



Original Research

# A longitudinal comparative study of the physical and mental health problems of affected residents of the firework disaster Enschede, The Netherlands

L. Grievink<sup>a,\*</sup>, P.G. van der Velden<sup>b</sup>, R.K. Stellato<sup>a</sup>, A. Dusseldorp<sup>c</sup>,  
B.P.R. Gersons<sup>d</sup>, R.J. Kleber<sup>e</sup>, E. Lebet<sup>a</sup>

<sup>a</sup>Centre for Environmental Health Research, National Institute for Public Health and the Environment (RIVM), P.O. Box 1, 3720 BA Bilthoven, The Netherlands

<sup>b</sup>Institute for Psychotrauma, Zaltbommel, The Netherlands

<sup>c</sup>Centre for Inspectorate Research, Emergency Response and Drinkwater, RIVM, Bilthoven, The Netherlands

<sup>d</sup>Department of Psychiatry, Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands

<sup>e</sup>Department of Clinical Psychology, Utrecht University, Utrecht, The Netherlands

Received 7 March 2005; received in revised form 22 August 2006; accepted 28 September 2006  
Available online 23 February 2007

## KEYWORDS

Disaster;  
Health status;  
Residents;  
Longitudinal;  
Comparison group

**Summary Objectives:** After the firework disaster in Enschede, The Netherlands, on 13 May 2000, a longitudinal health study was carried out. Study questions were: (1) did the health status change over this period; and (2) how is the health status 18 months after the disaster compared with controls?

**Study design:** A longitudinal comparative study with two surveys at 3 weeks and 18 months after the disaster.

**Methods:** A control group for the affected residents was included in the second survey. Respondents filled in a set of validated questionnaires measuring their physical and mental health problems.

**Results:** The prevalence of physical and emotional role limitations, severe sleeping problems, feelings of depression and anxiety, as well as intrusion and avoidance decreased from 3 weeks to 18 months after the disaster for the affected residents. Independent of background characteristics and other life events, residents had 1.5 to three times more health problems than the control group; for example, physical role limitations (odds ratio [OR] = 1.5, 95% confidence interval [CI] 1.2–2.0) and anxiety (OR = 3.1, 95% CI 2.4–4.2).

\*Corresponding author. Tel.: +31 30 274 4533; fax: +31 30 274 4451.

E-mail address: [Linda.Grievink@rivm.nl](mailto:Linda.Grievink@rivm.nl) (L. Grievink).

*Conclusions:* Although health problems decreased compared with 3 weeks after the disaster, 18 months after the disaster, the affected residents had more health problems than the people from the control group.

© 2006 The Royal Institute of Public Health. Published by Elsevier Ltd. All rights reserved.

## Introduction

In the past decade, many health studies that were mostly cross-sectional in design have been carried out in the aftermath of disasters. These studies show that survivors report, even years later, suffering from intrusive thoughts of the disaster, avoidance behaviour, feelings of anxiety and depression, severe sleeping difficulties and (medically unexplained) physical symptoms.<sup>1-3</sup> Although studies have indicated that most physical and mental health problems decline after disasters over time,<sup>2,4</sup> survivors reported generally more, and more persistent, health problems than the respondents in the control groups.<sup>5-7</sup>

Disasters are often described as a disruption exceeding the adjustment capacity of the affected community.<sup>8</sup> The disruption can also include a need for healthcare that exceeds normal levels. Therefore, healthcare workers in the affected area need information about the prevalence and trends of the health problems of the affected community to evaluate and improve their health policy. However, longitudinal comparative studies providing that information have been scarce.<sup>3</sup>

On 13 May 2000, The Netherlands was startled by a disaster. A firework storage facility exploded in a residential area in Enschede in the east of The Netherlands, close to the German border. The series of two explosions and subsequent fire killed 23 people, including four fire-fighters, and injured over 900 people; about 500 homes were severely damaged or destroyed. The Dutch government declared this a national disaster and the Ministry of Health, Welfare and Sports decided to launch a comprehensive health study for the first time shortly after the disaster. After an aeroplane crash in a residential area in Amsterdam in 1992, no such rapid health survey was organized. Years later, health symptoms were still attributed to the disaster, due partly to uncertainty about exposure to toxic substances. A parliamentary committee in 1999 recommended a rapid assessment of immediate health effects after a disaster in the future.<sup>9</sup>

Three weeks after the firework disaster, a study was carried out to measure potential exposure and

the health problems among residents and emergency rescue workers who were present at the time of the disaster.<sup>10</sup> The main aim was to collect data on exposure and health to inform health care and policy makers, and decrease uncertainty about exposure to toxic substances. Data collection for scientific purposes was a minor goal. To study potential exposure to substances related to fire-works and fire, elements in blood and urine were measured; no harmful levels in relation to the disaster were determined.<sup>11</sup> In addition, the respondents' location and experiences during, and in, the hours just after the disaster, and their physical and psychological health, were assessed with a set of standardized questionnaires.<sup>10</sup> The study was part of a larger healthcare programme especially designed for the survivors.<sup>12</sup>

Although we were in a unique situation to study the survivors so quickly after the disaster (3 weeks), we did not have time to collect reference data that were lacking for most of the specific questionnaires for the immigrant groups living in the affected area.<sup>10</sup> At the second survey, 18 months after the disaster, a control group was included. In this paper, we describe the results of the health status of the affected residents in the first follow-up, about 18 months after the disaster. The study questions were as follows: (1) were there changes in health problems of affected residents 18 months after the disaster compared with 3 weeks after the disaster?; and (2) were the prevalence estimates of the health problems 18 months after the disaster different between affected residents and respondents of the control group?

## Participants and methods

About 3 weeks after the disaster, the first survey was carried out. All residents were personally invited, and about 30% participated. In addition, rescue workers and passers-by were invited to participate, through their employers or through the media. In this paper, we only focus on the residents. The second survey started in November 2001, about 18 months after the disaster.

## Study populations

All affected residents who had completed a questionnaire in the first survey ( $n = 1567$ ), who were not lost to follow-up, and had given consent for follow-up, were invited to participate in the second survey (Fig. 1). In addition, survivors who were not able to participate in the first survey, but wanted to in the second, were included in the study.

The city of Tilburg was comparable to the affected residential area in Enschede in composition of the population and general health status. From Statistics Netherlands, four districts (postal areas) in Tilburg were chosen as the control group. Within each of these districts, a sample of 400 individuals (in total 1600), stratified by gender, age category and country of origin, was drawn from the Registry Office. As the Registry Office does not hold information on educational level, we pre-selected four districts that had a comparable socio-economic background to the affected area in Enschede. The stratification on age, gender and country of origin was used in order to make the sample comparable to the affected residents in the first survey.

## Recruitment

At the end of October 2001, the respondents received a letter describing the design of the survey. The letter was sent in Dutch and one other

language, depending on the respondent's country of origin. The Medical Ethical Testing Committee (TNO-Leiden-The Netherlands) approved the study protocol.

To stimulate participation, residents were called at home within 2 weeks after the announcement was sent. If the respondent agreed to participate, a questionnaire with a cover letter in the preferred language (Dutch, English, German or Turkish), and a prepaid envelope, was sent to their home address. Those who could not be reached after five phone call attempts ( $n = 345$ ), or did not have a known telephone number ( $n = 203$ ), were sent a Dutch questionnaire with a cover letter. As a token of appreciation, a gift certificate was included with every questionnaire. This personal approach was supported by extensive publicity before the start of the study.

Those respondents who needed help filling in the questionnaire could come to one of the two community centres in Enschede during the daytime for 2 weeks. In these community centres, Turkish and Arabic interpreters were present.

If the questionnaire was not returned within 3 weeks, the respondents were reminded by phone or by letter when the telephone number was unknown or the person could not be reached by telephone. The data collection stopped at the end of January, 2002.

The recruitment of the control population for the residents also started in November 2001. The recruitment procedure was comparable to that of the affected residents.

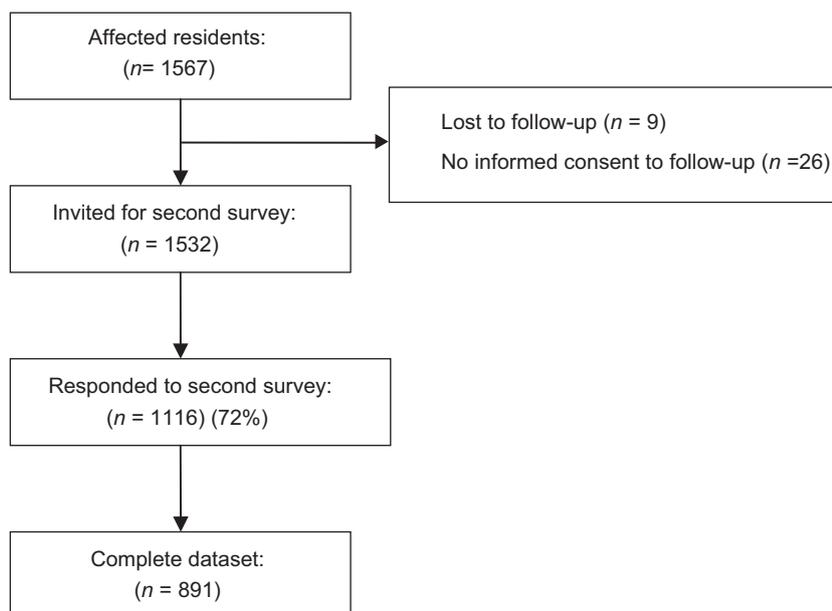


Figure 1 The affected population.

## Questionnaire

The questionnaire included primarily a set of standardized instruments that had been previously validated in the Dutch population as a whole. Most of the instruments have not yet been validated on specific subgroups of immigrants in The Netherlands. As the list of health variables (measured) was extensive, we limited the number of presented variables to those health problems that have often been described after disasters for reasons of comparability.<sup>2,3</sup> The selected health problems were emotional and physical role limitations as measures of general health, severe sleeping problems as a measure of sleep quality, and feelings of anxiety and depression. For the survivors, symptoms of avoidance and intrusion, as well as the self-reported symptoms of post-traumatic stress disorder (PTSD), were described. A full report of the other studied outcomes is available in Dutch.<sup>13</sup>

Emotional and physical role limitations were measured with the RAND36, which is comparable to the SF36;<sup>14</sup> a health problem was 'present' if the score was more than one standard deviation lower than the average for that scale in the Dutch population.<sup>15</sup> Severe sleeping problems were measured with the Groninger Sleep Quality Scale; respondents with more than three sleeping problems of the eight were classified as having severe sleeping problems.<sup>16</sup> Feelings of anxiety and depression were measured with the Symptom Check List (SCL-90);<sup>17</sup> the scales were dichotomized into 'very high' and 'high' scores (problem present) vs. 'above average', 'average', and lower scores, according to established references for the Dutch population.<sup>18</sup> Feelings of intrusion and avoidance were determined with the Dutch version of the Impact of Event Scale.<sup>19–21</sup> This scale has also been validated among the Turkish–Dutch immigrant group.<sup>22</sup> A respondent with an overall score greater than 25 was considered to have serious disturbances, such as PTSD.<sup>23</sup> Symptoms of PTSD were measured with a self-administered questionnaire.<sup>24</sup>

## Data analysis

The change in prevalence of health problems among survivors between the first and second survey was examined using McNemar's test for paired data. Crude odds ratios (ORs) were calculated in order to compare the prevalence of health problems of the survivors to the control group, and logistic regression models were used to estimate ORs adjusted for all potential confounding factors. The potentially confounding factors were sex, age,

educational level, employment status, immigrant status (first or second generation immigrant vs. native Dutch), living alone, presence of a chronic illness in the past 12 months and serious life event in the past 12 months. Life events included (among others) death or serious disease of a loved one, divorce and having been the victim of assault, serious threat, burglary, or a hold-up.<sup>23</sup>

## Results

Of the 1567 survivors who completed the questionnaire in the first survey, nine were lost to follow-up and 26 did not give their consent for follow-up (Fig. 1). In the second survey, 1116 completed and returned a questionnaire (71% response). Women, middle aged people, those with a high educational level and native Dutch were more likely to participate in the second survey (data not shown). In addition, the survivors who participated for the first time ( $n = 148$ ) were a small fraction (4%) of the initial non-responders and probably a selective group. Therefore, we focus in this paper on the longitudinal analysis of the affected residents who were followed-up. Of the 1116 respondents, 225 survivors (20.2%) had one or more missing values and were excluded from the dataset; in total, 891 survivors were included in the analyses.

Of the 1600 control participants in Tilburg, 821 completed and returned a questionnaire (response 52%). Gender and age distributions were similar between the responders and non-responders. Of the 821, 121 (14.7%) had one or more missing values and were excluded from the analysis. The final comparison group consisted of 700 participants.

The background characteristics for the affected residents and the residents of the control group are shown in Table 1. The affected residents had a higher percentage of immigrants and were more likely to live alone than residents in the control group. In addition, affected residents more often reported chronic illnesses in the past 12 months than the residents of the control group.

Table 2 shows the changes in crude prevalence estimates of health problems between 3 weeks and 18 months after the disaster for the affected residents. The prevalence of all health problems declined.

Of the affected residents, 19–47% had health problems only at the first wave and not at the second wave; 21–34% had health problems in both waves of the study and 4–10% reported health problems 18 months after the disaster for the first

**Table 1** Background characteristics for the affected residents ( $n = 891$ ) and the residents of the control group ( $n = 700$ ).

	Affected residents	Control group residents
Sex (% women)	55.8	53.3
<i>Age category (%)</i>		
18–24 years	8.2	11.3
25–44 years	48.3	46.3
45–64 years	34.3	33.6
65+ years	9.2	8.9
<i>Educational level (%)</i>		
Primary school	14.6	14.4
Junior high	30.8	36.0
Senior high/professional	34	31.0
High professional/university	20.7	18.6
Immigrant (% not native Dutch)	19.3 <sup>a</sup>	14.0
Employed (%)	57.5	59.7
Living alone (%)	17.4 <sup>a</sup>	13.4
Life events past 12 months (%)	41.0	38.6
Chronic illness (%)	51.4 <sup>a</sup>	45.3

<sup>a</sup>Statistically significant different from comparison groups ( $P < 0.05$ ); chi-square statistic for categorical outcome.

**Table 2** Change in crude prevalence estimates between 3 weeks and 18 months after the disaster for the affected residents ( $n = 891$ ).

Health variables	3 weeks	18 months
Emotional role limitations	74.0	30.4 <sup>a</sup>
Physical role limitations	54.8	27.6 <sup>a</sup>
Severe sleeping problems	49.9	40.4 <sup>a</sup>
Anxiety symptoms	47.4	31.7 <sup>a</sup>
Depressive symptoms	51.2	35.2 <sup>a</sup>
Intrusion & avoidance	72.0	37.5 <sup>a</sup>

<sup>a</sup> $P < 0.0001$  (McNemar test for paired data).

time (data not shown in tables). Eighteen months after the disaster, 19% of the affected residents had symptoms of PTSD (data not shown in table).

The crude and adjusted ORs and 95% confidence intervals of physical and mental health problems 18 months after the disaster are shown in Table 3. The adjustments scarcely changed the associations. The adjusted ORs of all health variables for the affected residents compared with the residents in the

control group ranged from 1.5 (physical role limitations) to 3.1 (anxiety), and were all statistically significantly different from one.

## Discussion

The findings suggest that, 18 months after the disaster, the prevalence estimates of the health problems declined for the affected residents but were higher than the estimates in the control group.

The prevalence estimates of all health variables decreased from 3 weeks to 18 months after the disaster. To our knowledge there are no published data with which to compare our results. We searched the literature for longitudinal studies among adult survivors ( $n > 50$ ) after a collective disaster with comparable timing i.e. immediately after [ $< 1$  month] to 1.5 years later [range 1–2 years]. One small ( $n = 46$ , 24 in all five waves) longitudinal study was able to determine the health immediately (1 week) and 5 months after a major flood. The authors found that the prevalence estimates of anxiety and depression among survivors decreased sharply after 6 weeks.<sup>25</sup>

The prevalence estimates of all health problems were higher for the affected residents than the residents in the control group. These results can be compared with three other cross-sectional studies. In all studies, the authors found that survivors had more health problems than the respondents in the control groups, 10 and 22 months after the incident or disaster. However, the type of disaster (natural and man-made), and the instruments used to measure the health problems (IES, PTSD-SRS, GHQ-28/30), differed between the studies.<sup>26–28</sup> To our knowledge no other cross-sectional studies with control groups have examined the health of survivors 1 or 2 years after a collective disaster.

## Strength and biases

This longitudinal follow-up study on the health of affected residents after the firework disaster in Enschede is unique in The Netherlands. To our knowledge, this study is one of the few international longitudinal studies that was started so quickly (i.e. 3 weeks) after a disaster of this scale. Most studies after collective disasters (natural and man-made) have been cross-sectional in design. In longitudinal studies, the first wave was usually carried out 1–6 months after the disaster.<sup>8</sup>

In this second wave, 72% of the respondents of the first wave of the longitudinal study participated.

**Table 3** The associations (odds ratios and 95% confidence intervals between brackets) for affected residents ( $n = 891$ ) compared with the control group ( $n = 700$ ) for several health variables-crude and after adjustment for potential confounding factors.<sup>a</sup>

Health variables	Crude odds ratio	Adjusted odds ratio <sup>a</sup>
Emotional role limitations	2.19 (1.70–2.82)	2.12 (1.62–2.77)
Physical role limitations	1.66 (1.29–2.14)	1.54 (1.17–2.02)
Severe sleeping problems	2.20 (1.77–2.75)	2.19 (1.73–2.79)
Anxiety symptoms	2.95 (2.28–3.81)	3.14 (2.38–4.16)
Depressive symptoms	1.91 (1.52–2.39)	1.88 (1.47–2.39)

<sup>a</sup>Confounding factors: sex-age categories (four categories); educational level (four levels); immigrant (yes/no); employment status (full- or part-time vs. not employed); living alone; life events in past 12 months; chronic illness in past 12 months (% one or more).

Fewer men and immigrants participated in this second wave. Immigrants with worse health 3 weeks after the disaster were more likely to participate 18 months later.<sup>29</sup> These results suggest a selection bias from the first to the second survey. However, after multiple imputations were used to fill in missing data in the second survey, only minor changes were observed in the prevalence estimates of health problems.<sup>30</sup> This most likely indicates that the effect of selection bias on the outcomes of interest was minimal, although it may also be an artefact of the limitations of multiple imputation under non-ignorable non-response.<sup>31</sup>

The possibility of selective response in the first survey cannot be excluded. Although every affected resident was invited to participate in the study, the residents who lost their homes may have been difficult to reach 3 weeks after the disaster. The response in the first survey was estimated to be 30% for the residents.<sup>12</sup> In a recent publication, we examined the possible selection bias in the first wave.<sup>32</sup> We found that the observed selective participation was not substantial enough to affect the prevalence estimates of the health problems in the survey.

Another limitation is that most of the standardized instruments used in this study have not been culturally validated for the different immigrant groups in The Netherlands. However, most of the instruments are used around the world in different ethnic groups and have been found to be reliable.<sup>22,33</sup> In this study we included a control group with a similar distribution of immigrant groups than in the affected group. Therefore, it is unlikely that differences between the affected and control group in health problems could be attributed to differences in culture.

It could be argued that we used a convenience sample instead of a random sample of survivors. However, every affected resident within the official disaster area was invited by letter to participate in

the first survey; however, only about 30% did so. In the wake of the chaos that follows a disaster, it is often difficult to define who the affected resident is. Apart from material losses and injuries, there are no objective criteria to define who is a victim and who is not, which makes it difficult to create a methodologically sound sample. Furthermore, in the chaotic aftermath, it is often difficult to obtain a representative sample. Therefore, most studies after disasters use a convenience sample.<sup>34</sup> However, even when studies use a random sample of the whole population, a difference between the survivors and control group has been found.<sup>28</sup>

## Conclusion

Most health problems decreased from the first (3 weeks after the disaster) to the second survey (18 months after) among affected residents. Although their health problems decreased, the residents still had two to three times more health problems (e.g. depression, anxiety, sleeping difficulties) than the respondents in the control group. Eighteen months after the disaster, additional healthcare is needed for those affected by the Enschede firework disaster. The results of these health surveys have been presented and discussed with various healthcare providers. On the basis of the results, improvements were made to health care, such as the implementation of educational programmes for survivors in Enschede.

## Acknowledgements

This longitudinal follow-up study was part of the Health monitor Survey Victims Firework Disaster Enschede (GGVE) and was carried out under the authority of the Ministry of Health, Welfare and

Sports in The Netherlands. Several research institutes co-operated on this monitor: The National Institute for Public Health and the Environment (RIVM), The Institute for Psychotrauma (IvP), The Dutch Institute for Health Care Research (NIVEL), and the department of Youth Health Care of the Regional Health Authority (GGD Regio Twente), The Netherlands. The Regional Health Authority was also the co-ordinator of this monitor. For the control group in Tilburg, The Regional Health Authority 'Hart voor Brabant' was involved.

We gratefully acknowledge the work of all people involved in designing, organising and analysing the survey.

## References

- Green BL, Lindy JD, Grace MC, Gleser GC, Leonard AC, Korol M, et al. Buffalo creek survivors in the second decade: stability of stress symptoms. *Am J Orthopsychiatry* 1990;**60**:43–54.
- Norris FH, Friedman MJ, Watson PJ, Byrne CM, Diaz E, Kaniasty K. 60,000 Disaster victims speak: part I. An empirical review of the empirical literature—1981–2001. *Psychiatry* 2002;**65**:207–39.
- Norris FH, Friedman MJ, Watson PJ. 60,000 Disaster victims speak: part II. Summary and implications of the disaster mental health research. *Psychiatry* 2002;**65**:240–60.
- Rubinos AV, Bickman L. Psychological impairment in the wake of disaster: the disaster–psychopathology relationship. *Psychol Bull* 1991;**109**:384–99.
- Bromet EJ, Gluzman S, Schwartz JE. Somatic symptoms in women 11 years after the Chernobyl accident: prevalence and risk factors. *Environ Health Perspect* 2002;**110**(Suppl 4):625–9.
- Prince-Embury S, Rooney JF. Psychological symptoms of residents in the aftermath of the Three Mile Island nuclear accident and restart. *J Soc Psychol* 1988;**128**:779–90.
- Grace MC, Green BL, Lindy JD, Leonard AC. The Buffalo Creek disaster; a 14-year follow-up. In: Wilson JP, Raphael B, editors. *International handbook of traumatic stress syndromes*. New York: Plenum Press; 1993. p. 441–9.
- Bromet E, Dew MA. Review of psychiatric epidemiologic research on disasters. *Epidemiol Rev* 1995;**17**:113–9.
- Yzermans J, Gersons BPR. The chaotic aftermath of an airplane crash in Amsterdam; a second disaster. In: Havenaar JM, Cwikel JG, Bromet EJ, editors. *Toxic turmoil; psychological and societal consequences of ecological disasters*. New York, Boston: Kluwer Academic, Plenum Publishers; 2002. p. 85–99.
- van Kamp I, van der Velden PG, Stellato RK, Roorda J, van Loon J, Kleber RJ, et al. Physical and mental health shortly after a disaster: first results from the Enschede firework disaster study. *Eur J Public Health* 2006;**16**:252–8.
- RIVM Project team. *Firework disaster Enschede: components in blood and urine (Dutch report no. 630930003)*. Bilthoven, The Netherlands: National Institute for Public Health and the Environment (RIVM); 2001.
- Roorda J, van Stiphout WAHJ, Huijsman-Rubingh RRR. Post-disaster health effects: strategies for investigation and data-collection; experiences from the Firework disaster. *J Epidemiol Community Health* 2004;**58**:982–7.
- van der Velden PG, Grievink L, Dusseldorp A, Fournier M, Stellato RK, Drogendijk AN, et al. *Health status of the survivors of the Firework Disaster Enschede; report of a health survey 18 months after the disaster (Dutch report no. 630930004)*. Zalbommel and Bilthoven, The Netherlands: Institute for Psychotrauma, National Institute for Public Health and the Environment (RIVM); 2002.
- van der Zee KI, Sanderman R. *Het meten van de algemene gezondheidstoestand met de RAND-36: een handleiding [Measuring general health with the RAND-36: a manual]*. Groningen: Noordelijk Centrum voor Gezondheidsvraagstukken; 1993.
- Aaronson NK, Muller M, Cohen PD, Essink-Bot ML, Fekkes M, Sanderman R, et al. Translation, validation and norming of the Dutch language version of the SF-36 Health Survey in Community and Chronic Disease Populations. *Clin Epidemiol* 1998;**51**:1055–68.
- Meijman TF, de Vries-Griever AHG, de Vries G, Kampman R. *The construction and evaluation of a one-dimensional scale measuring subjective sleep quality. Heijmans Bulletin (HB-0767)*. Groningen, The Netherlands: State University Groningen; 1985.
- Derogatis LR, Lipman RS, Covi L. SCL-90: an outpatient psychiatric rating scale, preliminary I. *Psychopharmacol Bull* 1973;**9**:13–28.
- Arrindell WA, Ettema JHM. *SCL-90: handleiding bij een multidimensionele psychopathologie indicator [Manual for a multidimensional psychopathology indicator]*. Lisse: Swets & Zeitlinger; 1986.
- Brom D, Kleber RJ. De Schok Verwerkings Lijst [The Dutch version of the Impact of Event Scale]. *Nederlands Tijdschrift voor de Psychol* 1985;**40**:164–8.
- Horowitz MJ, Wilner N, Alvarez W. The impact of event scale: a measure of subjective stress. *Psychosom Assess* 1979;**41**:209–18.
- van der Ploeg E, Mooren TM, Kleber RJ, van der Velden PG, Brom D. Construct validation of the Dutch version of the impact of event scale. *Psychol Assess* 2004;**16**:16–26.
- Drogendijk AN, van der Velden PG, Kleber RJ, Christiaanse BA, Dorresteyn SM, Grievink L, et al. Turkish victims of the Enschede firework disaster: a comparative study. *Gedrag en Gezondheid* 2003;**31**:145–62 [in Dutch].
- van der Velden PG, van der Burg S, Steinmetz CHD, van den Bout J. *Victims of bankrobbes*. Houten: Bohn Stafleu Van Loghem; 1992 [in Dutch].
- Carlier IVE, van Uchelen JJ, Lamberts RD, Gersons BPR. Clinical utility of a brief diagnostic test for posttraumatic stress disorder. *Psychosom Med* 1998;**60**:42–7.
- Cook FD, Bickman L. Social support and psychological symptomatology following a natural disaster. *J Trauma Stress* 1990;**3**:541–56.
- Selley C, King E, Peveler R, Osola K, Martin N, Thompson C. Post-traumatic stress disorder symptoms and the Clapham rail accident. *Br J Psychiatry* 1997;**171**:478–82.
- Catapano F, Malafrente R, Lepre F, Cozzolino P, Arnone R, Lorenzo E, et al. Psychological consequences of the 1998 landslide in Sarno-Italy: a community study. *Acta Psychiatr Scand* 2001;**104**:438–42.
- McFarlane AC, Clayer JR, Bookless CL. Psychiatric morbidity following a natural disaster: an Australian bushfire. *Soc Psychiatry Psychiatr Epidemiol* 1997;**32**:261–8.
- Dijkema MBA, Grievink L, Stellato RK, Roorda J, van der Velden PG. Determinants of response in a longitudinal health study following the firework-disaster in Enschede, The Netherlands. *Eur J Epidemiol* 2005;**20**:839–47.

30. Stellato RK, Grievink L, Lebrecht E. Effects of dropout and item nonresponse in the follow-up of the victims of the Enschede firework disaster (abstract). *Epidemiology* 2003;14:55.
31. Schafer JL. *Analysis of incomplete multivariate data*, 1st ed. London: Chapman & Hall; 1997.
32. Grievink L, van der Velden PG, Yzermans CJ, Roorda J, Stellato RK. The importance of estimating selection bias on prevalence estimates shortly after a disaster. *Ann Epidemiol* 2006;16:782–8.
33. Aroian KJ, Patsdaughter CA, Levin A, Gianan ME. Use of the brief symptom inventory to assess psychological distress in three immigrant groups. *Int J Soc Psychiatry* 1995;41:31–46.
34. Bromet EJ, Havenaar JM. Mental health consequences of disasters. In: Sartorius N, Gaebel W, Lopez-Ibor JJ, Maj M, editors. *Psychiatry in society*. New York: Wiley; 2002. p. 241–61.

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

