clinicians need to be aware of comorbidity and a possible shift in disorders over time and subsequently alter to more comprehensive treatment approaches. Child abuse and neglect form extra risk factors for long-term psychopathology in adulthood. We may profit from the predictive value of depressive symptom severity within a few weeks post-disaster, as this offers opportunities for early screening of trauma survivors at risk for long-term mental health problems.
Reference List


