Symptoms and Related Functioning in a Traumatized Community

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Background: Traumatic events are described as precipitating factors for medically unexplained symptoms. The aim of this study was to examine the prevalence and course of symptoms reported by disaster survivors and to assess whether the symptoms have features similar to those of medically unexplained symptoms.

Methods: A 3-wave longitudinal study was performed after an explosion of a fireworks depot. As a result of the explosion, 23 people were killed, more than 900 people were injured, and about 500 homes were damaged or destroyed. Respondents completed a set of validated questionnaires measuring their health problems 3 weeks (wave 1), 18 months (wave 2), and 4 years (wave 3) after the disaster. A comparison group was included at waves 2 and 3.

Results: The study population included 815 survivors who participated in the 3 waves. The mean number of symptoms was higher among survivors compared with control subjects at wave 2 (7.5 vs 5.8 symptoms) and at wave 3 (6.1 vs 4.9 symptoms) (P<.001 for both). Survivors and control subjects with more symptoms reported significantly lower mean scores on all scales of the Dutch version of the RAND 36-item health survey. Illness behavior and depression and anxiety were associated with the number of symptoms. For example, more than 60% of survivors with 10 or more symptoms reported depression and anxiety, compared with 2.4% of survivors with 0 to 1 symptoms (P<.001).

Conclusions: Up to 4 years after the disaster, symptoms were more prevalent among survivors than controls. Although medical disorders cannot be excluded, the reported symptoms showed several features similar to those of medically unexplained symptoms in the general population.

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SYMPTOMS SUCH AS HEADACHE, stomachache, fatigue, and pain in joints or muscles are common in the general population. An estimated 80% of the general population experiences at least 1 of these symptoms in any given month.1,2 When disclosed to a general practitioner (GP), many symptoms cannot be explained by a medical diagnosis and are considered medically unexplained.3

Traumatic events such as natural and man-made disasters are often described in the literature as precipitating factors for elevated levels of unexplained physical symptoms.4-6 A prospective study7 of a severe flood in Puerto Rico showed a higher number of new physical symptoms among survivors compared with control subjects 1 year after the flood. After disasters, survivors may attribute physical symptoms to suspected exposure to toxic substances, which can lead to amplification of health problems.8 After an airplane crash in Amsterdam, the Netherlands, many survivors attributed their physical symptoms to the harmful effect of substances from the wreck or cargo such as depleted uranium.9 Donker et al10 reported that GPs could not associate most of these symptoms with a medical disorder.

Medically unexplained symptoms (MUS) are seldom studied in the aftermath of disasters.6 Instead, the literature on traumatic events focuses on mental health problems such as posttraumatic stress disorder, depression, and anxiety. Almost all disaster investigations that examined physical symptoms used questionnaires.6 Only examination by a physician can rule out an underlying medical explanation for reported symptoms; this is one of the difficulties of studying MUS by means of a questionnaire.11 To get more insight into the similarities between MUS observed in medical practice and the physical symptoms reported on questionnaires, other characteristics of MUS have to be considered. In the general population, features associated with MUS are functional impairment and increased ill-

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ness behavior such as sick leave, health care, and medication use. In addition, studies have shown that patients with MUS have more comorbid psychiatric disorders, especially major depression and anxiety disorder.

To better understand the physical symptoms after disasters and their similarities with MUS in the general population, we explored the data of a longitudinal study that was performed after a man-made fireworks disaster. The following research questions were addressed: (1) What is the course of symptoms over time among survivors of the fireworks disaster? (2) Are symptoms more prevalent among survivors compared with controls? (3) Do the symptoms reported by survivors and controls have features similar to those of MUS in the general population, such as functional impairment, increased illness behavior, and psychological symptoms?

**METHODS**

**PARTICIPANTS AND PROCEDURE**

As a result of the explosion of a fireworks depot in a residential area in Enschede, the Netherlands, on May 13, 2000, and the subsequent fire, 23 persons were killed, more than 900 people were injured, and about 500 homes were severely damaged or destroyed. The Dutch government declared this a national disaster and began a longitudinal study of the health consequences of the disaster. An initial survey (wave 1) was commenced 3 weeks after the disaster. On the basis of the list of addresses at the registry office of Enschede, it was confirmed that the total affected group consisted of 4456 adult residents. All adult residents were invited to participate. Data collection took place at an air force base close to Enschede. In total, 1567 survivors (response rate, 35.2%) completed a questionnaire (Figure). Approximately 18 months after the disaster, in November 2001, a second survey (wave 2) was conducted. All wave 1 participants who had given informed consent for future contact received an announcement letter. In addition, a sample of 1600 residents was drawn from the registry office at Tilburg, the Netherlands, to serve as a control group. Tilburg was comparable to the affected area in Enschede with regard to the composition of the population and their general health status. The control sample was stratified according to sex, age, and country of origin to make it comparable to the survivors from wave 1.

To stimulate participation, survivors and controls were telephoned at home after the announcement letter was sent. If a respondent agreed to participate, a questionnaire was sent to his or her home address in the preferred language (Dutch, German, English, or Turkish). Interpreters were available at a community center to assist in completing the questionnaires. In total, 1116 of 1516 survivors (response rate, 73.6%) and 504 of the 793 controls who were lost to follow-up (response rate, 74.0%), and 53 of 184 immigrants (response rate, 28.8%) completed a questionnaire at wave 3. Details of the study population, participation, and procedures in the 3 waves have been described elsewhere. In this article, we describe 815 survivors who participated in the 3 surveys vs 821 controls at wave 2 and 640 controls at wave 3. The survivors and the control groups were similar in demographic characteristics.

**MEASURES**

The questionnaires were comparable in the 3 surveys for the survivors and in the 2 surveys for the controls. The questionnaires primarily included scales that had been previously validated in the Dutch population, as described in the next subsections.

**SYMPTOMS**

At wave 1, symptoms were measured by the 13-item Vragenlijst voor Onderzoek naar de Ervaringen Gezondheid (VOEG) (Questionnaire into Subjective Health Complaints) scale, a validated questionnaire that has often been used for studies in the Dutch population. The items of this scale ask respondents whether they regularly have symptoms such as stomachache, fatigue, pain in the region of the heart or chest, and pain in the bones and muscles. At the second and third waves, 12 symptoms were added to the questionnaire.

While most symptoms were asked about only once, gastrointestinal and fatigue symptoms were asked about in 3 different ways. In the analysis, these were treated as 1 gastrointestinal symptom and 1 fatigue symptom to avoid giving these 2 symptoms more weight compared with the other symptoms. Therefore, 21 different symptoms were used for the analyses of the symptoms at waves 2 and 3 (Table 1).

**FUNCTIONAL STATUS**

Participants completed the validated Dutch version of the RAND 36-item health survey (RAND-36). This questionnaire com-
Wave 3

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Table 1. Prevalence of 21 Symptoms Among Survivors and Control Subjects at Wave 2 and Wave 3

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Wave 2 (Survivors = 815)</th>
<th>Wave 2 (Controls = 821)</th>
<th>OR (95% CI)</th>
<th>Wave 3 (Survivors = 640)</th>
<th>Wave 3 (Controls = 640)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listlessness</td>
<td>46.6</td>
<td>25.5</td>
<td>2.8 (2.2-3.4)</td>
<td>37.9</td>
<td>21.9</td>
<td>2.2 (1.7-2.8)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>70.1</td>
<td>49.9</td>
<td>2.4 (1.9-2.9)</td>
<td>61.1</td>
<td>44.2</td>
<td>2.0 (1.6-2.5)</td>
</tr>
<tr>
<td>Forgetfulness</td>
<td>46.0</td>
<td>29.2</td>
<td>2.1 (1.7-2.5)</td>
<td>38.2</td>
<td>24.3</td>
<td>1.9 (1.5-2.4)</td>
</tr>
<tr>
<td>Ringing in the ears</td>
<td>25.6</td>
<td>16.1</td>
<td>1.8 (1.4-2.3)</td>
<td>20.8</td>
<td>13.8</td>
<td>1.6 (1.2-2.2)</td>
</tr>
<tr>
<td>Pain in the chest and the region of the heart</td>
<td>26.4</td>
<td>17.5</td>
<td>1.7 (1.3-2.2)</td>
<td>18.7</td>
<td>17.8</td>
<td>1.1 (0.8-1.4)</td>
</tr>
<tr>
<td>Lump in the throat</td>
<td>14.9</td>
<td>9.9</td>
<td>1.6 (1.2-2.2)</td>
<td>11.3</td>
<td>5.6</td>
<td>2.1 (1.4-3.2)</td>
</tr>
<tr>
<td>Stomachache</td>
<td>45.6</td>
<td>34.2</td>
<td>1.6 (1.3-2.0)</td>
<td>36.4</td>
<td>31.6</td>
<td>1.2 (1.0-1.6)</td>
</tr>
<tr>
<td>Pain in the bones and muscles</td>
<td>52.9</td>
<td>42.4</td>
<td>1.5 (1.3-1.9)</td>
<td>43.8</td>
<td>37.1</td>
<td>1.3 (1.1-1.6)</td>
</tr>
<tr>
<td>Nausea</td>
<td>19.3</td>
<td>13.7</td>
<td>1.5 (1.2-2.0)</td>
<td>12.7</td>
<td>11.3</td>
<td>1.1 (0.8-1.6)</td>
</tr>
<tr>
<td>Dizziness</td>
<td>27.8</td>
<td>20.9</td>
<td>1.5 (1.2-1.8)</td>
<td>22.9</td>
<td>16.0</td>
<td>1.6 (1.2-2.0)</td>
</tr>
<tr>
<td>Pain in the neck and shoulders</td>
<td>56.9</td>
<td>48.0</td>
<td>1.4 (1.2-1.7)</td>
<td>50.6</td>
<td>41.7</td>
<td>1.4 (1.2-1.8)</td>
</tr>
<tr>
<td>Cold fingers, hands, and feet</td>
<td>43.0</td>
<td>34.4</td>
<td>1.4 (1.2-1.8)</td>
<td>35.9</td>
<td>32.8</td>
<td>1.1 (0.9-1.4)</td>
</tr>
<tr>
<td>Excessive sweating</td>
<td>29.2</td>
<td>22.7</td>
<td>1.4 (1.1-1.8)</td>
<td>21.8</td>
<td>16.1</td>
<td>1.5 (1.1-1.9)</td>
</tr>
<tr>
<td>Pain in the back</td>
<td>49.2</td>
<td>41.6</td>
<td>1.4 (1.1-1.7)</td>
<td>45.6</td>
<td>39.1</td>
<td>1.3 (1.1-1.6)</td>
</tr>
<tr>
<td>Headache</td>
<td>46.7</td>
<td>39.0</td>
<td>1.4 (1.1-1.7)</td>
<td>39.3</td>
<td>30.4</td>
<td>1.5 (1.2-1.9)</td>
</tr>
<tr>
<td>Deafness</td>
<td>19.4</td>
<td>15.3</td>
<td>1.3 (1.0-1.7)</td>
<td>17.5</td>
<td>13.4</td>
<td>1.4 (1.0-1.9)</td>
</tr>
<tr>
<td>Tingling in the chest</td>
<td>24.0</td>
<td>20.3</td>
<td>1.3 (1.0-1.6)</td>
<td>19.5</td>
<td>16.2</td>
<td>1.3 (1.0-1.7)</td>
</tr>
<tr>
<td>Tingling in the arms and legs</td>
<td>38.1</td>
<td>32.4</td>
<td>1.3 (1.0-1.6)</td>
<td>32.3</td>
<td>26.6</td>
<td>1.4 (1.1-1.8)</td>
</tr>
<tr>
<td>Poor vision</td>
<td>25.9</td>
<td>22.0</td>
<td>1.2 (1.0-1.6)</td>
<td>20.6</td>
<td>18.6</td>
<td>1.1 (0.9-1.5)</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>33.3</td>
<td>28.8</td>
<td>1.2 (1.0-1.5)</td>
<td>24.6</td>
<td>21.1</td>
<td>1.2 (1.0-1.6)</td>
</tr>
<tr>
<td>Fainting</td>
<td>17.0</td>
<td>20.7</td>
<td>0.8 (0.6-1.0)</td>
<td>15.4</td>
<td>12.7</td>
<td>1.2 (0.9-1.7)</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; OR, odds ratio.

*Data are given as percentages unless otherwise indicated.

The 9 scales of Physical Functioning, Social Functioning, Physical Role Limitations, Emotional Role Limitations, Mental Health, Vitality, Bodily Pain, General Health Perceptions, and Change in Health. All scales were scored from 0 to 100, with higher scores indicating better health.

ILLNESS BEHAVIOR

Participants were asked whether they were currently on sick leave and whether they were currently receiving disability benefits. Participants were asked about their use of any prescription medication from a GP. In addition, participants were asked about the number of visits to their GP in the past 2 months, a period that was chosen to avoid recall bias. The number of visits in the past year was estimated using the 2 months’ figures.

PSYCHOLOGICAL SYMPTOMS

Depression and anxiety were measured by the Dutch version of the Symptom Checklist 90.22 Responses were based on a 5-point Likert scale and assessed the degree of depression and anxiety during the past week.

STATISTICAL ANALYSIS

t Tests were used to test differences in the mean numbers of symptoms reported by survivors at the 3 waves. The prevalences of symptoms among survivors and controls were compared by calculating crude odds ratios and 95% confidence intervals.

To evaluate the associations among the number of symptoms and functional status, illness behavior, and psychological problems, we added the 21 symptoms together and, using cutoff values, categorized the totals into 4 ranges. The cutoffs were based on the distribution of the symptoms reported by the control group at wave 2 and on cutoffs that were previously used for other scales, such as the Symptom Checklist 90.22

The first range was 0 to 1 symptoms, the second was 2 to 9 symptoms, the third was 10 to 14 symptoms (80th percentile), and the fourth was 15 or more symptoms (95th percentile).

Scores on the depression and anxiety subscales of the Symptom Checklist 90 were dichotomized using the sex-specific normal values for the healthy Dutch population. According to these tables, 20% of the Dutch population scores “high” to “extremely high” on the subscales.22

Analysis of variance and $\chi^2$ tests were used to evaluate the associations among the 4 symptom ranges and the 9 scales of the RAND-36, illness behavior, depression, and anxiety. Logistic regression analyses were used to calculate group effects for illness behavior, depression, and anxiety. To determine whether chronic diseases and associated symptoms affected the results, the analyses were repeated for survivors (361 at wave 2 and 402 at wave 3) and for controls (435 at wave 2 and 341 at wave 3) without self-reported chronic diseases.

SYMPTOMS OVER TIME

Three weeks after the disaster, survivors reported a mean±SD number of 5.6±3.3 symptoms on the 13-item VOEG scale. Eighteen months after the disaster, the mean±SD number of symptoms on this 13-item scale was comparable (5.5±3.7 symptoms). Almost 4 years after the disaster, the mean±SD number of symptoms had decreased significantly (4.6±3.6). On the 21-item scale of symptoms, survivors reported a mean±SD of 7.5±4.9 symptoms at wave 2, which was significantly higher than that at wave 3 (6.1±4.7 symptoms).
Symptoms were prevalent among survivors and controls. However, 18 months after the disaster, the mean number of symptoms was higher among survivors than controls (7.5 vs 5.8; \( P < .001 \), \( t \) test). Fifteen of 21 symptoms were significantly more prevalent among survivors (Table 1). The most prevalent symptoms were similar among survivors and controls, with higher prevalence rates among survivors for fatigue (70.1% vs 49.9%), pain in the neck and shoulders (56.9% vs 48.0%), and pain in the bones and muscles (52.9% vs 42.4%).

At wave 3, survivors reported a mean number of 6.1 symptoms, which was higher than the mean number of 4.9 symptoms among controls \( (P < .001) \). Twelve of the 21 symptoms were significantly more prevalent among survivors. The most prevalent symptoms were similar among survivors and controls, with higher prevalence rates among survivors.

At wave 2, 33.3% of survivors reported 10 or more symptoms compared with 20.6% of controls \( (P < .001, \chi^2 \) test). At wave 3, the proportion of survivors who reported 10 or more symptoms was still higher than among controls (26.2% vs 17.7%; \( P < .001, \chi^2 \) test).

## ASSOCIATED FEATURES

The symptoms reported at wave 2 were associated with functional impairment. With increasing numbers of symptoms, the mean scores of all 9 scales of the RAND-36 decreased considerably for survivors and controls. Despite reporting the same number of symptoms, survivors had significantly lower mean scores than controls on 5 of the 9 scales of the RAND-36 (Table 2).

In Table 3, the association between symptoms at wave 2 and increased illness behavior is summarized. Among survivors and controls, a higher number of symptoms was associated with a higher proportion of participants currently on sick leave. For both groups, having more symptoms was associated with receiving disability benefits.

Moreover, the use of medication increased significantly with an increasing number of symptoms, with a stronger association among survivors for the use of sedatives. The number of symptoms was also associated with health care use. For the survivors and controls, the mean number of visits to the GP increased from 3.1 visits a year for those with 0 to 1 symptoms to 18.4 visits a year for those with 15 or more symptoms.
Participants reporting more symptoms had significantly more depression and anxiety (Table 4). This association was stronger for survivors. Compared with controls, survivors with 10 or more symptoms had high scores 1.3 times more often on the depression subscale and 1.5 times more often on the anxiety subscale. Exclusion of respondents with chronic diseases did not change the odds ratios or any of the associations (data not shown).

In contrast to many studies in the aftermath of disasters, this study focused on physical symptoms among survivors rather than on mental health problems. Symptoms were more common among survivors compared with controls. Eighteen months after the disaster, 33.3% of survivors reported 10 or more symptoms compared with 20.6% of controls. Although the results showed a gradual decrease in the number of symptoms, survivors reported significantly more symptoms than controls 4 years after the disaster.

Despite the elevated number of symptoms among survivors, no theories about possible exposure to toxic substances developed in the aftermath of the fireworks disaster. The absence of such a theory might be explained by the reassuring results of the blood and urine samples that were obtained 3 weeks after the disaster, in which no elevated body burden was detected. In addition, analyses of the blood and urine samples demonstrated no elevated body burden due to the fireworks disaster. This makes it unlikely that the higher prevalence rates of postdisaster health problems were unaffected (L.G., unpublished data, June 2005). At wave 2, fewer men, fewer younger (18-24 years) and older (≥65 years) residents but more immigrants participated at the first wave. To study the magnitude of the selection bias, analyses of multiple imputations were used to fill in missing data of nonparticipants. The prevalence estimates of postdisaster health problems were unaffected (L.G., unpublished data, June 2005). At wave 2 and wave 3, additional analysis showed that this was not the result of nonparticipation at wave 2 among controls with high symptom levels.

As in most disaster studies, physical symptoms were based on self-reporting rather than physical examination; therefore, we could not assess the presence of medical disorders. However, excluding the respondents with self-reported chronic diseases did not affect our results. In addition, analyses of the blood and urine samples demonstrated no elevated body burden due to the fireworks disaster. This makes it unlikely that the higher prevalence of symptoms among survivors is the result of exposure to toxic substances. In addition, many survivors and controls reported 10 or more symptoms in different organ systems, making it unlikely that all of these symptoms were the result of a medical disorder or toxic exposure. The study of the airplane crash in Amsterdam confirmed that GPs associated only 40% of reported symptoms with a medical diagnosis, leaving 60% unexplained. The reported symptoms in this study show many similarities with MUS. Therefore, the term medically unexplained symptoms may be used to refer to symptoms that are common, persistent, and related to functional impairment, increased illness behavior, and comorbid psychological symptoms.

Because only a few disaster studies have focused on MUS, little is known about the contribution of precipitating factors, such as damage to house and property, and perpetuating factors, such as lack of social support and...
ment health problems, to the development and persistence of MUS after disasters. Because knowledge of these factors may facilitate detection of vulnerable individuals and optimize care delivery by clinicians after a disaster, future studies should focus on factors that might be responsible for MUS among survivors of disasters.

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REFERENCES