

# **Health problems of Enschede residents in the aftermath of the Fireworks Disaster**

**A longitudinal study with a pre-disaster assessment in general practice**

Jacob Hendrik Soeteman

The study presented in this thesis was performed at the Netherlands Institute for Health Services Research (NIVEL), Utrecht, The Netherlands.

The study was funded by the Dutch Ministry of Health, Welfare and Sport, The Hague, The Netherlands.

Financial support for the printing of the thesis has been kindly provided by the Netherlands Institute for Health Services Research (NIVEL), Utrecht, The Netherlands.

Cover : Fenix by Richard van Kruysdijk

Printing: Ponsen & Looijen

ISBN 978-90-6905-950-1

<http://www.nivel.nl>

[nivel@nivel.nl](mailto:nivel@nivel.nl)

Telefoon 003130 2 729 700

Fax 003130 2 729 729

©2009 NIVEL, Postbus 1568, 3500 BN UTRECHT

All rights reserved. No part of this thesis may be reprinted or reproduced or utilized in any form or any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or any information storage or retrieval system. Exceptions are allowed in respect of any fair dealing for the purpose of research, private study, or review.

# **Health problems of Enschede residents in the aftermath of the Fireworks Disaster**

**A longitudinal study with a pre-disaster assessment in  
general practice**

een wetenschappelijke proeve  
op het gebied van de Medische Wetenschappen

## **proefschrift**

ter verkrijging van de graad van doctor aan  
de Radboud Universiteit Nijmegen,  
op gezag van de Rector Magnificus prof. mr. S.C.J.J. Kortmann  
volgens besluit van het College van Decanen,  
in het openbaar te verdedigen op vrijdag 26 juni 2009  
om 13.00 uur precies

door

Jacob Hendrik Soeteman

geboren op 25 augustus 1956  
te Den Haag

Promotoren : Prof. dr. W.J.H.M. van den Bosch  
Prof. dr. J. van der Zee (MUMC)

Copromotor : Dr. C.J. IJzermans (NIVEL)

Manuscript commissie:  
Prof. dr. A.E.M. Speckens  
Prof. dr. J. van der Velden  
Prof. dr. F.G. Schellevis (VUMC)

## Contents

Chapter 1: General Introduction	7
Chapter 2: I am all right: Experiences of General Practitioners during and after a disaster	27
Chapter 3: A longitudinal cohort study in general practice on health problems following a disaster Design and organisational issues	39
Chapter 4: Health problems presented in family practice one year prior to and one year following a disaster	53
Chapter 5: The course of post-disaster health problems of victims with pre-disaster psychological problems as presented in general practice	73
Chapter 6: Changes in the pattern of service utilisation and health problems of women, men and various age groups following a destructive disaster A matched cohort study with a pre-disaster assessment	91
Chapter 7: Does disaster affect immigrant victims more than non-immigrant victims in Dutch general practice A matched cohort study	113
Chapter 8: Discussion and conclusions	129
Summary	153
Samenvatting	161
Dankwoord	171
Curriculum Vitae	177



# Chapter

# 1

## **General Introduction**





## Background: the Enschede Fireworks Disaster

On 13 May, 2000, on a sunny Saturday afternoon, a fireworks depot exploded in the city of Enschede (125,000 inhabitants) in the eastern part of the Netherlands. The explosions of 117 tons of heavy fireworks destroyed a neighbourhood in a few hours. About 1,200 persons lost their homes instantly and had to be relocated for a long period. Moreover, 19 residents and 4 fire-fighters were killed and about 1,000 persons were wounded.

The victims were confronted with a sudden and unexpected loss of safety and control. They had physically felt the explosions and the shock waves, many had lost their homes and personal belongings, and some of them had been confronted with severely wounded or dead persons. The explosions appeared suddenly and were devastating; the scale of the destruction was large and too extended for the victims to have an opportunity to escape. The infrastructure in the area was badly damaged. The chaos was complete.

In a disaster, two phases of care can be distinguished: an immediate phase and an aftermath phase. In the *immediate* phase, starting instantly at the moment of the disaster, the victims are exposed to an acute stressor which acts as a threat to their health or even their lives. The safety of victims and rescue workers, and the prevention and treatment of physical traumata play a central role in the rescue operations. At Enschede, an extended medical assistance system was built up within a few hours in order to treat victims with acute physical effects, e.g. burns, fractures and internal injuries. Hospitals in the area and various first aid services were mobilized. Other, non medical, assistance offered in this phase served practical aims such as the provision of food or medication, the arrangement of shelters, and the supply of information about missing persons, etc. In the immediate phase, there often is a risk of exposure due to a possible release of toxic or chemical substances. Fortunately, this was not the case at the Fireworks Disaster.

After the immediate phase of post-disaster care, the *aftermath* phase starts, which may last for years. In the disaster area, a certain routine situation develops when physical injuries have been treated and the media have left for another story. Rescue workers start to remove the debris of the disaster. Most dead people have been found. Victims, shocked and feeling uprooted by the events are moved to temporary housing. In the first period after a disaster, victims will present mental health problems like an acute stress

reaction and post-traumatic stress disorder (PTSD), depression and anxiety<sup>1</sup>. In a later stage, physical health problems, for instance medically unexplained physical symptoms (MUPS) will develop<sup>2</sup>. Mental health care workers and general practitioners will focus on these new mental and physical health problems. Arrangements will be effectuated in order to compensate for loss of housing, and other damage of other goods, etc.

In the aftermath phase of the Enschede Fireworks Disaster, the authorities responsible for managing the consequences of the disaster expected an increase of health problems, both psychological and physical. They decided to seek cooperation of the local General Practitioners\* in monitoring the health consequences of their enlisted patients, both, victims and non-victims. General practice could serve as a continuous database of these problems because patients present their every day health problems, both psychological and physical, to the General Practitioner (GP). A national consortium of research bodies (RIVM, the National Institute for Public Health and Environment, NIVEL, the Netherlands Institute for health services research, IvP, the Institute for Psychotrauma) was commissioned by the Ministry of Health, Welfare and Sports in The Netherlands to monitor the health consequences of the Fireworks Disaster. NIVEL was in charge of the general practice monitor.

The author got involved in the study because he worked as a General Practitioner at Enschede. He was in town during the disaster. He felt the explosions, saw and smelled the black plume of smoke in the air and felt the collective anxiety of the crowd in the streets of Enschede. In spite of the fact that his home and practice were not damaged by the disaster and he and his family were not personally struck by the disaster, he was concerned in the situation of his colleagues and the health status of the Enschede victims. Beside his work as a GP in Enschede he became a member of the disaster research team at NIVEL. Ultimately, his research resulted in the publication of this thesis.

---

\* The denominations of “General Practitioner” and “Family Practitioner” may be considered as interchangeable.

This thesis investigates in what way and to what extent victims among general practice patients of this man-made disaster differ from non affected patients in terms of psychological and physical health problems. Moreover, the health problems of the victims will be compared to their health before the disaster happened.

In this first chapter, characteristics of disasters are described. Results will be discussed of studies on disaster-related health problems in different populations. Also, attention is paid to risk factors of post-disaster health problems. Next, methodological differences between disaster research up till now and research in general practice are described and its possible consequences for the outcome of this study. Research questions are presented and remarks are made on the methodologies of this study. Finally, the health problems that have been studied and the structure of the thesis are presented.

## Disasters, definition and characteristics

Almost every day, a disaster strikes somewhere in the world<sup>1</sup>. The word "disaster" is derived from the Latin *dis* ("against") and *astrum* ("star") meaning "the stars are evil"<sup>3</sup>. Although generally self-evident, it is not always clear what constitutes a disaster. It happens in a short period of time, causing several people being killed or injured and exceeding the capacity of local health services. The accommodation of local hospitals and other health services may be destroyed, thus hampering the deployment of rescue workers. Often, the local population has to find refuge in a safer area.

The most common characteristics to define disasters are:

- a sudden onset;
- causing a collective stress situation;
- causing great damage, loss or destruction, exceeding the capacity of institutions, health care and social resources and requiring a long time to recover;
- a disruption that exceeds the system's capacity to respond<sup>4</sup>.

Disasters influence the living conditions and the behaviour of a complete population by disturbing their community. A common feature in the definition of disasters is that the event itself exhausts local resources and

threatens the function and safety of the community. The needs are exceeding the available resources of the community. In this respect, we define disasters as acute, collectively experienced events with a sudden onset, and with a cause of natural or man-made origin. Individual and traumatic experiences such as sexual abuse, motor vehicle accidents, residential fire accidents or war and conflict situations are excluded.

As has been described in the definition, disasters are caused by natural violence (e.g., earthquakes, floods, hurricanes, bushfires) or by man-made failures (e.g., industrial explosions, chemical or nuclear pollution, transportation disasters). However, this distinction is somewhat arbitrary because the impact of natural disasters is often related to human factors. Poor engineering of housing or poor land management may increase the damage of an earthquake or a flood<sup>5</sup>. Common examples of this phenomenon include building homes in unsafe areas such as flood plains or upon steep hillsides where mudslides could occur. Poor construction and high-density buildings can increase the number of people injured and killed exponentially following an earthquake. Besides, the tsunami of December 2005 could have such a fierce impact, because warning systems failed to function<sup>6</sup>. Moreover, disasters occur in many places: in developing countries and in developed countries, on a large, or on a relatively small scale. They can strike a community, e.g. a flood or industrial disaster<sup>7-9</sup>, or involve people who have never met before, e.g. transportation disaster<sup>10,11</sup>. A disaster can have a sudden impact, e.g. an explosion or an earthquake. However, others can develop fairly slow, e.g. a chemical disaster<sup>12-15</sup>. Exposure to hazardous substances may cause serious physical damage and moreover, the risk of exposure may turn out to be an increasing factor on presenting post-disaster distress<sup>16</sup>.

In sum, there are many types of disasters with different scales of destruction and effects on the community, all with their own specific characteristics. Some generic characteristics are often seen, e.g. the excessive effort of rescue services in the aftermath and the disturbance of a community.

## **Psychological and physical reactions, and risk factors in disaster research**

### ***Psychological problems***

Victims of a disaster often experience intense fear, terror and helplessness. This is caused by a serious threat to their life or physical integrity<sup>17</sup>. Moreover, family members, e.g. spouses, children or other close relatives can be threatened by a source of violence or co-existing phenomena, e.g. fires after an explosion, thus reinforcing the victims' fear. These existential experiences may provoke many psychological and physical health problems in the aftermath of any disaster. These problems can be described as single symptoms or as a combination of symptoms being combined in (syndrome-) diagnoses.

In literature, all sorts of disaster related psychological problems have been described, especially PTSD. In her review, Norris mentioned that 68% of all samples observed PTSD. Characteristic to PTSD is a perceived loss of control<sup>4</sup>. The victims' sense of security has vanished. He is expecting a new disaster to happen at any moment. Thus, he is in a state of constant alertness, resulting in symptoms of re-experiencing the disaster, avoidance of stressing situations and even of thinking about the disaster, and persistent arousal, hyper vigilance and poor concentration with duration of longer than one month. Moreover, the victims' alertness is associated with sleeping disturbances<sup>18</sup> and intense fatigue<sup>19</sup>.

Other specific psychological reactions in the aftermath of a disaster, often described in disaster research, are depressive disorder<sup>1,13,20-24</sup> and generalised anxiety disorder<sup>8,22,25</sup>. Disaster related non-specific distress refers to the elevation of various stress-related psychological problems rather than to problems being a part of a particular syndrome, such as anxiety or depressive disorder. Examples of these states of distress are demoralisation, perceived stress and negative affect<sup>26-28</sup>.

### ***Physical symptoms in health care and in disaster research***

Within the context of disasters, studies on physical symptoms were performed, in general, on two different populations. At first, veterans of war and combat have been investigated<sup>29-33</sup>. Since the Civil War in the United States physical symptoms have been described that showed a strong

resemblance to symptoms of recent studies after the Gulf war<sup>34</sup>. Secondly, studies on physical symptoms make use of general civilian populations being hit by natural<sup>9,35-37</sup> or by man-made disasters<sup>38-40</sup>.

In disaster literature several specifications for physical symptoms are used, such as somatic symptoms<sup>36-38</sup>, somatisation symptoms<sup>39</sup>, physical symptoms<sup>30</sup>, or medically unexplained physical symptoms<sup>2,31,41,42</sup>. These symptoms are often attributed by the victim to an assumed disorder, directly related to the disaster, while the physicians cannot find a medical diagnosis<sup>41</sup>.

In several studies, heightened levels were found of clusters of respiratory<sup>30,43</sup>, musculoskeletal<sup>30,32,33,43</sup>, digestive<sup>30,33,36,43</sup>, cardiovascular<sup>32,33,36</sup>, or dermatologic symptoms<sup>33</sup> after several disasters. An association with these disasters was perceived by – at least – the victims. Exceptionally, one recent study on an air show disaster in the Ukraine found no differences in physical symptoms of victims compared with a control group before and after the disaster<sup>39</sup>. Pre-disaster baseline data were compared with post-disaster data.

#### ***Risk factors for post-disaster morbidity in disaster research***

Many disaster-related risk factors for post-disaster health problems have been found and described as was summarized by Norris in her extensive review<sup>1</sup>. Most relevant risk factors directly related to experiencing the disaster are bereavement<sup>18,44</sup>, life threat<sup>39,45</sup>, injury<sup>11,46-48</sup>, separation from family<sup>49,50</sup>, loss of one's property<sup>51-54</sup>, exposure<sup>8,14,23,25,55-58</sup>, and forced relocation<sup>59-63</sup>. In her review, Norris postulated that the type of disaster did not mediate the presentation of post-disaster distress: victims of man-made disasters were not significantly more distressed than victims who experienced natural disasters. One specific type of disaster appeared to be mass violence: Norris analysed that mass violence (especially terrorist attacks) generated higher levels of severe distress than other man-made disasters or natural disasters<sup>1</sup>.

Person-related risk factors causing higher post-disaster distress levels were found in victims with a history of psychiatric illness or a disturbed pre-disaster psychological functioning<sup>39,51,64-68</sup>, and for victims who experienced panic<sup>21,25,69,70</sup>, numbness<sup>71</sup>, or dissociation<sup>24,72-76</sup> during the disaster. Other person-related risk factors are female gender<sup>68,77-83</sup>, (middle) age<sup>9,28,68,69,84-87</sup>,

low socio-economic status<sup>51,71,83,88</sup>, and immigrant status<sup>8,21,83,89,90</sup>. In general, these factors have adverse effects on post-disaster (mental) health.

In her review, van den Berg demonstrated that female gender, high physical damage and post-traumatic stress symptoms factor were the few risk factors that predicted physical symptoms<sup>2</sup>. She raised the question whether female gender modified the effect of the disaster or whether females already presented more physical symptoms before the disaster, because most studies were retrospective and did not have pre-disaster data.

## Methodology in disaster research

In the aftermath of any disaster, the victims can be questioned, not only about their current post-disaster situation, but about their pre-disaster condition as well. This methodology might be influenced by the victim's memory of the events and of the period previous to the disaster ("recall bias"), especially when a survey is organised over a longer period after the disaster. This will hamper drawing conclusions when risk factors, e.g. female gender or immigrant status, are used in disaster research.

Data that were collected pre-disaster for other purposes are sometimes used to measure changes in health. A similar situation may appear in case of a coincidental ongoing study in the disaster area. The registration systems of general practice or of occupational services can play such role. Data about the actual health condition of victims before the disaster occurred can be extracted from these systems.

In general, most studies in disaster research did not perform a pre-disaster measurement. In addition, before the Fireworks Disaster occurred no studies were known to us that performed a longitudinal surveillance in primary health care. Research without pre-disaster measurements took place on victims of various specific populations: on young children and adolescents<sup>56,91,92</sup>, on (older) adults<sup>9,21,48,49,93</sup>, on the elderly<sup>60,94</sup>, on rescue workers<sup>45,95,96</sup>, fire-fighters<sup>25</sup>, police officers<sup>97</sup>, and on body-handlers<sup>98</sup>. Other studies without a pre-disaster assessment described a more widespread population, meaning a population of different age groups<sup>20,35,55,99-103</sup>.

Studies with pre-disaster measurements are rather scarce and most of them show data of one or two cross-sectional measurements<sup>9,39,54,64,84,85,97,104,105</sup>. Only

three studies were found which used a longitudinal design<sup>95,106,107</sup>. Almost all studies with pre-disaster measurements aimed at specific groups: (older) adults<sup>9,84,85,107</sup>, the elderly<sup>54</sup>, children or adolescents<sup>64,104-106</sup>, police officers<sup>97</sup> or at rescue workers<sup>95</sup>.

In sum, disaster research is, so far, mostly based on studies with retrospectively collected data of the pre-disaster period. Conclusions on risk factors are hard to be drawn, because we do not have information about the actual health status of the victims before the disaster took place.

## **Setting of the study**

A crucial issue of this study was that almost all GPs at Enschede already worked with Electronic Medical Records (EMR) before the disaster struck. This offered several opportunities for the design of study. In a period of one year before the disaster occurred, all presented health problems of patients were already registered by their GPs. These pre-disaster data could be used as true baseline information, a special opportunity in disaster research. Thus, population based risk factors, gender, age, or immigrant status could be examined because actual pre-disaster morbidity had already been recorded by the GPs. Another consequence of the design was that a large majority of the victims, all enlisted as patients in the Enschede general practices, could be investigated for a long period (up to five years). As a result, 89% of all victims were included in the study. Finally, the design enabled a day by day monitoring of victims and non affected patients.

### ***General practice***

All 60 Enschede general practices were invited to participate in the study: 44 (73%) agreed to do so. Sixteen did not participate for three different reasons: six expected an increase in workload, nine had no victims among their patients and one did not use an electronic registration system. None of the practices that started to take part in the study terminated registration during the process.



**Victims**

The victims in the study of this thesis were included in two ways.

1. Survivors could register as victims at the municipal Information and Advice Centre (IAC). They were enlisted when they asked for practical help or intended to claim compensation.
2. Survivors were registered as victims in the electronic medical records of the GP using a specific list with ZIP codes of the affected area, or when disaster related health problems were discussed during consultation.

All victims and controls received a research number. Thus, both groups could be followed anonymously in the two databases. This created several problems, see Chapter 3 of this thesis.

Patients of the same general practices were included in a control group when they were not registered in any of the above mentioned victim groups.

**Health problems**

The surveillance of GPs' records in the study was based on the framework of the National Information Network of General Practice (LINH) in the Netherlands. Symptoms, problems and/or diagnoses were registered using the International Classification of Primary Care (ICPC).

In the present study, all contacts and post-disaster health problems were collected longitudinally resulting in figures for morbidity and utilisation, based on the clinical information and registered in symptoms or diagnoses by the GP. The symptoms and diagnoses were grouped in various clusters, one cluster with psychological problems (e.g. stress reactions, anxiety, major depression) and physical clusters (e.g. digestive or musculoskeletal symptoms and diseases).

**Risk factors**

We were able to identify several groups of potential high risk victims. In our study, a group of victims with pre-disaster psychological morbidity could be followed post-disaster; a history of these problems is often seen as a major risk factor for post-disaster psychological problems as measured in studies without pre-disaster measurement. Moreover, the risk factors of gender, age, socio-economic status (SES) and immigrant status could be analysed. In

literature it is often concluded that immigrants, people with a lower SES, women and the middle aged have more risk on pre-disaster health problems.

The potential risk factor of relocation was chosen as a strong predictor of post-disaster psychological morbidity. A group of victims could be distinguished by a change in zip code out of the affected area in the first weeks following the disaster. Relocation was inevitable due to the destruction of the victim's dwellings by the shock waves and the succeeding fires.

One risk factor was not available in the GP's EMRs: Turkish immigrant status was acquired from the IAC database. Victims were registered as Turkish, if they were born in Turkey, or if one or both parents were born there.

In our study, data on all health problems were extracted quarterly and anonymously from the EMRs for all patients, victims as well as controls.

## **Research questions of this thesis**

The research questions of this thesis aim at general practice morbidity and utilisation as presented by victims and controls and at analysing risk groups on the presented morbidity.

### ***Question 1:***

What are the effects of the Enschede Fireworks Disaster on morbidity presented in general practice and on the utilisation of general practice services in a pre-disaster and post-disaster study comparing victims and references?

### ***Question 2:***

How long do disaster related effects persist on morbidity presented in general practice and on utilisation of general practice services in the course of time?

### ***Question 3:***

Which risk groups can be distinguished in presenting morbidity?

## Structure of this thesis

Chapters 2 and 4 to 7 are based on papers published in peer-reviewed journals.

In chapter 2, interviews with seven general practitioners of Enschede are summarised. They were confronted with the disaster and its aftermath and their experiences are described.

Chapter 3 describes the methodology of the study. Several difficulties and pitfalls are described and discussed about implementing the study in general practice.

In chapter 4, health problems and possible risk factors on psychological, social and musculoskeletal problems in the first post-disaster year are presented, compared to the pre-disaster year.

Chapter 5 describes the course of health problems in a two-and-a-half year post-disaster period of victims with and victims without pre-disaster psychological problems. Both groups are compared and possible effects of the disaster as presented in psychological and physical problems are analysed.

In Chapter 6, women and men, and five age groups are distinguished in order to investigate differences in presentation of psychological, musculoskeletal and digestive problems.

Chapter 7 investigates the assumed vulnerability of Turkish immigrant victims to the effects of the disaster compared to Dutch indigenous victims, using results of utilisation and morbidity.

Chapter 8 presents an overview of the thesis including the results, discussion, conclusions, and recommendations.

The disaster related morbidity of question 1 will be described in the chapters 4, 5, 6 and 7. Question 2 about the time span of disaster related health effects will be discussed in the chapters 5, 6 and 7. The chapters 4, 5, 6 and 7 deal with question 3 about possible risk factors.

## References

1. 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.
2. van den Berg B, Grievink L, Yzermans CJ, Lebet E. Medically Unexplained Physical Symptoms in the aftermath of disasters, a review. *Epidem Reviews* 2005;**27**:92-106.
3. Farber IJ. Psychological aspects of mass disasters. *J Natl Med Assoc* 1967;**59**:340-5.
4. Yzermans CJ, Dirkzwager AJE, Breuning E. *Long-term health consequences of disaster*. Utrecht, NIVEL, 2005.
5. Norwood AE, Ursano RJ, Fullerton CS. Disaster psychiatry: principles and practice. *Psychiatric Quarterly* 2000;**71**:207-26.
6. Gheyntchi A, Joseph L, Gierlach E, Kimpara S, Housley J, Franco ZE, Beutler LE. The dirty dozen: twelve failures of the hurricane Katrina response and how psychology can help. *Am Psychol* 2007;**62**:118-30.
7. Green BL, Lindy JD, Grace MC, Gleser GC, Leonard AC, Korol M, Winget C. Buffalo Creek survivors in the second decade: stability of stress symptoms. *Am J Orthopsychiatry* 1990;**60**:43-54.
8. Palinkas LA, Petterson JS, Russell J, Downs MA. Community patterns of psychiatric disorders after the Exxon Valdez oil spill. *Am J Psychiatry* 1993;**150**:1517-23.
9. Phifer JF. Psychological distress and somatic symptoms after natural disaster: differential vulnerability among older adults. *Psychol Aging* 1990;**5**:412-20.
10. Eriksson NG, Lundin T. Early traumatic stress reactions among Swedish survivors of the m/s Estonia disaster. *B J Psychiatry* 1996;**169**:713-6.
11. 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.
12. Bertazzi PA, Consonni D, Bachetti S, Rubagotti M, Baccarelli A, Zocchetti C, Pesatori AC. Health effects of dioxin exposure: A 20-year mortality study. *Am J Epidemiol* 2001;**153**:1031-44.
13. Bowler RM, Mergler D, Huel G, Cone JE. Psychological, psychosocial, and psychophysiological sequelae in a community affected by a railroad chemical disaster. *J Trauma Stress* 1994;**7**:601-24.
14. Crighton EJ, Elliott SJ, Meer J, Small I, Upshur R. Impacts of an environmental disaster on psychosocial health and well-being in Karakalpakstan. *Soc Sci Med* 2003;**56**:551-67.
15. Dhara VR, Dhara R. The Union Carbide disaster in Bhopal: a review of health effects. *Arch Environ Health* 2002;**57**:391-404.
16. Havenaar JM, van den Brink W. Psychological factors affecting health after toxicological disasters. *Clin Psychol Rev* 1997;**17**:359-74.

17. Ursano RJ, Fullerton CS, McCaughey BG. Trauma and disaster. In: *Individual and community responses to trauma and disaster; the structure of human chaos*. Cambridge, Cambridge University Press, 2000:3-27.
18. Dooley E, Gunn J. The psychological effects of disaster at sea. *Br J Psychiatry* 1995;**167**:233-7.
19. Yzermans C, Gersons BPR. The chaotic aftermath of an airplane crash in Amsterdam: a second disaster. In: Havenaar J, Cwikel J & Bromet E (eds). *Toxic Turmoil*. New York, Kluwer Academic, 2002:85-99, lit.
20. Armenian HK, Morikawa M, Melkonian AK, Hovanesian A, Akiskal K, Akiskal HS. Risk factors for depression in the survivors of the 1988 earthquake in Armenia. *J Urban Health* 2002;**79**:373-82.
21. Galea S, Ahern J, Resnick H, Kilpatrick D, Bucuvalas M, Gold J, Vlahov D. Psychological sequelae of the September 11 terrorist attacks in New York City. *N Engl J Med* 2002;**346**:982-7.
22. Goenjian AK, Steinberg AM, Najarian LM, Fairbanks LA, Tashjian M, Pynoos RS. Prospective study of posttraumatic stress, anxiety, and depressive reactions after earthquake and political violence. *Am J Psychiatry* 2000;**157**:911-6.
23. Goenjian AK, Molina L, Steinberg AM, Fairbanks LA, Alvarez ML, Goenjian HA, Pynoos RS. Posttraumatic stress and depressive reactions among Nicaraguan adolescents after hurricane Mitch. *Am J Psychiatry* 2001;**158**:788-94.
24. North CS. The course of post-traumatic stress disorder after the Oklahoma City bombing. *Mil Med* 2001;**166**:51-2.
25. McFarlane AC, Papay P. Multiple diagnoses in posttraumatic stress disorder in the victims of a natural disaster. *J Nerv Ment Dis* 1992;**180**:498-504.
26. Dohrenwend BP. Psychological implications of nuclear accidents: the case of Three Mile Island. *Bull N Y Acad Med* 1983;**59**:1060-76.
27. Phifer JF, Norris FH. Psychological symptoms in older adults following natural disaster: nature, timing, duration, and course. *J Gerontol* 1989;**44**:S207-S217.
28. Thompson MP, Norris FH, Hanacek B. Age differences in the psychological consequences of Hurricane Hugo. *Psychol Aging* 1993;**8**:606-16.
29. Beckham JC, Moore SD, Feldman ME, Hertzberg MA, Kirby AC, Fairbank JA. Health status, somatization, and severity of posttraumatic stress disorder in Vietnam combat veterans with posttraumatic stress disorder. *Am J Psychiatry* 1998;**155**:1565-9.
30. Engel CC, Jr., Liu X, McCarthy BD, Miller RF, Ursano R. Relationship of physical symptoms to posttraumatic stress disorder among veterans seeking care for gulf war-related health concerns. *Psychosom Med* 2000;**62**:739-45.
31. Engel CCJ. Outbreaks of medically unexplained physical symptoms after military action, terrorist threat, or technological disaster. *Milit Med* 2001;**166**:47-8.
32. Ouimette P, Cronkite R, Henson BR, Prins A, Gima K, Moos RH. Posttraumatic stress disorder and health status among female and male medical patients. *J Trauma Stress* 2004;**17**:1-9.

33. Schnurr PP, Spiro A, III, Paris AH. Physician-diagnosed medical disorders in relation to PTSD symptoms in older male military veterans. *Health Psychol* 2000;**19**:91-7.
34. Hyams KC. Lessons derived from evaluating Gulf War syndrome: suggested guidelines for investigating possible outbreaks of new diseases. *Psychosom Med* 1998;**60**:137-9.
35. Bravo M, Rubio-Stipec M, Canino GJ, Woodbury MA, Ribera JC. The psychological sequelae of disaster stress prospectively and retrospectively evaluated. *Am J Community Psychol* 1990;**18**:661-80.
36. Escobar JL, Canino G, Rubio-Stipec M, Bravo M. Somatic symptoms after a natural disaster: a prospective study. *Am J Psychiatry* 1992;**149**:965-7.
37. Hollifield M, Hewage C, Gunawardena CN, Kodituwakku P, Bopagoda K, Weeraratnege K. Symptoms and coping in Sri Lanka 20-21 months after the 2004 tsunami. *Br J Psychiatry* 2008;**192**:39-44.
38. Bromet EJ, Gluzman S, Schwartz JE, Goldgaber D. Somatic symptoms in women 11 years after the Chernobyl accident: prevalence and risk factors. *Environ Health Perspect* 2002;**110 Suppl 4**:625-9.
39. Bromet EJ, Havenaar JM, Gluzman SF, Tittle NL. Psychological aftermath of the Lviv air show disaster: a prospective controlled study. *Acta Psychiatr Scand* 2005;**112**:194-200.
40. Lindeman M, Saari S, Verkasalo M, Prytz H. Traumatic stress and its risk factors among peripheral victims of the M/S Estonia Disaster. *European Psychologist* 1996;**1**:255-70.
41. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
42. Engel CC, Jr., Adkins JA, Cowan DN. Caring for medically unexplained physical symptoms after toxic environmental exposures: effects of contested causation. *Environ Health Perspect* 2002;**110 Suppl 4**:641-7.
43. Chen SH, Hung FC, Lin YS, Tseng HM. Trauma and psychosocial aftermath among high- and low-exposure adults three months post the 921 Chi-Chi earthquake in Taiwan. *Chinese J Psychology* 2002;**44**:167-88.
44. Vogel JM, Vernberg EM. Psychological responses of children to natural and human-made disasters: I. Children's psychological responses to disasters. *J Clin Child Psychology* 1993;**22**:464-84.
45. Marmar CR, Weiss DS, Metzler TJ, Ronfeldt HM, Foreman C. Stress responses of emergency services personnel to the Loma Prieta earthquake interstate 880 freeway collapse and control traumatic incidents. *J Trauma Stress* 1996;**9**:63-85.
46. Hull AM, Alexander DA, Klein S. Survivors of the Piper Alpha oil platform disaster: long-term follow-up study. *Br J Psychiatry* 2002;**181**:433-8.
47. Jehel L, Paterniti S, Brunet A, Duchet C, Guelfi JD. Prediction of the occurrence and intensity of post-traumatic stress disorder in victims 32 months after bomb attack. *Eur Psychiatry* 2003;**18**:172-6.

48. Middleton KL, Willner J, Simmons KM. Natural disasters and posttraumatic stress disorder symptom complex: Evidence from the Oklahoma tornado outbreak. *Int J Stress Management* 2002;**9**:229-36.
49. Armenian HK, Morikawa M, Melkonian AK, Hovanesian AP, Haroutunian N, Saigh PA, Akiskal K, Akiskal HS. Loss as a determinant of PTSD in a cohort of adult survivors of the 1988 earthquake in Armenia: Implications for policy. *Acta Psychiatr Scand* 2000;**102**:58-64.
50. Lonigan CJ, Shannon MP, Taylor CM, Finch AJ, Jr., Sallee FR. Children exposed to disaster: II. Risk factors for the development of post-traumatic symptomatology. *J Am Acad Child Adolesc Psychiatry* 1994;**33**:94-105.
51. Caldera T, Palma L, Penayo U, Kullgren G. Psychological impact of the hurricane Mitch in Nicaragua in a one-year perspective. *Soc Psychiatry Psychiatr Epidemiol* 2001;**36**:108-14.
52. Carlier IVE, Gersons BPR. Stress reactions in disaster victims following the Bijlmermeer plane crash. *J Traum Stress* 1997;**10**:329-35.
53. Kitayama S, Okada Y, Takumi T, Takada S, Inagaki Y, Nakamura H. Psychological and physical reactions on children after the Hanshin-Awaji earthquake disaster. *Kobe J Med Sci* 2000;**46**:189-200.
54. Lin MR, Huang W, Huang C, Hwang HF, Tsai LW, Chiu YN. The impact of the Chi-Chi earthquake on quality of life among elderly survivors in Taiwan: A before and after study. *Quality of Life Research* 2002;**11**:379-88.
55. Cao H, McFarlane AC, Klimidis S. Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake--the first 5-month period. *Soc Psychiatry Psychiatr Epidemiol* 2003;**38**:204-12.
56. La Greca A, Silverman WK, Vernberg EM, Prinstein MJ. Symptoms of posttraumatic stress in children after Hurricane Andrew: a prospective study. *J Consult Clin Psychol* 1996;**64**:712-23.
57. Parslow RA, Jorm AF, Christensen H. Associations of pre-trauma attributes and trauma exposure with screening positive for PTSD: analysis of a community-based study of 2,085 young adults. *Psychol Med* 2006;**36**:387-95.
58. Sprang G. Post-disaster stress following the Oklahoma City bombing: An examination of three community groups. *J Interpers Violence* 1999;**14**:169-83.
59. Kilic C, Aydin I, Taskintuna N, Ozcurumez G, Kurt G, Eren E, Lale T, Ozel S, Zileli L. Predictors of psychological distress in survivors of the 1999 earthquakes in Turkey: effects of relocation after the disaster. *Acta Psychiatr Scand* 2006;**114**:194-202.
60. Mecocci P, Di Iorio A, Pezzuto S, Rinaldi P, Simonelli G, MaggioD, Montesperelli P, Longo A, Cherubini A, Chiarappa N, Abate G, Senin U. Impact of the earthquake of September 26, 1997 in Umbria, Italy on the socioenvironmental and psychophysical conditions of an elderly population. *Aging-Clinical & Experimental Research* 2000;**12**:281-6.
61. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. Relocation after a disaster: posttraumatic stress disorder in Armenia after the earthquake. *J Am Acad Child Adolesc Psychiatry* 1996;**35**:374-83.
62. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. The effect of relocation after a natural disaster. *J Trauma Stress* 2001;**14**:511-26.

63. Riad JK, Norris FH. The influence of relocation on the environmental, social, and psychological stress experienced by disaster victims. *Environment and Behavior* 1996;**28**:163-82.
64. Asarnow J, Glynn S, Pynoos RS, Nahum J, Guthrie D, Cantwell DP, Franklin B. When the earth stops shaking: earthquake sequelae among children diagnosed for pre-earthquake psychopathology. *J Am Acad Child Adolesc Psychiatry* 1999;**38**:1016-23.
65. Basoglu M, Salcioglu E, Livanou M. Traumatic stress responses in earthquake survivors in Turkey. *J Trauma Stress* 2002;**15**:269-76.
66. Ginexi EM, Weihs K, Simmens SJ, Hoyt DR. Natural disaster and depression: a prospective investigation of reactions to the 1993 midwest floods. *Am J Community Psychol* 2000;**28**:495-518.
67. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consult Clin Psychol* 1998;**66**:883-92.
68. Salcioglu E, Basoglu M, Livanou M. Long-term psychological outcome for non-treatment-seeking earthquake survivors in Turkey. *J Nerv Ment Dis* 2003;**191**:154-60.
69. Boscarino JA, Galea S, Ahern J, Resnick H, Vlahov D. Utilization of mental health services following the September 11th terrorist attacks in Manhattan, New York City. *Int J Emerg Ment Health* 2002;**4**:143-55.
70. Pfefferbaum B, Stuber J, Galea S, Fairbrother G. Panic reactions to terrorist attacks and probable posttraumatic stress disorder in adolescents. *J Trauma Stress* 2006;**19**:217-28.
71. Epstein RS, Fullerton CS, Ursano RJ. Posttraumatic stress disorder following an air disaster: a prospective study. *Am J Psychiatry* 1998;**155**:934-8.
72. Cardena E, Spiegel D. Dissociative reactions to the San Francisco Bay Area earthquake of 1989. *Am J Psychiatry* 1993;**150**:474-8.
73. Green BL, Grace MC, Vary MG, Kramer TL, Gleser GC, Leonard AC. Children of disaster in the second decade: a 17-year follow-up of Buffalo Creek survivors. *J Am Acad Child Adolesc Psychiatry* 1994;**33**:71-9.
74. Koopman C, Classen C, Spiegel D. Dissociative responses in the immediate aftermath of the Oakland/Berkeley firestorm. *J Trauma Stress* 1996;**9**:521-40.
75. Laor N, Wolmer L, Kora M, Yucel D, Spirman S, Yazgan Y. Posttraumatic, dissociative and grief symptoms in Turkish children exposed to the 1999 earthquakes. *J Nerv Ment Dis* 2002;**190**:824-32.
76. Lima BR, Pai S, Toledo V, Caris L, Haro JM, Lozano J, Santacruz H. Emotional distress in disaster victims. A follow-up study. *J Nerv Ment Dis* 1993;**181**:388-93.
77. Anderson KM, Manuel G. Gender differences in reported stress response to the Loma Prieta earthquake. *Sex Roles* 1994;**30**:725-33.
78. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, alcohol use, and perceived safety after the terrorist attack on the pentagon. *Psychiatr Serv* 2003;**54**:1380-2.
79. Joh H. Disaster stress of the 1995 Kobe earthquake. *Psychologia: An International Journal of Psychology in the Orient* 1997;**40**:192-200.



80. Karanci NA, Alkan N, Aksit B, Sucuoglu H, Balta E. Gender differences in psychological distress, coping, social support and related variables following the 1995 Dinal (Turkey) earthquake. *North Am J Psychology* 1999;**1**:189-204.
81. Norris FH, Perilla JL, Ibanez GE, Murphy AD. Sex differences in symptoms of posttraumatic stress: Does culture play a role? *J Trauma Stress* 2001;**14**:7-28.
82. Steinglass P, Gerrity E. Natural disasters and post-traumatic stress disorder: Short-term versus long-term recovery in two disaster-affected communities. *Journal of Applied Social Psychology* 1990;**20**:1746-65.
83. Warheit GJ, Zimmerman RS, Khoury EL, Vega WA, Gil AG. Disaster related stresses, depressive signs and symptoms, and suicidal ideation among a multi-racial/ethnic sample of adolescents: a longitudinal analysis. *J Child Psychol Psychiatry* 1996;**37**:435-44.
84. Knight BG, Gatz M, Heller K, Bengtson VL. Age and emotional response to the Northridge earthquake: a longitudinal analysis. *Psychol Aging* 2000;**15**:627-34.
85. Norris FH, Murrell SA. Prior experience as a moderator of disaster impact on anxiety symptoms in older adults. *Am J Community Psychol* 1988;**16**:665-83.
86. Ohta Y, Araki K, Kawasaki N, Nakane Y, Honda S, Mine M. Psychological distress among evacuees of a volcanic eruption in Japan: A follow-up study. *Psychiatry Clin Neurosci* 2003;**57**:105-11.
87. Seplaki CL, Goldman N, Weinstein M, Lin YH. Before and after the 1999 Chi-Chi earthquake: traumatic events and depressive symptoms in an older population. *Soc Sci Med* 2006;**62**:3121-32.
88. Vila G, Witkowski P, Tondini MC, Perez-Diaz F, Mouren-Simeoni MC, Jouvent R. A study of posttraumatic disorders in children who experienced an industrial disaster in the Briey region. *Eur Child Adolesc Psychiatry* 2001;**10**:10-8.
89. March JS, Amaya-Jackson L, Terry R, Costanzo P. Posttraumatic symptomatology in children and adolescents after an industrial fire. *J Am Acad Child Adolesc Psychiatry* 1997;**36**:1080-8.
90. Norris FH, Perilla JL, Riad JK, Kaniasty K, Lavizzo EA. Stability and change in stress, resources, and psychological distress following natural disaster: Findings from Hurricane Andrew. *Anxiety, Stress and Coping* 1999;**12**:363-96.
91. Goenjian AK, Pynoos RS, Steinberg AM, Najarian LM, Asarnow JR, Karayan I, Ghurabi M, Fairbanks LA. Psychiatric comorbidity in children after the 1988 earthquake in Armenia. *J Am Acad Child Adolesc Psychiatry* 1995;**34**:1174-84.
92. Khoury EL, Warheit GJ, Hargrove MC, Zimmerman RS, Vega WA, Gil AG. The impact of hurricane Andrew on deviant behavior among a multi-racial/Ethnic sample of adolescents in Dade county, Florida: A longitudinal analysis. *J Trauma Stress* 1997;**10**:71-91.
93. Ferraro FR. Psychological resilience in older adults following the 1997 flood. *Clinical Gerontologist* 2003;**26**:139-43.
94. Livingston HM, Livingston MG, Fell S. The Lockerbie disaster: A 3-year follow-up of elderly victims. *Int J Geriatric Psychiatry* 1994;**9**:989-94.

95. Morren M, Dirkzwager AJ, Kessels FJ, Yzermans CJ. The influence of a disaster on the health of rescue workers: a longitudinal study. *CMAJ* 2007;**176**:1279-83.
96. North CS, Tivis L, McMillen JC, Pfefferbaum B, Spitznagel EL, Cox J, Nixon S, Bunch KP, Smith EM. Psychiatric disorders in rescue workers after the Oklahoma City bombing. *Am J Psychiatry* 2002;**159**:857-9.
97. Alexander DA, Wells A. Reactions of police officers to body-handling after a major disaster: A before-and-after comparison. *Br J Psychiatry* 1991;**159**:547-55.
98. Tucker P, Pfefferbaum B, Doughty DE, Jones DE, Jordan FB, Nixon SJ. Body handlers after terrorism in Oklahoma City: Predictors of posttraumatic stress and other symptoms. *Am J Orthopsychiatry* 2002;**72**:469-75.
99. Bleich A, Gelkopf M, Solomon Z. Exposure to terrorism, stress-related mental health symptoms, and coping behaviors among a nationally representative sample in Israel. *JAMA* 2003;**290**:612-20.
100. Catapano F, Malafronte R, Lepre F, Cozzolino P, Arnone R, Lorenzo E, Tartaglia G, Starace F, Magliano L, Maj M. Psychological consequences of the 1998 landslide in Sarno, Italy: a community study. *Acta Psychiatr Scand* 2001;**104**:438-42.
101. Galea S, Vlahov D, Resnick H, Ahern J, Susser E, Gold J, Bucuvalas M, Kilpatrick D. Trends of probable post-traumatic stress disorder in New York City after the September 11 terrorist attacks. *Am J Epidemiol* 2003;**158**:514-24.
102. Silver RC, Holman EA, McIntosh DN, Poulin M, Gil-Rivas V. Nationwide longitudinal study of psychological responses to September 11. *JAMA* 2002;**288**:1235-44.
103. Smith DW, Christiansen EH, Vincent R, Hann NE. Population effects of the bombing of Oklahoma City. *J Okla State Med Assoc* 1999;**92**:193-8.
104. Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. *J Pers Soc Psychol* 1991;**61**:115-21.
105. Reijneveld SA, Crone MR, Verhulst FC, Verloove-Vanhorick SP. The effect of a severe disaster on the mental health of adolescents: a controlled study. *Lancet* 2003;**362**:691-6.
106. Dirkzwager AJE, Kerssens JJ, Yzermans CJ. Health problems in children and adolescents before and after a man-made disaster. *J Am Acad Child Adolesc Psychiatry* 2006;**45**:94-103.
107. Dorn T, Yzermans CJ, van der Zee J. Prospective cohort study into post-disaster benzodiazepine use demonstrated only short-term increase. *J Clin Epidemiol* 2007;**60**:795-802.

# Chapter

# 2

## **I am all right: Experiences of General Practitioners during and after a disaster**

Rik JH Soeteman

---

Huisarts en Wetenschap 2006; 49: 299-303.

## **Abstract**

Not much is known about the consequences for general practitioners (GPs) in case of large scale disasters. After the Enschede Fireworks Disaster, the author, being a GP at Enschede, had several conversations with seven Enschede GPs with damage to their dwellings or practices or being involved in medical assistance during and/or after the disaster.

The disaster was a striking experience to them. Instantly after the disaster, their new and unexpected role as aid workers in an emergency setting was hard to accept.

In the later aftercare phase, they had to convince the authorities of the crucial role they could play in the post-disaster health care, because all victims already were enlisted in their practices and thus were known to them.

In the aftercare phase, the GPs encouraged their victims to tell about their experiences. Doctor and patient felt a mutual understanding by talking about the disaster, they both had gone through. A system of support was developed by the GPs themselves in the aftercare phase, like the employment of deputy GP's and administrative staff, and training skills.

It was hard for the GPs to consider themselves as victims being struck by the disaster. They thought themselves less struck by the disaster than others, e.g. their patients. One GP ironically talked about the "I'm all right-syndrome".

## Preface

Not much has been written on the consequences of disasters on GPs. The question how intensively GPs can be involved in a disaster became very real to me as a GP and inhabitant of Enschede with the Fireworks Disaster on a Saturday afternoon in May 2000. Me and my family survived undamaged; our house was undamaged and the practice turned out to be undamaged. With one deadly hurt patient and several, i.e. 50, casualties in our practice, we came out rather well and we did not suffer horribly; so I wondered how my colleagues who did offer medical assistance, who suffered damage to their house or practice and who did have many patients in their practice who were hit by the disaster, experienced the disaster and its aftermath. I decided to interview them about this issue.

This article describes the personal experiences of several Enschede GPs and their perception of the disaster and its aftermath. Next, a description is given of the support to and by Enschede GPs.

### **What does a disaster with the GP: literature**

Nowadays, articles have been published on the consequences of the Enschede Fireworks Disaster to the inhabitants' health<sup>1,2</sup>. This journal too describes the long term consequences of the Fireworks Disaster in an article<sup>3</sup>. Additionally, the impact of the disaster on a recently set up Out-Of-Hours Cooperative in Enschede has been described<sup>4</sup>. So far, little has been published on the consequences of a disaster to GPs. Blair described in a personal report the deprivation of Canadian GPs as aid workers and as family members during an ice storm which went on for a whole week<sup>5</sup>. Axelrod described how flooding influenced the management and the work load in a health centre: the number of home visits increased in the first three months with 32%<sup>6</sup>. Meijer published two articles on the victims of the Bijlmer disaster and mentioned in this article his tendency to identify as a GP with his patients<sup>7,8</sup>.

## **Preparation**

I knew that seven GPs, five men and two women, had been affected personally by the disaster, because their house was damaged, they had physically felt the explosion, or they had offered medical assistance at the place of the disaster; also, many people in their practice had been affected by the disaster, i.e. 130-700. I contacted them for two interviews each.

The first interviews took place in the spring of 2003. Enschede had, in some way or another, turned normal and enough time had passed to make it possible to look at the events with hindsight. The fluctuations in the workload of the GP practices seemed to have come to an end and the situation seemed stable at last. The GPs could now look back and review the disaster. I took the interviews using a checklist for the acute phase (where was the GP during the disaster, what was the damage to his house and practice, did he offer medical assistance, did he see any casualties?) and for the aftermath (what was the workload for the practice, what support did they receive, what were the changes in the years after the disaster?); the aftermath phase started at the first Monday morning after the disaster, when all practices were open.

I contacted the seven GPs again in the autumn of 2004 and asked them by phone whether any changes had taken place since our last interview in spring 2003.

Information about the support for GP practices, developed in Enschede, was collected from what GPs said on this issue during these interviews. Additionally, I spoke to two managers, a GP and a policy staff member of the Out-of-Hours Cooperative, who all played an active role in the development and implementation of this support.

### **GP during the Fireworks Disaster**

The moment the explosions took place, Saturday afternoon 13 May 2000, I was with my family at the Music Hall in the centre of Enschede. The events progressed rapidly: explosions shook the building, people panicked and ran hastily outside. Once outside, we saw an enormous black cloud. We tried to get away from the crowd on the street and go home as soon as possible. I consulted my wife (we run a practice together), collected my GP bag and went to a park near our house to help the injured people. I was scared to be facing heavily wounded people and I was not sure whether I could help as a GP. About twenty GPs were waiting in the park. Soon it turned out that we could not do anything at all. The aid workers of the GHOR (Medical Aid at Accidents and Disasters) had made a mobile coordination centre. They did not have any specific tasks for us, GPs. I left after an hour, because no injured people appeared. At home, we watched, mesmerised, the report on the disaster on the local television. We kept the windows closed because of the dense smoke above our district. The next night, and also the next morning, a smell of fire penetrated our house. Helicopters flew over. Exhausted we left town at Sunday morning, to stay with friends elsewhere and to take a rest for a day.

The next Monday morning, the week started without us knowing what to expect. It was quiet the first day, but at Wednesday it was getting busier. Consulting hours took more time, because patients came to tell their story. From then onwards, the number of patients that came for consultation and the duration of the consulting hours continued to increase. As far as I can remember, this situation of working hard and making long hours continued for about one year.

The disaster has affected us deeply casting its shadows far ahead: thunder and lightning made me jump, I developed an aversion to fire works at New Years Eve and felt burdened by the extra work in our practice population that was only lightly affected by the disaster.

### **Interviews with seven GPs**

#### *The acute phase of the disaster*

The disaster struck at a sunny Saturday afternoon and came out of the blue. Most GPs were off-duty. As the news of the disaster spread, GPs suddenly turned into first aid emergency assistants, a role they were not familiar with. They did not know which role to play in such a large-scale disaster. The confusion at the GHOR (Medical Aid at Accidents and Disasters) added to

their doubts. GPs that contacted the GHOR and offered their help were left in the dark: GPs were not mentioned in the protocol.

Two GPs spontaneously helped at the place of the disaster with care and triage of the sometimes seriously injured people. One of them faced a dangerous and horrible situation during his assistance. He continued working only to find out two years later that he was suffering from post-traumatic stress syndrome.

"I live less than a mile from the place of the disaster. I heard the terrible noise and firework and went to look what was happening. I walked into the area. After a heavy explosion, policemen and firemen sent me and others away. A second explosion struck me while running and threw me to the ground. I could not believe what was happening! Next, I dragged two apathetic women with me for cover behind a shop. The noise was increasing and I felt that things were really going wrong now: the heaviest bang followed sucking the windows out of their frames. Everybody fell to the ground. Shops were in flames. I was getting scared: I had to run away and I ran to my car.

Driving in my car, I saw a man lying on the street next to his bicycle. At that moment I realised that I was a doctor and that I had to help. The man was seriously hurt. A block of concrete that had struck him off his bike lay next to him. There was nothing I could do for him. He tried to say something to me before he died. Neighbours brought a blanket and I covered the body with it. After that I went back into the area to help looking after the injured people."

Of the other interviewed GPs, four have assisted in looking after the injured people elsewhere in the city. Small surgical interventions were done at their own practice or at the Out-of-Hours Cooperative. Others assisted in sports halls all over the city. The names of medicines had to be found, blood sugars and tensions arranged, etc.

Five of the seven interviewed GPs suffered damage to their house or practice: the roof was displaced, doors or windows were pushed in. They had to temporarily leave their house or practice. What struck me in their stories, was that the situation seemed not real.



“Straight after the disaster – I live at the other side of Enschede – my assistant told me that ‘the practice had been blown up’. I could not get near: the whole area was closed off by barricades set up by Special Forces of the police. Later on I heard from people at the barricades that my practice was still there.

At night I could not sleep. I had to go to my practice to see what the situation was like. It was five o’clock in the morning. The streets were empty. I managed to get through the road blocks. Once inside my practice, I saw that the ceilings had disappeared. The other damage seemed not so bad after all.

A member of the special police forces rang the doorbell. I had to leave the premises immediately because of the danger that the building would collapse. When I was back on the street, I noticed for the first time the complete quietness: even no sounds of birds. Next to the practice was a bike with a puncture. The tools and the bucket with water were still there.”

One of the GPs had been scared to death: he was taking a shower when the loudest explosion happened and for a moment he thought he would die. Another GP was blown off his feet by the air pressure. He described his feeling as stunned: he was completely off balance, too confused to be scared. A colleague who had lost his family for several hours and had found his house empty, windows broken, doors blown out, initially described all as a series of factual events; it was only later that he could describe his feelings, his desperation and fear.

## **The aftermath of the disaster**

Monday and Tuesday after the disaster were quiet at the practices: not many calls, short consulting hours. The GPs tried to get informed on the patients in the disaster area via their relatives. Three GPs could not use their practice because of the damage to the premises. They found a place for their consulting hours elsewhere, such as in the Out-of-Hours Cooperative. They wrote their notes on the prescriptions.

A few days later the work load increased rapidly, especially the consulting hours were a burden caused by the many people wishing to see their GPs, and each visit taking more time because patients had many problems. The GPs gave people the chance to tell their story first. Doctors and patients felt

a mutual understanding, because they had had the same experiences. Drawback of this attitude was that GPs lost distance resulting in problems with managing time. One GP reported that he had sympathy for all, even for the patient who was grieving over his dead plants. Two GPs devoted themselves to activities outside their work. One of them started risky activities in his spare time, such as driving a motor and bungee jumping. They were now able to talk about it with more distance during the interviews. Two out of the seven GPs felt that they were failing, because they were not able to help people with unsolvable problems and because they had not enough time for home visits. However, after a few months these feelings of failure disappeared.

Three years after the disaster, three of the seven GPs felt that material as well as emotional support had not been sufficient. They did not agree with the allocation of funds for practice support, which was based on the number of victims per practice. No funds were administered to GPs for offering support in the disaster area or for damages suffered to house or practice. All GPs had ambivalent feelings about the question whether they were struck by the disaster. Characteristic remarks during the interviews were: "I am not really struck by the disaster", "Others suffered far more", "I continued being a medical assistant", and "I was not a victim, I was just affected by it". One of the GPs called it ironically the 'I am all right'- syndrome. They were positive about the fact that the local branch of the RIAGG (Regional Institute for Outpatient Mental Health Care), Mediant, had developed a special department for after-care for the victims, where they could send their patients. All GPs regarded this to be a strong back-up. One of them was especially pleased, because he could efficiently refer a specific group of patients from a deprived inner city area to the recently established mental health care department. This GP thought, however, that this group had already been in a bad state before the disaster, in such a way that things could not get worse.

All interviewed GPs mentioned the solidarity after the disaster, the feeling of "joining efforts". They told us that their work attitude had changed three years after the disaster: they sit at their desks much more relaxed and they can understand people better. They seem to better recognise patients with disaster-related problems. "I seem to attract them". Two GPs reduced their working hours after the disaster. They limited their care for patients.

### **Follow-up in December 2004: quietude**

The follow-up by phone in December 2004 showed that all GPs regarded the situation to be stable. Hardly anything had changed since the interview of 2003. No extra workload was felt in the practices. By now, the disaster had become part of GPs' lives. All GPs were satisfied, in hindsight, about their role in the after-care of the disaster, because they had taken care of their patients and supported them. They said that, as a result, they do their work now with more quietude and precision.

### **Support**

The interviews with the two managers showed the following picture. On Saturday 13 May 2000, the day of the disaster, the central Out-of-Hours Cooperative in Enschede, which had been operative for just two weeks then, did a good job. Straight after the disaster, GPs and policy staff of the central Cooperative formed a crisis team to coordinate the huge flow of requests for aid and other problems. The team contacted local authorities, pharmacies, hospitals, the press, etc. GPs that contacted the Cooperative could help in the various emergency centres. That very weekend, the crisis team set up a uniform registration system of contacts with victims and developed the first ideas for supporting the Enschede GPs in the long term.

Monday 15 May, the crisis team of the central Cooperative took the initiative to visit the town hall for the first in a series of consultations with aid organisations and governmental representatives – nobody had thought of it to invite GPs. They had to be convinced that GPs were relevant interlocutors.

As a result of these consultations, a coordination centre for psychosocial after-care was set up; Enschede GPs have used the funds resulting from these consultations to develop logistic and relevant practice support in order to help the victims more efficiently. (see paragraph "Logistic and relevant support").

## **Logistic and relevant support at the Fireworks Disaster**

Logistic support:

- Locums in their own practice or for certain services
- Assist in reducing administrative backlog
- Providing a spokesman own language and culture
- Support in special tasks such as flu vaccination

Relevant support:

- Setting up a uniform registration system for patient contracts
- Continuing education for GPs and assistants
- Setting up consultation structures between GP groups and RIAGG/GGZ (Regional Institute for Outpatient Mental Health Care/Mental Health Care)

## **Finally**

The Fireworks Disaster has been a drastic event for the GPs involved.

- During and straight after the disaster they had problems performing their task as aid workers at a disaster, an unexpected and undefined task.<sup>9,10</sup>
- Some GPs felt they were failing in the first months after the disaster
- GPs are, in general, satisfied with their own role in the aftercare; the offered support has helped them in this period
- The GPs could hardly see themselves as victims.

## **Main topics**

- Little is known on the experiences of GPs with a large-scale disaster near their homes
- The Fireworks Disaster was a striking experience. In the acute phase GPs' role as aid workers was an unexpected and a vague one
- They are satisfied with the after-care of the disaster. The support they received was essential.

## References

1. Donker GA, Yzermans CJ, Kerssens JJ, Dorn T. Lessen voor de toekomst: gezondheidsklachten na een ramp. *Medisch Contact* 2004;**59**:1730-3.
2. Gersons BPR, Huijsman-Rubingh RRR, Olff M. De psychosociale zorg na de vuurwerkramp in Enschede; lessen van de Bijlmer-vliegramp. *Ned Tijdschr Geneesk* 2004;**148**:1426-30.
3. Yzermans CJ, Donker GA, Kerssens JJ, Dirkzwager AJ, Soeteman RJ, Ten Veen PM. Health problems of victims before and after disaster: a longitudinal study in general practice. *Int J Epidemiol* 2005;**34**:820-6.
4. Meulenberg F. Niemand vermoedde dat het zo erg zou kunnen zijn [Nobody anticipated it would be that bad]. *De Huisarts* 2000;7-11.
5. Blair L. Never the same again. Family doctors' priorities challenged by ice storm. *Can Fam Physician* 1998;**44**:721-8.
6. Axelrod C, Killam PP, Gaston MH, Stinson N. Primary health care and the Midwest flood disaster. *Public Health Rep* 1994;**109**:601-5.
7. Meijer JS. Een vliegramp in de huisartspraktijk: posttraumatische reacties in de eerste vier weken na de ramp in de Bijlmermeer [An air disaster in general practice: post-traumatic reactions in the first four weeks after the Amsterdam disaster]. *Ned Tijdschr Geneesk* 1992;**136**:2553-8.
8. Meijer JS. Een jaar na de vliegramp in de Bijlmermeer: posttraumatische reacties in een huisartspraktijk [One year after the Amsterdam air disaster: post-traumatic reactions in a general practice]. *Ned Tijdschr Geneesk* 1993;**137**:2681-5.
9. Somers GT, Maxfield N, Drinkwater EJ. General practitioner preparedness to respond to a medical disaster. Part I: Skills and equipment. *Aust Fam Physician* 1999;**28 Suppl 1**:S3-S9.
10. Somers GT, Maxfield N, Drinkwater EJ. General practitioner preparedness to respond to a medical disaster. Part II: Ability and training. *Aust Fam Physician* 1999;**28 Suppl 1**:S10-S14.

## 2

*Health problems of Enschede residents in the aftermath of the Fireworks Disaster*

# Chapter

# 3

## **A longitudinal cohort study in general practice on health problems following a disaster**

Design and organisational issues

Rik JH Soeteman  
Jolanda Groenendijk  
Henk van den Hoogen  
Joris Yzermans

---

Submitted

## Abstract

**Background** Longitudinal studies with a pre-disaster assessment are scarce in disaster research. This paper describes experiences with the implementation of a longitudinal study on health problems as presented in general practice after a man-made disaster.

**Methods/Design** A cohort of 9254 victims and a cohort of 7240 controls were followed during six years, one year before and five years post-disaster. This paper focuses on five major methodological and organisational issues:

1. The recruitment of general practitioners to participate in the study
2. The implementation of the study in general practice
3. The preparation of the retrieval of workable data
4. The privacy procedures
5. The assignment of the victim status

**Discussion** Design and implementation of the study are discussed. Advices are given for implementing research in general practice after a disaster, including an approach of privacy procedures.



## **Background**

Disasters may have a significant impact on the lives and health of the people involved. Insight into this impact and understanding of the risk factors that play a role in the development of health problems is important for future dealing with disasters<sup>1-3</sup>. Implementing a study on health problems after a major disaster will meet many problems, often connected to the prospects of a “modified cohort” study, using cross-sectional and retrospective designs<sup>3,4</sup>. Longitudinal studies measuring health before and after exposure are rare<sup>3,5-7</sup>. In the Netherlands we had the opportunity to implement a cohort study with inclusion of pre-disaster data, using the electronic medical records of general practitioners when a depot, storing 117 tons of heavy fireworks exploded on May 13, 2000, in a residential area in the city of Enschede, in the eastern part of the Netherlands. A complete neighbourhood was swept away, 18 residents and four fire fighters died and almost one thousand people were injured. About 1200 people had to be relocated for several years because they had lost their house and all personal belongings<sup>8</sup>.

In reaction, the ministry of Health, Welfare and Sports decided to implement an extensive health care project. First, an Information & Advice Centre (IAC), serving as one counter for all questions and problems, was set up under municipal responsibility. Moreover, the IAC coordinated and facilitated an integrated (psychosocial) health care. In addition, residents, rescue workers, and passers-by were registered as victims by the IAC.

Secondly, a longitudinal surveillance of victims and non-victims was started, using existing registries in general practice<sup>8</sup>. This research project aimed at exploring the psychological and physical morbidity, (primary) healthcare utilisation and at the identification of high risk groups among the victims.

In the Dutch health care system, every citizen is enrolled in the practice of just one General Practitioner (GP). When a patient moves (relocation), the medical patient record goes with him. The patient contacts 'his' GP to seek advice or treatment. The GP acts as a gatekeeper to secondary care. More than 90% of the patients' problems are addressed by the GPs themselves; the remaining 10% or less is referred to a specialist<sup>9-11</sup>. More than 75% of the Dutch population see their GP at least once a year, and more than 96% at least once every three years<sup>10,12</sup>. Thus, general practice can act as a source of

data of health problems presented by patients, whether they are affected by a disaster or not.

The present study describes methodological and organisational issues encountered in designing and implementing an epidemiological cohort study with pre- and post-disaster data in general practice after a man-made disaster in the Netherlands. The issues of the recruitment of general practitioners, the implementation of the study in general practice, the preparation of the retrieval of workable data, the assignment of the victim status, and the privacy procedures are described in the method section. In the discussion, the implications of the study are presented.

## Method

### *GPs recruitment*

It was crucial to recruit as many GPs as possible with victims of the disaster registered in their practice. The research coordinator and a GP who participated in another post-disaster study, attended a meeting in Enschede to motivate GPs to take part in the study. The coordinator explained the objectives and the procedures of the study and the GP motivated those present by explaining that longitudinal surveillance would give them better insight in the course of post-disaster morbidity and the possible links with the disaster.

Of the 44 GP practices in the disaster area, 30 participated. GP practices refused participation anticipating increased workload in times of pressure due to the disaster (N=4) and/or having no (or just a few) victims enlisted in their practice (N=9). One GP practice had to be excluded because paper records were used. Finally, two thirds of all GP practices participated.

### *Implementing the study in general practice*

The idea of surveillance using GPs' records was based on the existing framework of the National Information Network of General Practice (LINH) in the Netherlands <sup>13</sup>. In the surveillance procedure, data on the complete morbidity of the practice population of the participating GPs are collected <sup>14</sup>. A medical record is kept for each patient, which consists of patient- and contact information. GPs use the International Classification of Primary Care (ICPC) to register symptoms, problems and/or diagnoses. The ICPC is

compatible with the ICD-10 and with DSM-III-R. In order to adjust computer systems, a new infrastructure had to be developed to retrieve the electronic data every three months.

#### *The retrieval of workable data*

In the electronic medical records of the GP the evaluation or diagnosis of the contact need to be registered as an ICPC-code<sup>15</sup>. Before this study started, most GPs used free text instead of ICPC-codes. Therefore, all symptoms and diagnoses registered in free text needed to be classified as an ICPC-code to enable comparison between pre- and post-disaster data. This was done by medical students with a Master's degree and trained in using the ICPC. To make sure that all GPs registered on the basis of ICPC-codes post-disaster, two training sessions were arranged, in which the use of the ICPC was thoroughly explained and practiced using cases. Moreover, the registration of at least one diagnosis per contact was made obligatory software-wise. In the beginning of the study some GPs had to invest substantial extra time, but in the course of the study it became routine<sup>16</sup>.

It was crucial in the study that a high quality level of registration had to be maintained among the participating GP practices. Therefore, each practice had to fulfil two registration requirements. The mean number of contacts per patient per year per practice had to be a minimum of 3.0, because the mean number of contacts in Dutch general practice was 3.5<sup>13</sup>. Furthermore, at least 80% of the contacts needed to contain an ICPC-code.

One of the main problems of this longitudinal study was to keep GPs motivated. Therefore, they received an individual feedback report every three months which informed them about (the number of) ICPC-codes they registered in their practice, the number of contacts a day, the total number of ICPC-codes per employee, the number of consultations per employee and the top 10 of new symptoms and diseases. Besides, regular meetings were organized for all participating GPs. In these meetings, the research coordinator presented population based data about the course of the health problems of victims and the control group. Some of the meetings also addressed specific themes such as 'children' or 'posttraumatic stress disorder'. This procedure helped to keep the GPs alert and motivated: during the study period only in one practice surveillance was terminated as the GP retired.

***Protecting the privacy***

A specific procedure was developed to protect the privacy of the victims and to keep the possibility still open in order to retrace them. Linking of the databases of the IAC and the GPs was necessary to enable retracing data to the individual victim in case of relocation within city borders<sup>17</sup>. One person, who was stationed outside and acted independently of the research institute, was responsible for linking the IAC records with the GP records (only patient and no contact information). This person had been given the authority to use the names and addresses of the victims to link the two databases. A unique number was given to each victim, who was retraceable, only by this one person. This meant that the research institute worked with completely anonymous data but still could make mutations when victims relocated or died.

This privacy procedure was made public in local newspapers and through posters and flyers in the waiting room of each GP. Moreover, announcements of the study and its procedures were made in a bulletin by the municipality, especially published for the victims. People could call the research institute if they had any questions. They could also refuse inclusion in the project, but nobody did. This procedure was in accordance with the rules and procedures of the Dutch Data Protection Authority<sup>8</sup>. According to Dutch legislation, neither obtaining informed consent, nor approval by a medical ethics committee was obligatory for this observational study.

***Assignment of the victim-status and analysis***

Because of funding problems the surveillance could start only 16 months after the disaster. In the meantime, two systems of victim registration were developed. Firstly, about 12000 persons, residents, passers-by and rescue-workers, were registered at the IAC. Using the municipal identity register and zip codes, all residents of the affected area were registered. Besides, rescue workers and passers-by were registered by self-reporting. Reasons for registration at the IAC were not recorded. Reasons for self registration could be the achievement of a new house and/or new furniture, assistance in procedures concerning insurance or claiming financial compensation. Of the group of 12000 about 1600 persons, passers-by and rescue-workers could not be included because they lived outside town. The remaining 10398 patients were all listed in general practices. Of this group 11% could not be included,

because they were enlisted in non participating practices (9254 survivors eligible for the study).

Secondly, shortly after the disaster all local GPs received a list with the zip codes of the affected area. On the basis of this list and/or when disaster related health problems were discussed during consultation, GPs marked patients as a victim, using a special code in the electronic medical patient record. In total, almost 5000 victims were marked as such in general practice. In order to get a complete database the names of the victims on the two lists were matched: there appeared to be a moderate match (39%) between the databases of IAC en GPs. Differences were caused by spelling mistakes in names of victims; women were registered with different names (maiden name or husband's name) at the IAC and in general practice; addresses were wrongly registered (tax-dodging/students). After correction these administrative errors, four different groups of victims could be formed:

1. The double marked group (++); marked as a victim at the IAC and also by the GP.
2. The relocated group: all victims who had to relocate for several years due to severe damage to their dwellings in the affected area. They were registered by a change of zip code in the first weeks post-disaster. All relocated victims were also double marked victims but they were surveyed as a separate group. The choice of a group of relocated victims was based on international studies on disasters <sup>18,19</sup>. Forced relocation appeared to be a risk factor on presenting post-disaster psychological problems.
3. A group not registered at the IAC but marked by the GP (-+).
4. A group registered at the IAC but not marked by the GP (+-).

Moreover, a group of persons not registered at the IAC nor marked as a victim (--) in general practice was formed. This 'non-marked group' of Enschede residents, inhabitants of the same town and not affected by the disaster, was used as a control group. Thus, possible regional and cultural differences were excluded and inter-doctor variation was minimised: the victims and the control group were treated by and registered on the list of the same GPs.

As an example, all these groups are described through demographics and morbidity in six clusters of health problems being presented one year pre-

disaster and in the first year post-disaster. Mean age of the victim groups was tested by ANOVA; gender and insurance by Chi-square. In the Netherlands, the type of health insurance was used as a proxy for SES because it is directly related to income. If a person was in the public health insurance a lower or medium SES was assumed, while private health insurance indicated a higher SES.

Prevalence rates per 1000 persons in the year prior to and in the year following the disaster were calculated as the number of victims or control patients presenting problems divided by the total numbers of victims or controls. The presented clusters of problems were chosen based on highest prevalence rates. The prevalence rates were tested by Chi-square.

## Results

The demographic characteristics of all four groups of victims and the non marked control group (Table 3.1) showed significant differences ( $p < 0.001$ ) on mean age, gender and type of insurance.

Table 3.1: Characteristics of the four groups of victims and the non marked control group

	Relocated (n= 927)	Double marked IAC+ GP+ (n= 3114)	Single marked IAC + GP- (n=3367)	Single marked IAC- GP+ (n=1846)	Control IAC- GP- (n= 7240)
Mean					
Age (SD)	33.1 (19.8)	40.7 (20.5)	39.7 (20.0)	35.2 (22.6)	37.9 (20.8)***
Male	52.3%	52.7%	59.8%	40.9%	51.9%***
Female	47.7%	47.3%	40.2%	59.1%	48.1%
Insurance:					
Public	82%	73.4%	68.3%	62.8%	66.4%***
Private	18%	26.6%	31.7%	37.2%	33.6%

IAC: Information and Advice Centre

GP: General Practitioner.

\*\*\* The differences between the groups are significant ( $p < 0.001$ ).

The *relocated* victims had the lowest ratio privately-publicly insured, meaning the lowest SES, and were the youngest of all victim groups. The *double marked group* was relatively old and the ratio privately-publicly insured is still lower to that of the general Dutch population. The *two single marked groups* appeared to be evidently dissimilar. The group of victims registered at the IAC, but not marked by the GP, consisted of slightly older men. The group of single marked victims, that was just registered in general practice, mainly consisted of relatively young women with a higher SES.

Table 3.2: Relocated, double marked and single marked victims and non marked controls presenting health problems (in clusters) one year pre- and one year post-disaster (in prevalence rates per 1000 persons)

Cluster	Relocated		Double Marked		Single Marked		Single Marked		Control	
	IAC + GP +		IAC + GP +		IAC + GP -		IAC - GP +			
	pre	post	pre	post	pre	post	pre	post	pre	post
Psychological	177	937***	193	725***	148	210***	188	580***	167	172
Musculoskeletal	283	297	310	350	256	272	265	291	257	256
Respiratory	224	168**	199	198	197	171*	209	209	196	180*
Digestive	186	188	169	201*	133	137	150	182	146	150
Skin	175	193	195	192	181	180	182	190	192	194
Injury	129	185*	132	170**	113	132*	112	132	127	116

IAC: Information and Advice Centre.

GP: general practitioner.

\* p<0.05

\*\* p<0.01

\*\*\* p<0.001, tested for pre-post differences within groups.

Significant differences between the groups of victims were found in the presentation of various clusters of health problems (Table 3.2). The *relocated group* showed the largest significant rise in psychosocial problems one year post-disaster of all groups and a significant increase in disaster related injuries. The *double marked group* showed significant increases of psychological problems and injuries in the year following the disaster.

The two *single marked groups* appeared to be evidently dissimilar. The morbidity of the group of victims registered at the IAC, but not marked by the GP, changed slightly post-disaster: a small but significant rise in injuries and in psychological problems. The group of single marked victims just registered in general practice, demonstrated a significant increase in psychological problems post-disaster only, however the figure is higher than in the other single-marked group.

## Discussion

Advantages of our study in general practice, as a methodological design, are the large number of victims that can be included (while it does not put an extra burden on the victims), the possibility of a longitudinal study with retrospectively collected baseline data of the pre-disaster period, and the possibility of acquiring a control group of non-exposed patients from the same practices. Moreover, it was possible to correct for differences between groups already existing pre-disaster<sup>20</sup>. The information retrieved can also be used to direct or redirect the health care of disaster victims and to prepare for possible future disasters<sup>17</sup>.

The most important organisational issue turned out to be the assignment of the victims-status. The demographic characteristics of the four groups show that it is difficult to talk of 'the victim' as an unequivocal group. This is why we, in general, choose all victims when aiming at morbidity of the greatest possible population<sup>20</sup> and choose just the group of double marked victims, supposed to be most heavily exposed, in order to identify risk factors<sup>21</sup>. In these studies on the Fireworks Disaster a huge and significant increase of psychological problems was found in the first year post-disaster and relocation appeared to be the greatest risk factor on presenting these problems<sup>20</sup>. The increases on psychosocial problems in the relocated group correspond with international disaster literature on the effects of forced relocation after (natural) disasters<sup>22-26</sup>. A possible explanation for the decrease of encounters for chronic diseases and respiratory problems may be that these problems receded into the background for a while because of the occurrence of disaster-related problems.



Our complicated privacy procedure enabled us to match the two databases (IAC and general practice). It produced four victim groups with different characteristics. A similar situation existed in an epidemiological study after the explosion of a chemical factory with a nearby residential area: five different kinds of victims were identified<sup>27</sup>.

We believe that the inclusion of various kinds of victims was the best choice. If the GP registration had been used as a source only, a risk of overrepresentation of victims with health problems would have occurred. An underestimation of the health effects of a disaster could have happened when using only self-reported, IAC-victims, including those aiming for material profit. Moreover, by means of the independent person we could follow a victim to another practice in case of relocation.

The finding of important discrepancies (name, date of birth, etc) between the two victims' databases pleads for an objective, rapid and central registration of victims after a disaster, which should be operational within hours (preferably using web applications). In this respect, other equally important aims of an effective victim registration have to be mentioned: re-establishing contact between family members, providing information to emergency services and providing names for health impact assessments and/or surveillance. After the disaster, it was decided in the Netherlands that every municipality has to be prepared for the rapid launch of an IAC-operational organisation in case of a future calamity or disaster. Besides, it will be advisable to record a reason for registration for every victim: people registering themselves only in order to gain a financial benefit can be recognised.

The type of health insurance represents a limited indication of low SES; patients with a public health insurance, 64% of the Dutch population<sup>11</sup>, have low or middle incomes. Low income could not be distinguished as a separate characteristic and it is probable that low income as a measure of low SES plays a more prominent role than in our study. Still, the demographic compositions of our groups suggest differences between relocated and double marked victims, especially because of a lower SES of the relocated group. On the other hand, the low SES of the relocated victims may have an additional effect on the outcomes of the study: this group of victims, that had to leave their homes and lost all personal belongings, will present more health problems, not only by the effects disaster, but due to

their assumed lower SES too. This was confirmed in studies of victims with a particularly low SES and a high exposure<sup>28,29</sup>.

A possible disadvantage of the design used is that classifying and registering by a GP is a 'reduction of reality'. GPs' evaluation of the patients' problem is the result of the interaction between them and lack of completeness could not be excluded. In our opinion, these disadvantages are compensated for by the advantage of a pre-post design with a control group.

### **Implications**

Surveillance by retrieving the electronic medical records of GPs is a valuable source to collect information about long-term health effects of a disaster. The possibility of comparing data about the health problems of victims with pre-disaster data and the possibility to obtain a control group are important advantages. The design can be applied in any country with a functioning and organised general practice system in the aftermath of a disaster in a residential area.

Finally, four different types of victims could be distinguished after the Fireworks Disaster. Researchers who implement a study in the aftermath of a disaster have to be aware of this phenomenon.

## References

1. Yzermans J, Gersons BPR. The chaotic aftermath of an airplane crash in Amsterdam: a second disaster. In: Havenaar J, Cwikel J & Bromet E (eds) *Toxic Turmoil*. New York, Kluwer Academic/Plenum Publishers, 2002:85-99.
2. 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.
3. 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.
4. Bromet E, Dew MA. Review of psychiatric epidemiologic research on disasters. *Epidemiol Rev* 1995;**17**:113-9.
5. Knight BG, Gatz M, Heller K, Bengtson VL. Age and emotional response to the Northridge earthquake: a longitudinal analysis. *Psychol Aging* 2000;**15**:627-34.
6. Fogarty PW, George PJ, Solomon M, Spiro SG, Armstrong RF. Long term effects of smoke inhalation in survivors of the King's Cross underground station fire. *Thorax* 1991;**46**:914-8.
7. Simeon DT, Grantham-McGregor SM, Walker SP, Powell CA. Effects of a hurricane on growth and morbidity in children from low-income families in Kingston, Jamaica. *Trans R Soc Trop Med Hyg* 1993;**87**:526-8.
8. Roorda J, van Stiphout WA, Huijsman-Rubingh RR. Post-disaster health effects: strategies for investigation and data collection. Experiences from the Enschede firework disaster. *J Epidemiol Community Health* 2004;**58**:982-7.
9. Lei Jvd, Duisterhout JS, Westerhof HP, Does Evd, Cromme PVM, Boon WM, Bommel JHv. The introduction of computer-based patient records in the Netherlands. *Ann Int Med* 1993;**119**:1036-41.
10. Schellevis FG, Westert GP, de Bakker DH. The actual role of general practice in the Dutch health-care system: results of the Second Dutch National Survey of General Practice. *J Public Health* 2005;**13**:265-9.
11. van der Linden MW, Westert GP, Bakker DH, Schellevis FG. *Tweede Nationale Studie naar ziekten en verrichtingen in de huisartspraktijk: klachten en aandoeningen in de bevolking en in de huisartspraktijk (in Dutch)*. Utrecht, NIVEL, 2004:136.
12. Yzermans CJ, Oskam SK. *Clustering, Continuïteit en Co-morbiditeit in de huisartspraktijk (in Dutch, dissertation)*. Amsterdam, 1990.
13. Verheij R, Jabaaij L, de Bakker D, Abrahamse H, van den Hoogen H, Braspenning H, van Althuis T, Rutten R. *LINH: jaarrapport 2001 (in Dutch)*. Utrecht, 2002.
14. Fleming DM, Schellevis FG, Paget WJ. Health monitoring in sentinel practice networks. *Eur J Public Health* 2004;**Supplement 3**:80-4.
15. Lamberts H, Wood M. *International Classification of Primary Care*. Oxford, Oxford University Press, 1987:1-9.
16. Chauvin P, Valleron A. Monitoring the compliance of sentinel General Practitioners in public health surveillance: Which GPs persevere? *Int J Epidemiol* 1997;**26**:166-72.

17. Franken WJ, Bartels JC. *Privacy aspects of data collection in favour of scientific research within the framework of health monitoring of victims and health/rescue workers involved in the Enschede fire work disaster (in Dutch)*. Utrecht, Deloitte&Touche, 2001.
18. Najarian B, Goenjian A, Pelcovitz D, Mandel F, Najarian B. The effects of relocation after a natural disaster. *J Trauma Stress* 2001;**14**:511-26.
19. Riad J, Norris F. The influence of relocation and the environmental, social and psychological stress experienced by disaster victims. *Environment and Behavior* 1996;**28**:163-82.
20. Yzermans CJ, Donker GA, Kerssens JJ, Dirkzwager AJ, Soeteman RJ, Ten Veen PM. Health problems of victims before and after disaster: a longitudinal study in general practice. *Int J Epidemiol* 2005;**34**:820-6.
21. Soeteman RJ, Yzermans CJ, Kerssens JJ, Dirkzwager AJ, Donker GA, van den Bosch WJ, van der Zee J. The course of post-disaster health problems of victims with pre-disaster psychological problems as presented in general practice. *Fam Pract* 2006;**23**:378-84.
22. Kilic C, Aydin I, Taskintuna N, Ozcurumez G, Kurt G, Eren E, Lale T, Ozel S, Zileli L. Predictors of psychological distress in survivors of the 1999 earthquakes in Turkey: effects of relocation after the disaster. *Acta Psychiatr Scand* 2006;**114**:194-202.
23. Mecocci P, Di Iorio A, Pezzuto S, Rinaldi P, Simonelli G, Maggio D, Montesperelli P, Longo A, Cherubini A, Chiarappa N, Abate G, Senin U. Impact of the earthquake of September 26, 1997 in Umbria, Italy on the socioenvironmental and psychophysical conditions of an elderly population. *Aging-Clin Experimental Research* 2000;**12**:281-6.
24. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. Relocation after a disaster: posttraumatic stress disorder in Armenia after the earthquake. *J Am Acad Child Adolesc Psychiatry* 1996;**35**:374-83.
25. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. The effect of relocation after a natural disaster. *J Trauma Stress* 2001;**14**:511-26.
26. Riad JK, Norris FH. The influence of relocation on the environmental, social, and psychological stress experienced by disaster victims. *Environment and Behavior* 1996;**28**:163-82.
27. Lang T, Schwoebel V, Diene E, Bauvin E, Garrigue E, Lapierre-Duval K, Guinard A, Cassadou S. Assessing post-disaster consequences for health at the population level: experience from the AZF factory explosion in Toulouse. *J Epidemiol Community Health* 2007;**61**:103-7.
28. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
29. Rubonis AV, Bickman L. Psychological impairment in the wake of disaster: the disaster-psychopathology relationship. *Psychol Bull* 1991;**109**:384-99.

# Chapter

# 4

## **Health problems presented in family practice one year prior to and one year following a disaster**

Rik J.H. Soeteman  
C. Joris Yzermans  
Jan J. Kerssens  
Anja J.E. Dirkzwager  
Gé A. Donker  
Petra M.H. ten Veen  
Wil J.H.M. van den Bosch  
Jouke van der Zee

---

Journal of the American Board of Family Medicine 2007; 20: 458-556

## Abstract

**Context** Disasters often have negative health consequences. Studies of health problems presented in family practice (prior to and) following a disaster are rare.

**Objective** The present study analysed pre- and post-disaster health problems and predictors of increased morbidity post-disaster as presented in family practice.

**Method** A matched cohort study design with one year pre-disaster and one year post-disaster measurements. Victims (N=9183) and matched controls (N=7066) were surveyed in the electronic medical records of 30 family practices after the explosions of a fireworks depot in the Netherlands. All health problems were registered using the International Classification of Primary Care.

**Results** Victims showed post-disaster significantly higher prevalence rates for psychological problems than pre-disaster (422 vs.133 per 1000 person years,  $p<0.001$ ) and for problems of the musculoskeletal system (450 vs. 401 per 1000 person years,  $p<0.05$ ).

Relocation due to the disaster (OR=10.65; 95% CI=8.15-13.94) and to a lesser degree, pre-disaster psychological morbidity (OR=2.31; 95% CI=1.42-3.76) were the strongest predictors of post-disaster psychological problems.

**Conclusion** The results suggested that forced relocation and a history of psychological problems were risk factors to post-disaster psychological problems of victims in family practice.

**Keywords:** disasters, morbidity, longitudinal study, family medicine

## **Introduction**

Experiencing a disaster is an emotionally charged event. The terror, the fear, and the inability to cope may lead to serious health consequences for the victims in the short as well as the long term. Victims present health problems, both psychological and physical in the aftermath of any natural or man-made disaster<sup>1-6</sup>. In her review, Norris concluded that people who experienced man-made or technological disasters were not significantly more distressed, on average, than people who experienced natural disasters<sup>7</sup>. The problem with research on health problems after disasters is that every disaster is unique and does occur in specific communities, in specific periods. However, one of the generic aspects is that disasters tend to occur especially in deprived areas where people live under sea level, on the slopes of volcanoes or in the nearness of chemical plants.

One of the theoretical frameworks for health consequences of disasters is the Conservation of Resources (COR) stress theory<sup>8-10</sup>. This theory proposes that people often possess a number of resources that are used to cope with their life circumstances and that loss results in increased physical and psychological distress and further diminished coping capacities. In the event of a disaster, often in deprived areas, it is an important principle that 'resource loss is disproportionately more salient than resource gain' and 'that those who lack resources are not only more vulnerable to resource loss but that initial loss begets future loss'<sup>10</sup>. The degree of exposure to a disaster<sup>11,12</sup>, relocation<sup>13,14</sup> and pre-disaster psychological problems<sup>15-17</sup> are all considered important risk factors for problems after a disaster. Therefore, for people with few resources pre-disaster, it is nearly impossible to gain new resources thereafter.

On 13 May, 2000, a fireworks depot exploded in the city of Enschede (125,000 inhabitants) in the eastern part of the Netherlands. The explosions totally destroyed a neighbourhood in only a few hours. Approximately 1200 persons lost their homes and had to be relocated for a long period of time. Moreover, 18 residents and 4 fire fighters were killed and approximately 1000 persons were wounded.

The Dutch government offered support to the local authorities and health care workers. A municipal Information and Advice Centre (IAC) was implemented where all victims could be registered and an integrated post-

disaster health care facility was set up, in which all disciplines of psychosocial and physical health care were represented, including family practice. In the present study, the health problems of residents and passers-by living in town are presented using the electronic medical records (EMRs) of family physicians (FPs).

The objective of the study is twofold:

- a) to analyze health problems of patients, whether affected by the disaster or not, as presented in family practice one year before and one year after the disaster; and
- b) to explore the risk factors that may contribute to an increase of the presentation of health problems in the first year following the disaster.

## **Methods**

### ***Setting***

In the Dutch health care system, every citizen is registered with one FP who acts as a gatekeeper to secondary care. As a result, victims of the disaster were known to their FP prior to the disaster. A patient is enlisted in the practice of his choice being often located in the neighborhood of ones home. We asked all 60 FPs in town to participate in this study and 44 of them did so (30 practices, 73%). Sixteen did not participate for three different reasons: six expected an increase in workload, nine had no victims among their patients and one did not use an electronic registration system.

Patients were informed about the participation of their FP in this study by leaflets in their doctor's waiting room and by the local newspapers. They could object to the use of their data (nobody did so). The data remained anonymous. Data collection was performed in accordance with the privacy protection procedures of the Dutch Data Protection Authority, and no explicit ethical approval or informed consent was needed<sup>18</sup>.

### ***Victims***

In total, about 12000 persons were registered as a victim either by their FP or by the authorities in the database of the IAC. Of these 12000 victims, approximately 1600 persons, passers-by and rescue-workers, could not be included in the study because they were no residents.



The remaining 10398 patients were all listed in family practices. Patients were marked as a victim in the FP's electronic medical records when they were resident of the destroyed or the surrounding areas (postal code). At the IAC, people were registered as a victim based on the municipal identity register and by self adherence when they considered themselves as a victim. They all received a research number in order to follow them anonymously in both databases.

Of the remaining group, 11% could not be included, because they were enlisted in non-participating practices. Of the victim group (N=9254) 9183 patients were still registered in the EMRs of their FP after one year. This group was included as victims in our cohort.

If FPs' patients were neither marked as a victim by the FP nor by the municipal IAC and were no resident of the destroyed area, they were included as a control. They were on the lists of the same study practices. We randomly selected as many controls as victims and stratified for gender and age.

### ***Key variables***

The independent variables of relocation and non-relocation were taken from the IAC database. A victim was distinguished as relocated when his or her zip code in the affected area changed after the disaster took place. Relocation was inevitable due to the destruction of their dwellings by the shock waves and the succeeding fires. If not, they were non-relocated victims.

The other independent variables, presenting pre-disaster psychological problems, gender, age and socio-economic status (SES) were extracted from the EMR. The variable of pre-disaster psychological problems was applied to victims and controls who visited their FP at least once in the pre-disaster year for a problem classified in this group. Health insurance was used as a proxy for SES because in the Netherlands it is directly related to income. If a person receives public health insurance a lower or medium SES is assumed, whereas private health insurance indicates a higher SES.

The dependent variables were collected in the EMR. These included all morbidity and psychological problems as presented by the patient to the FP, whether being a victim or not. The outcome variable was whether or not a patient contacted the FP at least once in a year either before or after the disaster. All presented symptoms and diagnoses registered during

consultations, visits and telephone contacts were extracted and were classified in International Classification of Primary Care (ICPC) which is compatible with the International Classification of Diseases<sup>19</sup> and with the Diagnostic and Statistical Manual of Mental Disorders<sup>20</sup>. They were analyzed separately and were grouped together in the organ-based clusters of the ICPC classification, such as the digestive or musculoskeletal cluster. Moreover, in accordance with the ICPC, one cluster with social problems (e.g. housing problem, loss of spouse) and another cluster with psychological problems (e.g. anxiety, sleeping problems, major depression) were used.

In our study, data on all problems were extracted anonymously from the EMR of all patients (victims and controls) every three months. Data from one year before the disaster were extracted retrospectively.

#### ***Statistical analysis***

Demographic data on the victim and the control group were compared using Chi-square tests.

Prevalence rates per 1,000 persons in the year before the disaster and the year after the disaster were calculated as the number of victims or controls presenting problems divided by the numbers of victims or controls. The number of person-years during which problems were counted was taken into account, as well as the time that elapsed before problems were presented, as recommended by Rothman and Greenland<sup>21</sup>.

Odds Ratios (OR) and 95% Confidence Intervals (CI) were calculated for the ICPC-coded symptoms and diagnoses in order to test differences before and after the disaster between victims and controls. Table 4.3 presents those symptoms and diagnoses that are most sensitive to a change due to the disaster in ORs with 95% CIs.

A logistic regression model was tested to compare the post- disaster increase in clusters of health problems for victims and controls. This amounted to the formal test that the pre-disaster/post-disaster ORs for victims before and after the disaster were statistically significantly higher than the corresponding ORs for controls with regard to the various health problems ( $\alpha$  set at 5%). ORs were calculated with 95% confidence intervals. The selection criterion was a high prevalence rate after the disaster within the

ICPC-clusters. Moreover, pre-disaster differences between victims and controls in the same health clusters were tested.

Six predictor variables were included in a multilevel (MIWin) model. Two dummy variables were used for the coding of group membership: relocated victims (yes=1, no=0) and non-relocated victims (yes=1, no=0); reference category is controls). Another dummy variable indicated whether a patient presented with pre-disaster psychological problems (yes=1, reference category no pre-disaster psychological problems=0). The other three variables in the equation were gender (female=1, male=0), socio-economic status (SES, low/medium SES=1, high SES=0) and age (divided by 10 years). Age was converted into periods of 10 years, because its original scale in years (range, 0 to 100) made comparisons difficult with other predictors (with values 0 and 1).

Two different multilevel logistic regression models were used to analyze the association between predictor variables and two significantly increased post-disaster clusters of problems (see Table 4.4). The cluster of social problems was not included in the multilevel model being indissolubly related to the disaster. All interactions between the two types of victim groups, relocated or not, were included in the models to analyze whether the relation between the predictor variables and the outcome variables were different for the two victim groups compared with the controls.

Table 4.1: Characteristics of victims and controls registered on their FP's list between May 1999 and May 2001 in percentages (except mean age)

Groups of victims	Victims N=9183	Controls N=7066
Mean age in yrs	38.5	37.9
Male	52.8	52.0
Children <15 years	13.7	14.4
Low/medium SES***	70.4	67.1
Pre-disaster psychological problems	9.5	9.2
Relocated victims	8.8	-
No contact with FP	5.8	6.4

SES = Social Economic Status, \*\*\*  $p < 0.001$  (between victims and controls).

## Results

More than half of the population was male; mean age was approximately 38 years. Victims and controls did not differ with respect to gender and age. Moreover, the percentages within the groups of victims and controls presenting pre-disaster psychological problems and with or without contacting their FP in the entire study period did not differ (Table 4.1). The victims more often had a lower/medium SES ( $p < 0.001$ ) compared with controls.

Table 4.2: Health problems of victims and controls one year pre- and post-disaster (13/05/99-12/05/01) in ICPC-clusters (in prevalence rates per 1000 person years)

ICPC cluster	Victims		Controls	
	pre	post	pre	post
Musculoskeletal	418	450*	404	401
Psychological	131	422***	129	133
Respiratory	399 <sup>††</sup>	388	363	348
Others <sup>1</sup>	359 <sup>††</sup>	358	335	335
Skin	303 <sup>†</sup>	321	321	314
Digestive	180	198	170	177
General	167 <sup>††</sup>	197	143	154
Circulatory	151	158	150	154
Neurological	112 <sup>††</sup>	116	94	89
Ear	106	113	104	102
Social	50 <sup>††</sup>	106***	41	47
Endocrine	81	85	77	81
Urinary	67	74	60	67

<sup>1</sup> Others: B (Blood, blood forming), E (Eye), W (Pregnancy, childbearing, family planning), X (Female genital), Y (Male genital).

<sup>†</sup>  $p<0.05$ , <sup>††</sup>  $p<0.01$ , <sup>†††</sup>  $p<0.001$ , differences between victims and controls regarding their pre-disaster rates.

\*  $p<0.05$ , \*\*\*  $p<0.001$ , differences between victims and controls regarding their changes between pre-disaster and post-disaster rates.

### *Physical and psychological health problems*

In the period before the disaster, victims had significantly higher prevalence rates than the controls for respiratory (399 vs. 363 per 1000 person years;  $p<0.001$ ), “general” (167 vs. 143 per 1000 person years;  $p<0.001$ , e.g. fatigue), neurological (112 vs. 94 per 1000 person years;  $p<0.01$ ), social (50 vs. 41 per 1000 person years;  $p<0.01$ ), and “other” (359 vs. 335 per 1000 person years;  $p<0.01$ ) clusters. Only the prevalence rates of the skin problems before the disaster (303 vs. 321 per 1000 person years;  $p<0.05$ ) were significantly lower in victims than in controls (Table 4.2).

Comparing periods before and after the disaster, victims showed higher prevalence rates for almost all organ systems, indicating increased illness diversity. Compared with controls, victims had higher post-disaster

prevalence rates for three clusters: psychological problems (422 vs.133 per 1000 person years;  $p<0.001$ ), social problems (106 vs. 47 per 1000 person years;  $p<0.001$ ) and for musculoskeletal problems (450 vs. 401 per 1000 person years;  $p<0.05$ ).

Table 4.3: Prevalence rates and Odds Ratios (ranked in order) of specific health problems one year pre- and one year post-disaster in victims and controls one year post-disaster (13/05/00-12/05/01)

P-value	Health problem	Victims		Controls		OR	CI (95%)	
		pre	post	pre	post		L	U
***	Acute stress	9	273	11	19	15.96	(10.95 - 23.27)	
***	Problems housing/neighbourhood	2	26	1	1	13.16	(4.23 - 40.96)	
***	Loss/death parent/family	4	12	4	3	4.26	(2.04 - 8.93)	
**	Herpes zoster	4	6	5	3	2.65	(1.31 - 5.36)	
*	Abrasion/scratch/blister	5	7	5	4	2.36	(1.21 - 4.63)	
**	Hyperventilation	7	13	8	7	2.26	(1.35 - 3.76)	
***	Disturbance of sleep/insomnia	28	55	33	30	2.21	(1.72 - 2.84)	
***	Feeling anxious/nervous/tense	23	43	24	20	2.20	(1.64 - 2.95)	
**	Palpitations	9	12	9	5	2.20	(1.32 - 3.69)	
**	Anxiety disorder	9	16	7	6	2.19	(1.31 - 3.67)	
*	Other infection of the eye/uveitis	5	8	4	3	2.10	(1.02 - 4.34)	
*	Depressive disorder	21	28	19	18	1.44	(1.05 - 1.99)	
*	Laceration/cut	18	23	18	17	1.43	(1.02 - 2.01)	
*	Neck symptoms	34	45	33	35	1.29	(1.01 - 1.65)	

OR = Odds Ratio, Risk of victims health problems post-disaster related to controls and pre-disaster.

\*  $p<0.05$ , \*\*  $p<0.01$ , \*\*\*  $p<0.001$ .

The individual problems of victims compared to controls were analyzed using Odds Ratios.

Acute stress problems (OR=15.96; 95% CI=10.95-23.27) and problems with housing (OR=13.16; 95% CI=4.23-40.96) showed the strongest relation to the disaster (Table 4.3). Another problem was loss of parent/family (OR=4.26; 95% CI=2.04-8.93). Other health problems with a statistically significant relation to the disaster but a lower OR were, herpes zoster, wounds,

hyperventilation, sleeplessness, feeling anxious and anxiety disorder, uveitis, etc.

***Predictors of disaster-related clusters of health problems***

Victims who had to relocate due to the disaster had the highest probability (OR=10.65; 95% CI=8.15-13.94) of presenting psychological problems to their FP in the period after the disaster (Table 4.4). Non-relocated victims also had an increased probability (OR=4.24; 95% CI=3.58-5.03) of presenting these kind of problems.

Table 4.4: Odds Ratios and 95% Confidence Intervals calculated from multilevel logistic regression models analysing the probability of visiting the FP for psychological and musculoskeletal problems in the post-disaster year

	Psychological		Musculoskeletal	
	OR	95% CI	OR	95% CI
Constant	0.08			
Relocated Victims (ref Controls)	10.65***	(8.15-13.94)	0.50	
Non-relocated Victims (ref Controls)	4.24***	(3.58-5.03)	0.98	(0.76-1.26)
			1.20**	(1.06-1.35)
<b>Female in interaction with</b>				
Controls	1.26**	(1.07-1.49)	1.15***	(1.03-1.28)
Relocated Victims	1.56***	(1.17-2.08)	1.05***	(0.78-1.42)
Non-relocated Victims	1.53***	(1.37-1.69)	1.15***	(1.04-1.26)
<b>Low/medium SES in interaction with</b>				
Controls	1.48***	(1.22-1.80)	1.54***	(1.36-1.74)
Relocated Victims	1.04	(0.70-1.54)	1.06	(0.70-1.60)
Non-relocated Victims	1.43***	(1.27-1.61)	1.36***	(1.22-1.51)
<b>Age in interaction with</b>				
Controls	1.14***	(1.09-1.18)	1.15***	(1.12-1.18)
Relocated Victims	1.17***	(1.08-1.25)	1.17***	(1.08-1.26)
Non-relocated Victims	<b>1.08***</b>	(1.05-1.10)	1.15***	(1.12-1.18)
<b>Psy pre-disaster in interaction with</b>				
Controls	8.11***	(6.80-9.67)	1.27***	(1.09-1.49)
Relocated Victims	<b>2.31***</b>	(1.42-3.76)	1.91***	(1.23-2.97)
Non-relocated Victims	<b>3.59***</b>	(3.10-4.15)	<b>1.44***</b>	(1.25-1.65)

\*\*\* p<0.001.

\*\* p<0.01, ***Bold italic***: Odd Ratios of Victims and Controls differ statistically significant.

Women had a higher probability of presenting post-disaster psychological problems than did men, but this applied to victims and controls alike. The ORs (controls, OR=1.26; relocated victims, OR=1.56 and non-relocated victims, OR=1.53) did not differ statistically significant, indicating that women in general present more psychological problems to their FP than men, irrespective of the disaster.



People of low/medium SES also had a higher probability of presenting post-disaster psychological problems than did people with a high SES persons but, again, this applied to both victims and controls. The odds ratios (controls, OR=1.48; relocated victims, OR=1.04 and non-relocated victims, OR=1.43) did not differ statistically significant, indicating that people with a low/medium SES did not present more psychological problems to their FP than did people with a high SES.

Older people had a higher probability of presenting post-disaster psychological problems compared to younger people. However, the relation between age and presentation of psychological problems differed statistically significant between the groups. The non-relocated victims had a lower OR (OR=1.08; 95% CI=1.05-1.10) than the controls and the relocated victims, pointing to the fact that age in the group of non-relocated victims had a smaller effect on the presentation of post-disaster psychological problems than in the other groups.

The last predictor was whether someone presented psychological problems or not in the year before the disaster. The ORs differed statistically significant between victims and controls. Controls who presented psychological problems before the disaster had a higher probability of presenting post-disaster psychological problems compared to controls who did not present pre-disaster psychological problems (OR=8.11; 95% CI=6.80-9.67). This is, of course, not related to the disaster but merely because, in normal circumstances, someone who presents psychological problems in one year has an increased probability of presenting psychological problems in the following year. Relocated victims who presented pre-disaster psychological problems had an increased probability of presenting post-disaster psychological problems (OR=2.31; 95% CI=1.42-3.76) compared with relocated victims without pre-disaster psychological problems. This is also the case for non-relocated victims (OR=3.59; 95%CI=3.10-4.15). Being a non-relocated victim reduced the effect of the predictor of presenting pre-disaster psychological problems considerably (compare OR 8.11 with OR 3.59) and being a relocated victim further reduced that effect (compare OR 8.11 with 2.31). Still, relocated victims with pre-disaster psychological problems showed a higher OR ( $2.31 \times 10.65 = 24.60$ ) than non-relocated victims with the same problems ( $3.59 \times 4.24 = 17.98$ ).

With regards to musculoskeletal problems, only non-relocated victims showed an increase (OR=1.20; 95%CI=1.06-1.35). Female gender, low/medium SES, age, and pre-disaster psychological problems also had an effect on presenting musculoskeletal problems, but the differences between the ORs of victims and controls are not statistically significant, indicating that the disaster had no differential effect on any of these outcome variables.

## Discussion

### *Main findings*

In this study, we found an increase in psychological and musculoskeletal morbidity presented to the FP when comparing patients directly affected by a fireworks depot explosion to other patients in the same city not directly affected. The strongest predictors of morbidity were forced relocation due to destruction of their dwellings, the presentation of psychological problems before the disaster occurred and, to a lesser degree, being a victim without forced relocation. Relocation due to the disaster and loss of all personal belongings may be considered as a traumatic experience: a victim has to leave its dwelling by a (risk of) collapse due to the enormous air pressure or by the extended fires attaching the area.

If victims, whether relocated or not, had a history of presenting psychological problems they had an even higher risk of post-disaster psychological problems than victims without such a history, the risk of relocated victims being the highest.

Another remarkable finding among the predictors is that female gender, age and SES seemed to have a contribution to post-disaster psychological problems, however irrespective of the disaster. The contribution of gender, age and socio-economic status was not higher for victims than for controls. In our opinion, this important finding is a result of our design, containing pre-disaster, baseline data. This result is in contrast to the findings of other studies (without pre-disaster data) as summarized in Norris' review <sup>7</sup>.

The overrepresentation in the period before the disaster of six clusters of health problems among victims compared with controls is a remarkable finding. The significant difference between victims and the controls in SES may play a role in the presentation of this higher number of social

problems<sup>22,23</sup>. Moreover, victims are known to live in socially deprived areas and are known to present a higher morbidity.

Fourteen significantly increased separate problems were found in the post-disaster period. Most of them could be related to the disaster. For the two social problems, the relation is, of course, not astonishing. For the psychological problems like acute stress symptoms, anxiety disorder etc. this is rather obvious. Hyperventilation is related to fear and thus, a disaster-related connection can be supposed. Palpitations and neck symptoms (e.g. neck pain, no diagnosis like spondylosis) may be considered to be Medically Unexplained Physical Symptoms as has been described after many disasters<sup>24</sup> and in family practice<sup>25</sup>.

The codes of uveitis and herpes zoster are both related to immunological factors<sup>26-28</sup>. In one study, performed after the Kobe earthquake, a post-disaster increase of uveitis was seen that was administered to psychological stress due to the disaster<sup>29</sup>. However, we have no explanation for this finding even though immunological changes after disasters were described<sup>30-32</sup>. Moreover, the ORs of these two issues are based on low prevalence rates.

Some of our results can be viewed in the light of the COR stress theory<sup>9,10</sup>, which defines resources broadly to include objects (housing), conditions and personal characteristics (psychological problems before a disaster). Resource loss is highly correlated with symptom severity in several disaster studies<sup>33,34</sup>.

### ***Limitations and Strengths***

The present study has some important strengths. The study design is robust: comparisons with pre-disaster data and a control group were both possible, a design that is rather unique in literature. Moreover, a majority of all victims (89%) was monitored, which makes it likely that the results of this study can be generalized to all victims of the disaster in Enschede. Finally, the problem of recall bias was avoided by using FPs' EMRs instead of self-reported questionnaires.

Some issues need to be considered. The type of health insurance represents a limited indication of SES, because patients in The Netherlands with public health insurance (over 60% of the Dutch population) have a low or middle income. Low income as a separate characteristic could not be distinguished.

Low income as a measure of low SES probably plays a more prominent role than we were able to show.

A substantial number of the relocated victims (approximately 400) moved outside of town or went to non-participating practices in Enschede. Thus, we have no information about the characteristics or morbidity of these people. On the other hand, the most probable reason for relocation outside of town seems to be the lack of substituting dwellings in the town itself. Therefore, we have no reason to think that this group differed in exposure compared with the relocated group in our study.

In this study a risk of overrepresentation could have happened if the FP acted as the only source of identifying a victim. However, a victim, claiming financial compensation at the municipal IAC, could be marked by self-identification too. Self-identification of these victims (possibly less affected by this disaster) may have caused an underestimation of health effects. On the other hand, a victim may attribute his or her problems to the disaster: they may think that a symptom developed after the disaster, when in reality the FP found the symptom in the patients' history prior to the disaster<sup>6</sup>. Thus, the symptom is not related to the disaster. In this respect, we believe that FPs' evaluation of the patients' problem is more reliable than are self reported symptoms. In addition, the use of EMRs has some advantages: recall bias can be avoided and baseline data from before the disaster can be included. Moreover, the FPs were properly trained in the ICPC classification system and they received feedback on the quality of their registrations every three months.

### ***Implications***

The present study shows that exposure to a man-made disaster not only resulted in increased psychological problems, but also in increased physical problems. The results emphasize the importance of supplying post-disaster interventions for stress reactions and anxiety problems, as well as for physical symptoms such as musculoskeletal symptoms. The results also suggest that victims who had to relocate because of the disaster and who had psychological problems before the disaster are most vulnerable to having psychological problems after the disaster.

The finding that relocated victims with pre-disaster psychological problems had the highest risk for (psychological) health problems after the disaster is explained in their original small pool of resources, which was further depleted by the disaster. The role of the FP is to monitor the need for resource management to reduce negative health outcomes. In this respect, the EMR can be used by identifying victims with psychological problems in the year before the disaster and by instantly tracing relocated victims who had a change in postal code after the disaster.

The present study shows that family practice is a valuable source for collecting data about health problems before and after a disaster. The FP can play a role in the identification of high-risk victims in order to facilitate close monitoring after a disaster.

## References

1. Galea S, Ahern J, Resnick H, Kilpatrick D, Bucuvalas M, Gold J, Vlahov D. Psychological sequelae of the September 11 terrorist attacks in New York City. *N Engl J Med* 2002;**346**:982-7.
2. Galea S, Vlahov D, Resnick H, Ahern J, Susser E, Gold J, Bucuvalas M, Kilpatrick D. Trends of probable post-traumatic stress disorder in New York City after the September 11 terrorist attacks. *Am J Epidemiol* 2003;**158**:514-24.
3. North CS. The course of post-traumatic stress disorder after the Oklahoma City bombing. *Mil Med* 2001;**166**:51-2.
4. Yzermans CJ, Donker GA, Kerssens JJ, Dirkzwager AJ, Soeteman RJ, Ten Veen PM. Health problems of victims before and after disaster: a longitudinal study in general practice. *Int J Epidemiol* 2005;**34**:820-6.
5. Yzermans C, Gersons BPR. The chaotic aftermath of an airplane crash in Amsterdam: a second disaster. In: Havenaar J, Cwikel J & Bromet E (eds). *Toxic Turmoil*. New York, Kluwer Academic, 2002:85-99, lit.
6. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
7. 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.
8. Arata CM, Picou JS, Johnson GD, McNally TS. Coping with technological disaster: An application of the Conservation of Resources model to the Exxon Valdez oil spill. *J Trauma Stress* 2000;**13**:23-39.
9. Hobfoll SE. Conservation of resources. A new attempt at conceptualizing stress. *Am Psychol* 1989;**44**:513-24.
10. Hobfoll SE. *Stress, culture and community*. New York, Plenum press, 1998.
11. Garrison CZ, Weinrich MW, Hardin SB, Weinrich S, Wang L. Post-traumatic stress disorder in adolescents after a hurricane. *Am J Epidemiol* 1993;**138**:522-30.
12. Palinkas LA, Petterson JS, Russell J, Downs MA. Community patterns of psychiatric disorders after the Exxon Valdez oil spill. *Am J Psychiatry* 1993;**150**:1517-23.
13. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. Relocation after a disaster: posttraumatic stress disorder in Armenia after the earthquake. *J Am Acad Child Adolesc Psychiatry* 1996;**35**:374-83.
14. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. The effect of relocation after a natural disaster. *J Trauma Stress* 2001;**14**:511-26.
15. Asarnow J, Glynn S, Pynoos RS, Nahum J, Guthrie D, Cantwell DP, Franklin B. When the earth stops shaking: earthquake sequelae among children diagnosed for pre-earthquake psychopathology. *J Am Acad Child Adolesc Psychiatry* 1999;**38**:1016-23.

16. Ginexi EM, Weihs K, Simmens SJ, Hoyt DR. Natural disaster and depression: a prospective investigation of reactions to the 1993 midwest floods. *Am J Community Psychol* 2000;**28**:495-518.
17. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consult Clin Psychol* 1998;**66**:883-92.
18. Roorda J, van Stiphout WA, Huijsman-Rubingh RR. Post-disaster health effects: strategies for investigation and data collection. Experiences from the Enschede firework disaster. *J Epidemiol Community Health* 2004;**58**:982-7.
19. Lamberts H, Wood M. *International Classification of Primary Care*. Oxford, Oxford University Press, 1987:-201.
20. Pingitore D, Sansone RA. Using DSM-IV primary care version: a guide to psychiatric diagnosis in primary care. *Am Fam Physician* 1998;**58**:1347-52.
21. Rothman KJ, Greenland S. *Modern epidemiology*. Philadelphia, Lippincott, Williams and Wilkins, 1998:-738.
22. Mackenbach JP. Socio-economic health differences in The Netherlands: a review of recent empirical findings. *Soc Sci Med* 1992;**34**:213-26.
23. Seeman TE, Crimmins E. Social environment effects on health and aging: Integrating epidemiologic and demographic approaches and perspectives. In: *Population health and aging: Strengthening the dialogue between epidemiology and demography*. New York, NY, US, New York Academy of Sciences 323 pp,88-117.
24. van den Berg B, Grievink L, Yzermans CJ, Lebrecht E. Medically Unexplained Physical Symptoms in the aftermath of disasters, a review. *Epidem Reviews* 2005;**27**:92-106.
25. Escobar JI, Hoyos-Nervi C, Gara M. Medically unexplained physical symptoms in medical practice: a psychiatric perspective. *Environ Health Perspect* 2002;**110 Suppl 4**:631-6.
26. Dullforce PA, Seitz GW, Garman KL, Michael JA, Crespo SM, Fleischman RJ, Planck SR, Parker DC, Rosenbaum JT. Antigen-specific accumulation of naive, memory and effector CD4 T cells during anterior uveitis monitored by intravital microscopy. *Cell Immunol* 2006;**239**:49-60.
27. Hajj-Ali RA, Lowder C, Mandell BF. Uveitis in the internist's office: are a patient's eye symptoms serious? *Cleve Clin J Med* 2005;**72**:329-39.
28. Thomas SL, Hall AJ. What does epidemiology tell us about risk factors for herpes zoster? *Lancet Infect Dis* 2004;**4**:26-33.
29. Yamamoto H, Azumi A, Sakai J, Yamamoto M. The Kobe earthquake and recurrent endogenous uveitis. *Jpn J Ophthalmol* 1997;**41**:111-4.
30. Boyce WT, Chesterman EA, Martin N, Folkman S, Cohen F, Wara D. Immunologic changes occurring at kindergarten entry predict respiratory illnesses after the Loma Prieta earthquake. *J Dev Behav Pediatr* 1993;**14**:296-303.
31. Ironson G, Wynings C, Schneiderman N, Baum A, Rodriguez M, Greenwood D, Benight C, Antoni M, LaPerriere A, Huang HS, Klimas N, Fletcher MA. Posttraumatic stress

- symptoms, intrusive thoughts, loss, and immune function after Hurricane Andrew. *Psychosom Med* 1997;**59**:128-41.
32. Rotton J, Dubitsky SS. Immune function and affective states following a natural disaster. *Psychol Rep* 2002;**90**:521-4.
  33. Freedy JR, Saladin ME, Kilpatrick DG, Resnick HS, et al. Understanding acute psychological distress following natural disaster. *J Trauma Stress* 1994;**7**:257-73.
  34. Smith BW, Freedy JR. Psychosocial resource loss as a mediator of the effects of flood exposure on psychological distress and physical symptoms. *J Trauma Stress* 2000;**13**:349-57.



## Chapter

# 5

### **The course of post-disaster health problems of victims with pre-disaster psychological problems as presented in general practice**

Rik J.H. Soeteman  
C. Joris Yzermans  
Jan J. Kerssens  
Anja J.E. Dirkzwager  
Gé A. Donker  
Wil J.H.M. van den Bosch  
Jouke van der Zee

---

Family Practice 2006; 23: 378-384

## Abstract

**Background** Survivors of disaster with pre-disaster psychological problems are believed to be at risk for presenting post-disaster psychological and physical morbidity. Up till now this statement is based on cross-sectional studies with self-reported data and without pre-disaster measurement.

**Objective** To monitor post-disaster health care utilisation and morbidity presented in general practice after a man-made disaster by victims and controls with and without pre-disaster psychological problems.

**Methods** A controlled cohort study with pre-disaster (one year) and post-disaster (two-and-a-half years) data. Victims (N=2518) of an exploding fireworks depot in a residential area and matched controls (N=2512), representing patients in 30 general practices, were included. Main outcome measures were utilisation measured by GP attendances, and psychological and physical problems registered by the GP using the International Classification of Primary Care.

**Results** Only victims without pre-disaster psychological problems demonstrated a significant increase in utilisation in the first half year post-disaster. Victims with pre-disaster psychological problems did not. Being a victim (OR=6.13; 95% CI=4.84-7.77) had a greater effect than pre-disaster psychological problems (OR=4.96; 95% CI=3.96-6.21) on presenting post-disaster *psychological* problems. Pre-disaster psychological problems had more effect (OR=1.93; 95% CI=1.79-2.08) than the effect of being a victim (OR=1.25; 95% CI=1.18-1.32) on the development of post-disaster *physical* symptoms.

**Conclusion** Post-disaster increases in utilisation and psychological morbidity were observed. Post-disaster psychological problems were more influenced by the disaster, while post-disaster physical symptoms were more influenced by pre-disaster psychological problems. GPs should concentrate on the pre-disaster health history of victims of man-made disasters in their practices.

**Keywords:** disasters, morbidity, longitudinal study, general practice

## Introduction

Victims of a disaster are at risk of developing psychological problems in the period following the disaster. This finding is mainly based on cross-sectional studies usually without a pre-disaster measurement<sup>1-3</sup>. Some other studies described the effect of pre-disaster anxiety or depression on post-disaster psychological problems. Pre-disaster anxiety<sup>4,5</sup> or depression<sup>6</sup> may predict post-disaster distress however, specific groups were examined, such as children or students.

Moreover, it has been shown that disaster victims may present physical symptoms as well. This has been illustrated by cross-sectional studies describing self reported post-disaster data, especially within the framework of Post Traumatic Stress Disorder<sup>7-13</sup>. Some of these studies on physical symptoms<sup>8,10,12</sup> made use of actual pre-disaster data. However, the effect of pre-disaster psychological well-being on post-disaster physical symptoms (illness) was not explored. The relation between psychiatric diagnoses and functional somatic symptoms and syndromes has been described in several studies, but not often in literature on disasters<sup>14-16</sup>. It has been shown that a psychiatric (sub-threshold) disorder predicts the presentation of multiple somatic symptoms<sup>17</sup>.

In Enschede, a city with 125,000 inhabitants in the eastern part of The Netherlands, a fireworks depot exploded in a residential area on 13 May 2000. The explosions destroyed a residential area where 1,500 people lived. As a result, 18 residents and 4 firemen were killed, and about 1,000 people were injured. Some 1,200 victims lost their homes and had to be relocated for quite some time.

In the present study in which health consequences of a major explosion were explored it was possible to collect data on patients' health pre- and post-disaster, because general practitioners (GPs) had already been registering all contacts with their patients electronically.

Thus, the development of pre- and post-disaster psychological problems and physical symptoms could be described in both victims and controls. In particular, victims and controls with and without pre-disaster psychological problems could be distinguished in a one-year period prior to the disaster.

This enabled us to study both the effect of pre-disaster psychological problems and the effect of being a victim on presenting post-disaster psychological problems and physical symptoms in a two-and-half years post-disaster period. Therefore, the association could be studied between, the assumed, vulnerable and non-vulnerable victims pre-disaster and their presentation of health problems post-disaster.

Specifically, the research question of the present study is:

Do victims of a man-made disaster with pre-disaster psychological problems present a greater increase in utilisation and in health problems post-disaster than victims without pre-disaster psychological problems?

## **Methods**

### ***General Practitioners***

In the Netherlands, every citizen has to be registered with just one GP, who acts as a gatekeeper to secondary care. As a result, victims of the disaster and their medical histories were already known to their GP in the period prior to the disaster. In this study, data could be collected one year prior to the disaster, because all participating GPs already were using a computerized information system.

All 60 GPs in the town of Enschede were asked to participate in this study, of which 44 did. The sixteen GPs who did not participate gave three different reasons: six expected an increase in workload, nine had no victims in their practices, and one did not use an electronic data system.

Patients were informed about their GP's participation in this study by posters and leaflets in the waiting room and could object to the use of their data (but nobody did). Moreover, announcements of the study were made in the local newspapers and in a paper by the municipality, especially published for the victims. Data collection was performed in accordance with the privacy protection procedures of the Dutch Data Protection Authority<sup>18</sup>. Data anonymously left the practice.

***Patients***

Patients were either marked as a victim by their GP (using zip codes of the disaster area) or by the Information and Advice Centre (IAC) of the municipal authorities. The IAC was an integrated post-disaster facility, where all victims were invited to register themselves. It was implemented immediately after the disaster and acted as one counter for all problems.

The databases of the IAC and the GPs were merged and inconsistencies were corrected. Patients were included as victims if they had both a mark by their GP and were registered at the IAC. Thus a group of 3909 “double marked” victims, including children and the elderly, and a control group (not marked in either of the databases) could be extracted. Only victims between 15 and 65 years old were included in the present study. Furthermore, these victims had to be enlisted in their GP’s practice during the entire study period from 13 May, 1999 till 13 November, 2002. Ultimately, 2518 victims were included.

The controls were matched for gender, age and health insurance. In the Netherlands, people with lower or middle incomes have public health insurance. As the type of insurance was recorded in the GP’s patient records, the insurance type could be used as an indicator of socio-economic status (SES). Two victim groups were distinguished: victims with pre-disaster psychological problems (N=400, 15.8%) and those without (N=2118). A victim with pre-disaster psychological problems had to contact his GP at least once in the year pre-disaster presenting a psychological problem. Similarly, two control groups were formed: one group with (N=323, 12.8%) and one without (N=2189) psychological problems in the period prior to the disaster.

***Procedures***

In Dutch general practice, the International Classification of Primary Care (ICPC)<sup>19</sup> is used, which is compatible with ICD-10 and DSM-III-R. Symptoms and diagnoses of both victims and controls registered by the participating GPs during contacts with patients were extracted for this study every three months.

In order to study the course of health symptoms and problems of victims and controls, with and without pre-disaster psychological problems four clusters were chosen: psychological problems, all physical symptoms,

digestive symptoms and musculoskeletal symptoms. These clusters were chosen, as they demonstrated a relation to the Fireworks Disaster in a previous study<sup>20,21</sup>.

### ***Analysis***

Analysis started one year before the disaster occurred and lasted two and a half years post-disaster. Mean numbers of contacts per patient, victims and controls with and without pre-disaster psychological problems, were calculated in seven 26-weeks periods. An overall F-test from the MANOVA with repeated measurements was executed to analyze differences between groups and time periods and followed by paired t-test between time periods within groups. The period November 1999 – May 2000 was compared to May 2000 – November 2000 to study short term effects and the period May 2000 – November 2000 was compared to May 2002 – November 2002 to study long term effects. An independent t-test was calculated in order to compare two groups within a time period.

Prevalence rates of victims and controls with and without pre-disaster psychological problems (PP) were calculated as the number of patients visiting their GP in periods of thirteen weeks divided by the total number of persons in that specific group.

Four logistic regression analyses were executed to analyze trends in the post-disaster period of the four clusters of health problems. Odds Ratio's with 95% Confidence Intervals were obtained (as well as various other statistics) to determine the effect of pre-disaster psychological problems and/or being a victim. Time was measured in 10 periods of 13 weeks. The time variable 'Immediately' applies to the first 13-weeks period after the disaster and 'Trend' is concerned with trends over the entire post-disaster study period. Interaction variables were included to test whether the course of post-disaster health problems differed between victims and controls (with or without pre-disaster psychological problems).

## Results

More than half of the victims and controls were male, on average the victims and controls were 40 years old, and about 77% had a low or medium SES (Table 5.1). About 16% of the victims presented psychological health problems before the disaster compared to 13% of the controls ( $p<0.001$ ). A small proportion (2.1% victims, 3.8% controls,  $p<0.01$ ) did not contact their GP in the entire study period of three and a half years.

Table 5.1: Characteristics of victims and controls, 15-65 years of age, registered on their GP's list between May 1999 and November 2002

Groups of patients	Victims N=2518	Controls N=2512
Mean age in years	39.6	39.6
Male (%)	54.7	54.8
Low/middle SES (%)	76.8	77.7
Pre-disaster psychological problems (%)	15.9***	12.9
Without GP contacts (%)	2.1***	3.8

SES= Socio-Economic Status.

\*\*\* $p<0.001$  (Chi<sup>2</sup> test) Victims compared to Controls.

### *Victims with pre-disaster psychological problems and their utilisation*

An overall F-test from the MANOVA with repeated measurements revealed statistically significant differences between groups and time periods ( $F=22.3$ ,  $df_1=6$ ,  $df_2=10050$ ,  $p<0.001$ ). The utilisation of persons with pre-disaster psychological problems is about twice as high compared to persons without pre-disaster psychological problems in all time periods. This applied to victims and controls (Table 5.2).

Table 5.2: Utilisation in mean numbers of contacts with GPs of victims and controls with and without pre-disaster psychological problems (PP) between May 1999 and November 2002 in 26 weeks-periods.

Groups of patients	Victims N=2518		Controls N=2512	
	With PP N=400	Without PP N=2118	With PP N=323	Without PP N=2189
<b>Pre-disaster</b>				
May 1999-November 1999	4.78	2.00	4.06	1.75
November 1999-May 2000	5.63	2.13	4.43	1.75
<b>Post-disaster</b>				
May 2000-November 2000	5.76	2.72**	3.75*	1.77
November 2000-May 2001	5.20	2.51	3.67	1.95
May 2001-November 2001	4.89	2.57	3.86	1.97
November 2001-May 2002	5.08	2.55	3.63	1.96
May 2002-November 2002	4.99 <sup>†</sup>	2.73	3.73	2.19 <sup>†</sup>

\*  $p < 0.01$ , \*\* $p < 0.001$ , May 2000-November 2000 compared to November 1999-May 2000.

<sup>†</sup>  $p < 0.01$ , May 2002-November 2002 compared to May 2000-November 2000.

Differences between other periods were not tested.

In the first months post-disaster the victims without pre-disaster psychological problems were the only group with a significant increase immediately post-disaster. Two-and-a-half years later utilisation was at a same level compared to immediately post-disaster, but still higher than the utilisation of comparable controls ( $p < 0.001$ ). Victims with pre-disaster psychological problems showed a small but non-significant increase in utilisation immediately post-disaster, where after utilisation decreased. In the last period, 2-2.5 years post-disaster, utilisation was significantly lower ( $p < 0.01$ ).

Controls with pre-disaster psychological problems showed a significant decrease in utilisation immediately post-disaster ( $p < 0.01$ ). This post-disaster level hardly changed during the rest of the study period. Controls without pre-disaster psychological problems demonstrated no difference immediately post-disaster.



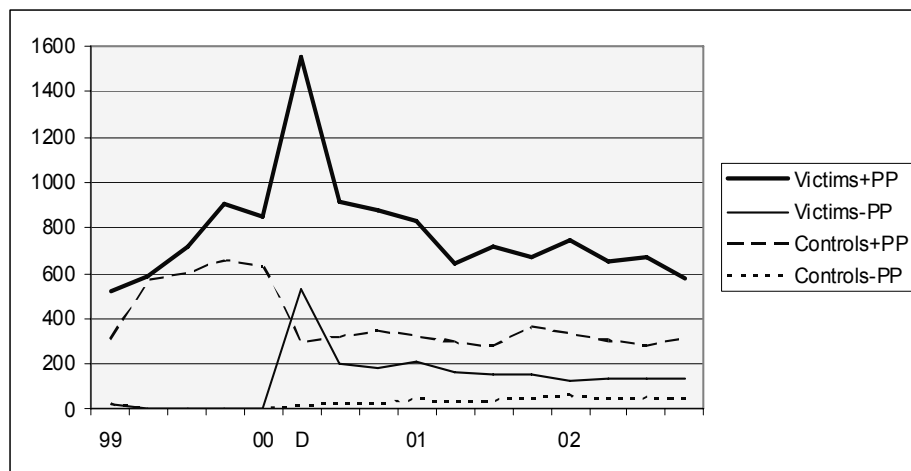
Victims and controls both with pre-disaster psychological problems had a higher utilisation during the entire study period than victims and controls without these problems.

***Victims with pre-disaster psychological problems and their post-disaster morbidity***

**1. Psychological problems.**

Post-disaster psychological problems were examined. Victims with and without pre-disaster psychological problems presented many problems in the first months post-disaster (Figure 5.1), especially victims with these pre-disaster problems. Both groups of victims showed a moderate decline of the problems.

Figure 5.1: Prevalence rates of psychological problems for victims and controls with or without pre-disaster psychological problems (PP) in 13 weeks-periods.



D = disaster date.

Controls with pre-disaster psychological problems showed an abrupt decrease in psychological problems in the first period post-disaster. Subsequently, their psychological problems stayed at this level, lower than

before the disaster but still higher than victims without pre-disaster psychological problems.

In a logistic regression analysis on the course of these post-disaster psychological problems (Table 5.3), the effect of being a victim of the disaster ( $OR=6.13$ ) was stronger than the effect of pre-disaster psychological problems ( $OR=4.96$ ). The trend variable indicated that prevalences of victims with ( $OR=1.02 \times 0.91 \times 0.92=0.86$ ) or without ( $OR=1.02 \times 0.91=0.93$ ) pre-disaster psychological problems decreased slowly. Controls without pre-disaster psychological problems showed no trend ( $OR=1.02$ , not statistically significant), while controls with pre-disaster psychological problems showed a slightly increasing trend ( $OR=1.02 \times 1.06=1.08$ ).

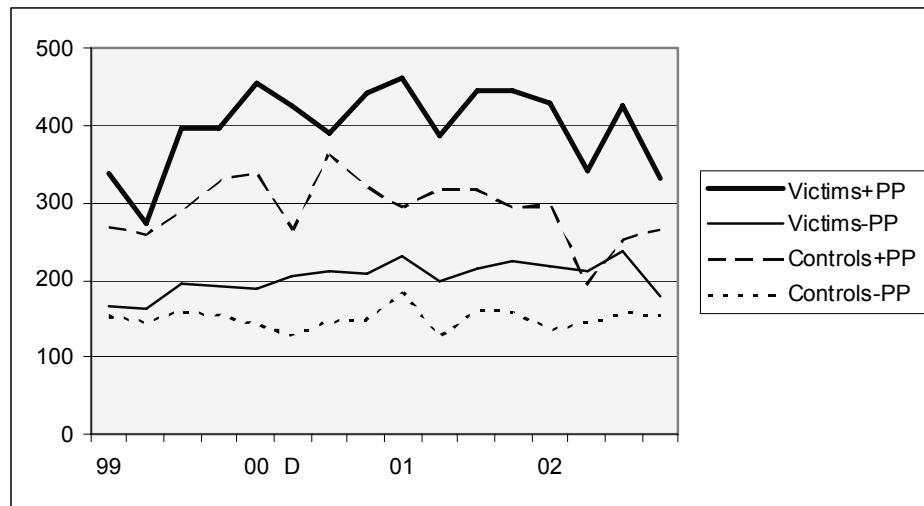
Table 5.3: Results of a logistic regression analyses for post-disaster psychological problems

	Regression coefficient	Wald statistic	df	p<	Odds Ratio	95%CI
<b>Main Effects</b>						
Victims	1.814	225.3	1	.000	6.13	(4.84- 7.77)
Pre-disaster psychol. problems	1.601	194.3	1	.000	4.96	(3.96-6.21)
Trend	0.018	0.7	1	.403	1.02	(0.98-1.06)
Immediately	-0.535	7.76	1	.006	0.59	(0.40-0.86)
<b>Interaction Effects</b>						
Trend victims	-0.100	18.3	1	.000	0.91	(0.86-0.95)
Trend pre-disaster psychol. problems	0.058	5.89	1	.015	1.06	(1.01-1.11)
Trend victims pre-disaster psychol. problems	-0.081	16.1	1	.000	0.92	(0.89-0.95)
Immediately victims	1.551	58.1	1	.000	4.72	(3.17-7.02)
Immediately pre-disaster psychol. problems	1.001	22.0	1	.000	2.72	(1.67-4.44)
Immediately victims pre-disaster psychol. problems	-1.368	27.6	1	.000	0.25	(0.15-0.42)
Constant	-3.576	1008.3	1	.000	0.03	

## 2. Physical symptoms.

Victims with pre-disaster psychological problems showed a yearly, seasonal, effect in the cluster of post-disaster all physical symptoms: a trough in summertime and a peak in late winter (Figure 5.2A).

Figure 5.2A: Prevalence rates of all physical symptoms for victims and controls with or without pre-disaster psychological problems (PP) in 13 weeks-periods



D = disaster date.

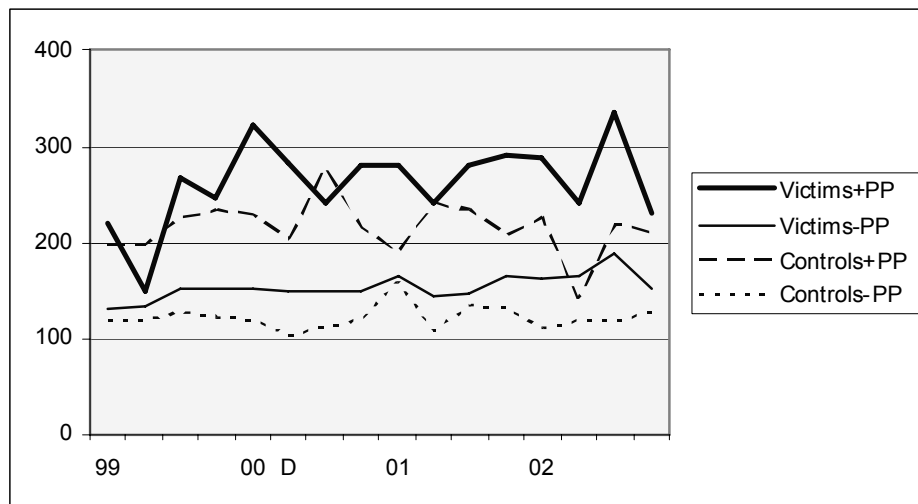
Controls with pre-disaster psychological problems showed a decline of physical symptoms in the first three months following the disaster. Victims and controls with pre-disaster psychological problems showed more physical symptoms pre- and post-disaster than victims and controls without pre-disaster psychological problems.

In a regression analysis of this cluster of all post-disaster physical symptoms (Table 5.4) pre-disaster psychological problems demonstrated more effect ( $OR=1.93$ ;  $95\%CI=1.79-2.08$ ) on presenting post-disaster physical symptoms than just the effect of being a victim ( $OR=1.25$ ;  $95\%CI=1.18-1.32$ ). The variables "trend" and "immediately (after the disaster)" were not statistically significant indicating that prevalences of physical symptoms remained at stable levels in all groups of victims and controls.

### 3. Musculoskeletal and digestive symptoms.

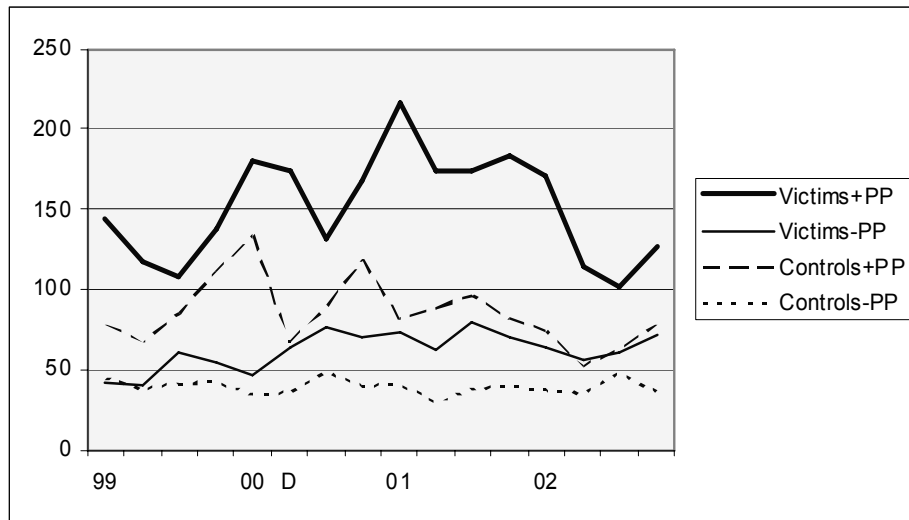
Victims and controls with pre-disaster psychological problems had higher pre- and post-disaster prevalence rates in both clusters of musculoskeletal and digestive symptoms than victims and controls without these problems (Figure 5.2B, 5.2C).

Figure 5.2B: Prevalence rates of musculoskeletal symptoms for victims and controls with of without pre-disaster psychological problems (PP) in 13 weeks-periods



D = disaster date.

Figure 5.2C: Prevalence rates of digestive symptoms for victims and controls with of without pre-disaster psychological problems (PP) in 13 weeks-periods



D = disaster date.

Again controls with pre-disaster psychological problems showed a decrease in these two clusters in the post-disaster quarter.

On presenting post-disaster musculoskeletal and digestive symptoms, the effect of pre-disaster psychological problems was higher than the effect of the disaster (Table 5.4). In the logistic regression model the variables "trends" and "immediately (after the disaster)" of both musculoskeletal and digestive symptoms were not significant indicating a stable level of these two clusters. These results are similar to those of the cluster of all physical symptoms.

Table 5.4: Results of three logistic regression analyses for three clusters of health problems

	Regression coefficient	Wald statistic	df	p<	Odds Ratio	95%CI
<b>All physical symptoms</b>						
Victims	0.221	55.3	1	.000	1.25	(1.18-1.32)
Pre-disaster psychol. problems	0.656	291.8	1	.000	1.93	(1.79-2.08)
Trend	-0.007	0.905	1	.342	0.99	(0.98-1.01)
Immediately	-0.092	2.77	1	.096	0.91	(0.82-1.02)
<b>Musculoskeletal symptoms</b>						
Victims	0.170	26.6	1	.000	1.19	(1.11-1.27)
Pre-disaster psychol. problems	0.600	196.7	1	.000	1.82	(1.68-1.98)
Trend	0.002	0.079	1	.779	1.00	(0.99-1.02)
Immediately	-0.066	1.13	1	.287	0.94	(0.83-1.06)
<b>Digestive symptoms</b>						
Victims	0.456	77.1	1	.000	1.58	(1.42-1.75)
Pre-disaster psychol. problems	0.701	128.5	1	.000	2.02	(1.79-2.28)
Trend	-0.029	4.474	1	.034	0.97	(0.95-1.00)
Immediately	-0.157	2.81	1	.094	0.85	(0.71-1.03)

All interactions were tested, but none was statistically significant.

## Discussion

Aim of the present study was to explore whether victims with pre-disaster psychological problems were possibly more vulnerable to the effects of the disaster than victims without those problems.

Victims with and without pre-disaster psychological problems both showed a significant increase of psychological morbidity after the disaster. This was found in a previous study on the Fireworks Disaster<sup>21</sup> and in a review<sup>1</sup>. However, only the group of victims without pre-disaster psychological problems showed a significant post-disaster increase in GP utilisation. The assumed, vulnerable, group of victims with pre-disaster psychological problems showed no effect in utilisation due to the disaster. The effects of the disaster on physical morbidity differed from psychological morbidity: the disaster had a smaller effect on presenting post-disaster physical symptoms and the victims showed no increase in physical morbidity immediately post-disaster.

Controls with pre-disaster psychological problems showed a decrease in post-disaster utilisation and morbidity: psychological problems, as well as physical symptoms. It looks like these controls, living in the same city, were holding their breath after the disaster occurred. In psychological literature this has been described as downward social comparison<sup>22,23</sup>. When applied to this study: these controls with pre-disaster psychological problems tend to downplay their problems comparing their problems with those of victims of which they think they are more distressed. Probably, this effect was not shown if we had chosen controls in an other, not affected, area.

The utilisation in the pre-disaster period of both groups of victims, with and without pre-disaster problems, was higher than the utilisation of the similar control groups. An explanation for this finding is unclear as the control group was stratified for SES, gender and age.

The present study on the course of health problems after a man-made disaster had a strong design with a data set longitudinally collected pre- and post-disaster. There may be a risk of overrepresentation of presenting disaster-related problems, as the GP knew whether his patient was a victim or not. The risk of overrepresentation could not be excluded for presenting post-disaster psychological problems. However, a significant increase in physical symptoms could not be found, notwithstanding that the GPs had several trainings on recognizing (unexplained) physical symptoms as a side-effect of psychological stress by the disaster.

The process of selecting victims and controls with pre-disaster psychological problems and the post-disaster registration of the same psychological problems could have a regression to the mean-effect in the long term. In this study Odds Ratios suggest this phenomenon: on the long run both groups with pre-disaster psychological problems will show same prevalences of these problems.

The strength of this study was not only the use of a control group, but the availability of pre-disaster baseline data as well, which is rather unique in disaster literature. Moreover, the problem of recall bias was avoided by using GPs' electronic medical records instead of self-reported questionnaires.

In conclusion, victims with pre-disaster psychological problems presented post-disaster not only more psychological problems but also more physical symptoms (illness). The psychological problems are more influenced by

being exposed to the disaster, as the physical symptoms are more influenced by a victims' history of pre-disaster psychological problems. Thus, the victims' vulnerability being expressed by pre-disaster psychological problems is of great importance on post-disaster psychological and physical problems.

### **Implications**

The GP is already known by all his patients in the pre-disaster period, and is therefore well suited for recognizing more complex health problems which are presented after a disaster. Patients with a history of psychological problems may in fact be expressing their, pre-existing, distress in presenting psychological and physical symptoms to their GP. Every health care professional should concentrate on this phenomenon after a disaster. Selection of victims with pre-disaster psychological problems can be useful in determining a post-disaster high risk population. In this context, support for victims in the aftermath of a disaster has to focus not only on psychological problems but on physical symptoms as well.



## References

1. 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.
2. Yzermans C, Gersons BPR. The chaotic aftermath of an airplane crash in Amsterdam: a second disaster. In: Havenaar J, Cwikel J & Bromet E (eds). *Toxic Turmoil*. New York, Kluwer Academic, 2002:85-99, lit.
3. Ginexi EM, Weihs K, Simmens SJ, Hoyt DR. Natural disaster and depression: a prospective investigation of reactions to the 1993 midwest floods. *Am J Community Psychol* 2000;**28**:495-518.
4. Asarnow J, Glynn S, Pynoos RS, Nahum J, Guthrie D, Cantwell DP, Franklin B. When the earth stops shaking: earthquake sequelae among children diagnosed for pre-earthquake psychopathology. *J Am Acad Child Adolesc Psychiatry* 1999;**38**:1016-23.
5. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consult Clin Psychol* 1998;**66**:883-92.
6. Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. *J Pers Soc Psychol* 1991;**61**:115-21.
7. Bromet EJ, Gluzman S, Schwartz JE, Goldgaber D. Somatic symptoms in women 11 years after the Chernobyl accident: prevalence and risk factors. *Environ Health Perspect* 2002;**110 Suppl 4**:625-9.
8. Dirkzwager AJ, Yzermans CJ, Kessels FJ. Psychological, musculoskeletal, and respiratory problems and sickness absence before and after involvement in a disaster: a longitudinal study among rescue workers. *Occup Environ Med* 2004;**61**:870-2.
9. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
10. Escobar JI, Canino G, Rubio-Stipec M, Bravo M. Somatic symptoms after a natural disaster: a prospective study. *Am J Psychiatry* 1992;**149**:965-7.
11. McFarlane AC, Atchison M, Rafalowicz E, Papay P. Physical symptoms in post-traumatic stress disorder. *J Psychosom Res* 1994;**38**:715-26.
12. Phifer JF. Psychological distress and somatic symptoms after natural disaster: differential vulnerability among older adults. *Psychol Aging* 1990;**5**:412-20.
13. van den Berg B, Grievink L, Yzermans CJ, Lebet E. Medically Unexplained Physical Symptoms in the aftermath of disasters, a review. *Epidem Reviews* 2005;**27**:92-106.
14. Barsky AJ, Borus JF. Functional somatic syndromes. *Ann Intern Med* 1999;**130**:910-21.
15. Burton C. Beyond somatisation: a review of the understanding and treatment of medically unexplained physical symptoms (MUPS). *Br J Gen Pract* 2003;**53**:231-9.

16. Wessely S, Nimnuan C, Sharpe M. Functional somatic syndromes: one or many? *Lancet* 1999;**354**:936-9.
17. Hotopf M, Mayou R, Wadsworth M, Wessely S. Temporal relationships between physical symptoms and psychiatric disorder. Results from a national birth cohort. *Br J Psychiatry* 1998;**173**:255-61.
18. Roorda J, van Stiphout WA, Huijsman-Rubingh RR. Post-disaster health effects: strategies for investigation and data collection. Experiences from the Enschede firework disaster. *J Epidemiol Community Health* 2004;**58**:982-7.
19. Lamberts H, Wood M. *International Classification of Primary Care*. Oxford, Oxford University Press, 1987:1-9.
20. Soeteman RJH, Yzermans CJ, Kerssens JJ, Dirkzwager AJE, Donker GA, ten Veen PMH, van den Bosch WJHM, van der Zee J. Health problems presented in general practice one year prior to and one year following a disaster. *J Am Board Fam Med* 2007;**20**:548-56.
21. Yzermans CJ, Donker GA, Kerssens JJ, Dirkzwager AJ, Soeteman RJ, Ten Veen PM. Health problems of victims before and after disaster: a longitudinal study in general practice. *Int J Epidemiol* 2005;**34**:820-6.
22. Aspinwall LG, Taylor SE. Effects of social comparison direction, threat, and self-esteem on affect, self-evaluation, and expected success. *Journal of Personality and Social Psychol* 1993;**64**:722.
23. Taylor SE. Adjustment to threatening events: A theory of cognitive adaptation. *Am Psychologist* 1983;**38**:1173.

# Chapter

# 6

## **Changes in the pattern of service utilisation and health problems of women, men and various age groups following a destructive disaster**

### **A matched cohort study with a pre-disaster assessment**

Rik J.H. Soeteman  
C. Joris Yzermans  
Peter Spreeuwenberg  
Toine A.L.M. Lagro-Janssen  
Wil J.H.M. van den Bosch  
Jouke van der Zee

---

Biomed Central Family Practice;  
<http://www.biomedcentral.com/1471-2296/9/48>

## Abstract

**Objectives** Female gender and young age are known risk factors for psychological morbidity after a disaster, but this conclusion is based on studies without a pre-disaster assessment. The aim of this study in family practice was to investigate if these supposed risk factors would still occur in a study design with a pre-disaster measurement.

**Methods** A matched cohort study with pre-disaster (one year) and post-disaster (five years) data. Community controls (N=3164) were matched with affected residents (N=3164) on gender, age and socio-economic status. Main outcome measures were utilisation rates measured by family practice attendances and psychological, musculoskeletal and digestive health problems as registered by the family practitioner using the International Classification of Primary Care (ICPC).

**Results** Affected residents of female and male gender and in five age groups all showed increases in utilisation rates in the first post-disaster year and in psychological problems when compared to their pre-disaster baseline levels. The increases showed no statistically significant changes, however, between women and men and between all age groups.

**Conclusion** Gender and age did not appear to be disaster-related risk factors in this study in family practice with a pre-disaster baseline assessment, a control group and using existing registries. Family practitioners should not focus specifically on these risk groups.

## Background

Disasters often have an effect on the victims' health and victims present more psychological and physical health problems as a result. Within this context, several risk groups may be distinguished, as gender and age, which have been described after many disasters<sup>1</sup>.

Most of the studies found that women present with more health problems than men in the aftermath of a disaster-related to earthquakes and hurricanes<sup>2-7</sup>. Some studies showed other results, however, in which men appeared to be more vulnerable than women<sup>8,9</sup>.

In her review using 160 studies about the health problems after disasters, Norris<sup>1</sup> concludes that in 49 studies a statistically significant gender difference was observed in post-disaster stress, distress or disorder. Of these, 46 studies found female survivors to be more adversely affected, especially for developing a Posttraumatic Stress Disorder (PTSD). In a meta-analysis Brewin found that when men and women were directly compared within the same study, women were more at risk of developing PTSD holding constant the type of trauma<sup>10</sup>. Finally, Tolin & Foa conducted a meta-analysis on sex differences in trauma and PTSD, using 290 studies published between 1980 and 2005. Their general conclusion was that females were more likely than males to meet criteria for PTSD, although females were less likely to experience potentially traumatic events<sup>11</sup>.

Some studies on the effect of age in presenting post-disaster health problems showed that middle aged (40-65) victims were most distressed<sup>6,9,12</sup> and showed a higher utilisation of health care services<sup>13</sup>. Two groups of different ages were compared in most of these studies and the results showed that the older group (65+ years) presented with fewer symptoms of distress or depression. The inoculation theory has to be mentioned in this context, viz. that victims with more experience of life and its major and minor (personal) disasters are more resilient to the effects of a "new" disaster than "inexperienced" victims<sup>12,14-16</sup>. Contradictory results are found too, however, and several studies have shown elderly Japanese, Polish and Australian victims of natural disasters to be more at risk of post-disaster distress than younger groups<sup>17-19</sup>. In general, however, older victim groups are more resilient to the effects of a disaster than younger groups<sup>1</sup>.

Almost all studies referred to above are based on designs that did not use pre-disaster data and used a cross-sectional, retrospective design with short-term follow-up, using (self-report) questionnaires. In the reviews and meta-analysis mentioned above<sup>1,11,20</sup> it was suggested that the design of the study strongly influenced outcomes and results. Retrospective studies were associated with weaker effects for female gender and stronger effects for younger age and the effect size was greater when respondents were interviewed rather than given questionnaires. Epidemiological studies were associated with a significantly greater sex difference in PTSD than were convenience-sample studies.

Moreover, most studies discussed gender and age differences concerning PTSD, while in family practice (or primary care in general) this disorder is not often diagnosed. After disasters family practitioners often diagnose other psychological problems (anxiety, depression, disturbances of sleep, concentration or memory) and/or physical symptoms. In addition, we know of no studies in family practice of gender and age as possible risk factors for post-disaster health problems.

On 13 May 2000 a fireworks depot exploded in a residential area of Enschede, a city with 125,000 inhabitants in the eastern part of the Netherlands. As a result, 18 residents and 4 firemen were killed and about 1,000 people were injured. Some 1,200 victims lost their homes and personal belongings and had to be relocated for several years. Baseline data were available after the disaster, because the health problems of (future) victims and controls had already been registered by the family practitioner in the period prior to the disaster. This enabled us to investigate health problems longitudinally, therefore, with the inclusion of pre-disaster utilisation rate and morbidity.

The aim of this study was to explore whether the supposed risk factors of female gender and younger age would (also) appear in a study in family practice in which a pre-disaster baseline measurement was available with a longitudinal design, without recall bias and using a control group.

We hypothesized that women and members of the younger age groups will have, for several years post-disaster, elevated rates of psychological problems and physical symptoms and an increased utilisation compared to

their pre-disaster baseline, to members of a control group and compared to men and older age groups.

## Methods

### *Setting*

Every citizen of the Netherlands is registered with one family practitioner (FP), who acts as a gatekeeper to secondary care. This means that patients affected by the disaster and their medical histories were already known to their FPs in the period prior to the disaster. All participating FPs were already using electronic medical records (EMR). Thus in this study, it was possible to collect data from one year prior to the disaster and the study period continued until 5 years after the disaster.

All 60 FPs in Enschede were asked to participate in this study and 44 of them agreed. The sixteen FPs who refused to participate gave three different reasons; six expected an increase in workload, nine had no victims in their practices, and one did not use an electronic data system.

Patients were informed about their FP's participation in this study by posters and leaflets in the waiting room and by announcements in the local newspapers. They were entitled to object to the use of their anonymized data, but nobody did. The study was carried out according to Dutch legislation on privacy. The privacy regulation of the study was approved by the Dutch Data Protection Authority<sup>21</sup>. According to Dutch legislation, neither obtaining informed consent, nor approval by a medical ethics committee was obligatory for this observational study.

### *Matching variables*

After the disaster (as after many others) it was problematic to identify exactly who had been directly affected by the disaster, not at least because of the various possible definitions of 'affected', including the concept 'exposed'.

To overcome this problem two external sources were used: persons were either marked as affected in the patient registration of their FP (using the zip-codes of the affected area or because being affected was mentioned in the patient – practitioner encounter), or were registered in the database of

the municipal Information and Advice Centre (IAC); residents were for example registered here to acquire a new house and for financial compensation. The two databases were compared and inconsistencies were corrected. Despite our efforts, we are not completely sure that every single person in our study was directly exposed to the explosions, while we are pretty sure they were all affected. By way of precaution, we will not use 'victim', but 'affected resident'.

All victims had to be registered with one family practice during the entire study period, from 13 May 1999 until 13 May 2005 and 3168 affected residents were finally included. FP patients were included as member of a control group when they were not identified as affected resident (see above), so that we could relate our findings to normal fluctuations in utilisation rate and morbidity over time. The control group were patients in the same practices involved in our study and they had to have been registered throughout the study period. They were matched with the affected residents on gender, age and health insurance, variables which were extracted from the FPs' electronic medical records (EMR). The type of health insurance was used as a proxy for socio-economic status (SES), because this is directly related to income in the Netherlands. Persons with public health insurance are presumed to belong to a low or medium SES category and they make up 64% of the general population<sup>22</sup>. Private health insurance indicates a high SES.

Groups of female and male affected residents were made and five age groups were constructed. The limits of the age groups were chosen on the basis of research in Dutch family practice<sup>22,23</sup>. Children younger than five years of age were not included.

### **Dependent variables**

The International Classification of Primary Care (ICPC), which is used in Dutch family practice, is compatible with the International Classification of Diseases (ICD-10) and with the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R)<sup>24</sup>. ICPC is a multi-axial classification system in which it is possible to register problems and symptoms in the words of the patient ('the Reason for Encounter') as well as the diagnoses as objectivised by the family practitioner. Symptoms and diagnoses registered in the EMR during contacts with patients were extracted for this study every three months and



were grouped in one psychological and two physical clusters (musculoskeletal and digestive) in accordance with the ICPC. The choice of these clusters was based on the results of other studies in this population demonstrating a relationship with the disaster<sup>25-27</sup>. The cluster of the psychological problems consisted of ICPC codes representing stress reactions, anxiety and depressive problems/disorders. The most prevalent ICPC codes within the pre-disaster psychological cluster represented depressive disorder, sleeping problems, anxious feelings and depressed feelings (constituting 64% of the cluster). By clustering problems and disorders specific information was lost, but we prevent coincidental differences between gender and age groups due to limited numbers. In the ICPC no specific code exists for PTSD. There is one code for all stress reactions, acute, transient as well as PTSD.

### ***Statistical analysis***

The study period started one year before the disaster and lasted until five years post-disaster. Utilisation of family practice care was calculated as the number of contacts (consultations, visits and telephone contacts) per patient - affected residents and members of the control group - in six one-year periods. A dummy variable was created with yes (=1, at least one contact in a one-year period) and no (=0, no contact in a one-year period). Morbidity of health problems in the three clusters was calculated as the number of affected residents attending their FPs with those problems.

Differences and trends in average utilisation rate and percentage of morbidity for each group (combinations of affected residents and members of the control group with gender or age categories) in different years were calculated and tested using a logistic multilevel model for repeated measures (using the MLwiN software) and the logistic estimation was performed with second order penalized quasi-likelihood (PQL) approach with unconstrained level 1 variance, which made it possible to control for the autocorrelation between measurements in individuals (modelling the full variance/covariance matrix between measurement occasions at person level). The person cluster in the practices was also controlled for, by using the FPs as a higher level in the model. Our research questions are specified as a linear contrast function that captures the relevant changes between post-disaster versus pre-disaster years within one group of affected residents,

compared to another, referenced, group of affected residents. It was subsequently tested whether the difference between these internal group changes differed from zero.

## Results

The groups of affected residents and matched controls both contained 3164 persons, 52% of which were men (Table 6.1). There were more women in the youngest groups and in the oldest groups (5-14 and 65+).

Table 6.1: Numbers of male and female affected residents registered with a family practice in a period of one year pre-disaster and five years post-disaster

Age group in years	Male	Female
5-14	150	160
15-24	202	176
25-44	624	532
45-64	508	394
65+	156	262

## Gender

### *Utilisation rates*

Utilisation rate was monitored during one pre-disaster year and five post-disaster years. Female affected residents and controls already had a higher utilisation than male affected residents and controls before the disaster occurred. Both female and male affected residents had a significant post-disaster increase (Table 6.2) in the first year ( $p < 0.001$ ) compared to pre-disaster. The second year again showed a statistically significant difference in both female ( $p < 0.001$ ) and male affected residents ( $p < 0.01$ ).

Table 6.2: Utilisation rate by male and female affected residents and members of the control group as number of contacts with FPs per year, one year pre-disaster and five years post-disaster.

Utilisation rate	Male		Female	
	affected	control	affected	control
Pre-disaster year 0	3,69	3,06	6,61	5,44
Post-disaster year 1	5,21***	3,25	8,51***	5,63
year 2	4,73**	3,34	8,38***§	6,06
year 3	4,81	4,13	8,60	6,98
year 4	4,48	4,16	8,17	7,30
year 5	4,53	4,12	7,88	6,59

\*\*  $p < 0.01$ , year compared with year 0.

\*\*\*  $p < 0.001$ , year compared with year 0.

§  $p < 0.01$ , women compared with men within one year and related to year 0.

When the increases in the utilisation rates for female and male affected residents were tested in the first two years, a significant difference ( $p < 0.01$ ) was found in the second year alone, which means that the increase in utilisation rate remained significantly higher in female affected residents. The increase in the first year was similar for both sexes.

### *Psychological problems*

Psychological problems were analyzed per gender during the same period. Female affected residents had higher levels of psychological problems than males during the overall study period, including the pre-disaster period (Table 6.3), and both groups of affected residents showed a statistically significant increase in these problems ( $p < 0.001$ ) in the first post-disaster year. The psychological problems decreased moderately after the first year post-disaster. The difference with the pre-disaster year remained significant until the fourth year for men and until the third year for women. When the differences between the increases for men and women were tested, however, they did not appear to be significant, which meant that the increased morbidity of psychological problems post-disaster was similar for men and women, given the existing pre-disaster differences.

Table 6.3: Psychological, musculoskeletal and digestive symptoms in percentages of male and female affected residents and members of the control group attending their FP at least once per year, one year pre-disaster (year 0) and five years post-disaster (years 1 through 5).

	Male		Female	
	affected	control	affected	control
<b>Psychological symptoms</b>				
Pre-disaster year 0	12,9	10,9	19,1	14,9
Post-disaster year 1	40,8***	11,5	55,1***	18,4
year 2	24,6***	12,8	33,5***	16,9
year 3	24,0***	13,7	33,4**	20,4
year 4	19,0*	12,7	28,8	20,8
year 5	16,9	13,2	24,3	17,3
<b>Musculoskeletal symptoms</b>				
Pre-disaster year 0	23,0	19,8	29,1	23,9
Post-disaster year 1	25,4	19,8	31,1	24,2
year 2	22,8	18,8	30,7	24,8
year 3	22,2	19,6	31,3	24,4
year 4	20,1	19,4	27,1	24,4
year 5	20,7	17,7	28,5	23,6
<b>Digestive symptoms</b>				
Pre-disaster year 0	12,2	10,1	14,9	14,1
Post-disaster year 1	12,9	9,4	18,1	14,3
year 2	11,9	9,6	16,6	13,3
year 3	12,9	10,4	16,8	14,6
year 4	13,2	11,7	18,7	15,4
year 5	11,5	11,3	16,6	14,7

\* p<0.05, year compared with year 0.

\*\* p<0.01, year compared with year 0.

\*\*\* p<0.001, year compared with year 0.

### *Physical symptoms*

No statistically significant increases were found in male and female affected residents when changes in musculoskeletal and digestive symptoms were compared between the pre-disaster year and the five post-disaster years.

Nor were any significant differences found between the changes in both sexes (Table 6.3).

## Age

### Utilisation rates

Utilisation rates in five post-disaster years were compared with the pre-disaster year. The tests were implemented for all affected residents in five age groups and related to the control group (Table 6.4). All age groups demonstrated a statistically significant increase in the first post-disaster year (5-14years  $p<0.05$ , all other groups  $p<0.001$ ) and this increase persisted in the second year in some groups (25-44 years,  $p<0.001$  and 44-65 years,  $p<0.01$ ) and even in the third year (25-44 years,  $p<0.05$ ).

Table 6.4: Utilisation rate by five age groups of affected residents and members of the control group as mean number of contacts with FPs per year, one year pre-disaster (year 0) and five years post-disaster (years 1 through 5)

Utilisation rate	Age groups									
	age 5-14		age 15-24		age 25-44		age 45-64		age 65+	
	A	C	A	C	A	C	A	C	A	C
Pre-disaster year 0	0,97	1,61	3,20	2,42	4,51	3,48	6,51	5,19	9,44	9,28
Post-disaster year 1	1,69*	1,58	4,79***	2,46	6,54***	3,36	8,19***	5,84	11,12***	9,66
year 2	1,48	1,77	3,73	2,78	6,20***	3,67	8,19**	5,98	10,80	9,99
year 3	1,42	2,06	3,91	3,22	5,86*	4,12	8,30	6,76	12,54	12,88
year 4	1,45	1,97	3,05	2,91	5,34	4,43	8,13	7,23	12,23	12,66
year 5	1,55	1,74	3,05	2,65	4,84	4,03	8,35	6,77	12,17	12,43

A Affected residents.

C Control group.

\*  $p<0.05$ , year compared with year 0.

\*\*  $p<0.01$ , year compared with year 0.

\*\*\*  $p<0.001$ , year compared with year 0.

These increases in each age group were compared with the adjoining older group and with the mean of all older groups, but no significant differences were found in the changes between the pre-disaster year and the post-disaster year in all age groups.

### *Psychological problems*

Psychological problems in the post-disaster years were compared with those in the pre-disaster year and a statistically significant increase in psychological problems was found in all five age groups in the first year ( $p < 0.001$ , Table 6.5). These significant differences persisted in the adult groups and in the elderly in the second year (25-44 years ( $p < 0.001$ ), 45-64 years ( $p < 0.001$ ), 65+ ( $p < 0.01$ )) and in the third year (25-44 years ( $p < 0.001$ ), 45-64 years ( $p < 0.001$ ), 65+ ( $p < 0.05$ )). A statistically significant difference was finally found in the adult group of 25-44 years in the fifth year ( $p < 0.001$ ). No significant differences were found between the pre/post increases in all age groups.

Table 6.5: Psychological morbidity in percentage of five age groups of affected residents and members of the control group visiting their FP at least once per year, one year pre-disaster (year 0) and five years post-disaster (year 1 through 5)

Psychological problems	Age groups									
	age 5-14		age 15-24		age 25-44		age 45-64		age 65+	
	A	C	A	C	A	C	A	C	A	C
Pre-disaster year 0	6,2	7,1	12,2	8,7	17,9	12,6	18,4	14,8	16,4	19,0
Post-disaster year 1	25,6***	5,2	41,2***	10,4	49,9***	15,6	53,9***	17,5	51,4***	20,4
year 2	14,0	7,4	22,2	11,2	31,9***	15,5	33,8***	17,3	28,0**	18,3
year 3	13,0	8,9	25,8	15,0	30,8**	16,3	31,0**	18,5	31,5*	25,0
year 4	12,4	7,4	19,4	12,7	25,9	17,0	26,3	18,8	25,2	23,4
year 5	8,4	6,1	18,1	10,9	22,5***	16,2	23,0	16,3	21,5	22,7

A Affected residents.

C Control group.

\*  $p < 0.05$ , year compared with year 0.

\*\*  $p < 0.01$ , year compared with year 0.

\*\*\*  $p < 0.001$ , year compared with year 0.

***Physical symptoms***

No statistically significant differences were found in the first year post-disaster when the post-disaster musculoskeletal and digestive symptoms of five age groups were compared with their pre-disaster levels (see additional file 1). Again, no significant differences were found when all age groups were compared with their adjacent older age groups.

**Discussion**

The aim of this study was to explore whether female affected residents were more vulnerable than male ones and whether younger age groups were more vulnerable than older groups to the effects of a man-made disaster in a longitudinal design with a pre-disaster measurement and a control group. Changes in service utilisation and in morbidity as presented by patients in family practice were tested.

The main finding of the study is that no statistically significant differences were found between men and women and between various age-groups with regard to post-disaster increases in utilisation rate, in psychological problems and in physical symptoms. We conclude, therefore, that as such, female gender and younger age were no risk factor in family practice following this disaster. The finding that women present a higher utilisation than men in the second year alone was an unexpected one. It is hard to explain, because no gender differences in presenting with psychological problems were found in the same year.

This finding that female gender is not a risk factor after a disaster is in contrast with the findings of many other studies<sup>1-7,28</sup>. A difference between our study and previous studies on gender differences may be that the previous studies were often based on natural disasters with a sudden and fierce impact, e.g. earthquakes or hurricanes. Such disasters may cause more extensive destruction of housing and infrastructure than the man-made disaster in the present study and these large scale disasters may have an additional impact on women as breadwinners, having to raise children, or losing social support<sup>11</sup>.

Some studies on gender, however, demonstrated results resembling those in our study. In a study on gender effects after 9/11<sup>29</sup>, a lifetime risk of post-

traumatic stress disorder (PTSD) in women was found that showed that PTSD was not directly related to the attacks. In another study on 9/11, an excess burden of PTSD was attributed to female behavioural factors (e.g. acting as primary care-giver, experience of peri-event panic attacks) and biographical factors (e.g. previous unwanted sexual contact, recent history of mental problems)<sup>30</sup>. The disaster itself seemed to play a limited role in these studies. Another study concerning the effect of an air show disaster showed that gender did not act as a risk factor on post-traumatic stress symptoms<sup>31</sup>. These three studies were controlled for pre-disaster morbidity. One 9/11 study about female victims without a pre-disaster assessment found a relationship between social and economic circumstances and PTSD suggesting that women are not more vulnerable to PTSD than men<sup>32</sup>.

After studying reviews and meta-analyses<sup>1,11,33</sup> we concluded that results of studies about gender being a risk factor for post-disaster utilisation and morbidity (or not) were influenced by the study design. Retrospective studies were associated with weaker effects for female gender and the effect size was greater when respondents were interviewed rather than given questionnaires<sup>34</sup>. Epidemiological studies were associated with a significantly greater sex difference in PTSD than were convenience-sample studies<sup>11</sup>. Our design was not retrospective, no respondents were used (no 'recall bias') and epidemiological methods were applied. Based on the literature mentioned we hypothesized (strong) effects for women, although our study did not concern PTSD, but stress reactions, depressive feelings/disorders and anxiety feelings/disorders and physical symptoms. Moreover, the effect of demographic characteristics can not be thoroughly understood without controlling exposure and/or subjective appraisal characteristics. As mentioned before, privacy rules made it impossible to be 100% certain about the amount of exposure and subjective characteristics were not available because existing registries were used.

In our study, all five separate age groups presented post-disaster increases in psychological problems and utilisation. These increases did not differ from one another, however, and so it appeared that all age groups were equally vulnerable to the effects of the disaster. This is in contrast with the finding of Norris in her review, which was that 88% of all studies of adult victims showed that younger adults were more adversely affected by disaster than older adults<sup>1</sup>. We found no results, therefore, to support the



inoculation theory as presented in several studies showing a stronger resilience of elderly victims to the effects of a disaster<sup>14-16</sup>. In contrast to the present study, however, these studies were performed after natural disasters and two of them included high proportions of older adults<sup>14,15</sup>. High age elderly were compared with young age elderly, but these groups were pooled in one 65+ group in our study, because of the low numbers of victims in these groups. One of the flood studies was controlled for pre-disaster morbidity<sup>15</sup>. Age was studied in an adult group of victims in the study of an air show disaster referred to above, which was controlled for pre-disaster symptoms. Like gender, age did not appear to be a risk factor for post-disaster psychological problems in this study<sup>31</sup>.

In summary, gender and (younger) age as such are not risk factors for presentation of post-disaster utilisation or morbidity in the present study. Of the few studies that confirm our findings, two had a “pre-disaster” design similar to our study<sup>15,31</sup>. The studies that showed female gender and younger age to be risk factors were mostly based on large scale natural disasters and they did not perform pre-disaster assessments and or used a control group.

### Limitations and strengths

The present study has a strong design with pre-disaster data being used as a baseline measurement; as Norris stated in her review<sup>1</sup>: ‘controlling for pre-disaster symptoms when assessing the effects of exposure yields the strongest design possible in this field of research’. As a consequence, we already had insight into pre-disaster health problems and the results of our study could be controlled for pre-disaster baseline values. Health data of affected residents and controls were also compared and a risk of recall bias was avoided as well by using FPs’ electronic medical records instead of self-reported questionnaires.

Some issues relating to the present study need to be considered. Differences between affected residents and the control group already existed before the disaster occurred and affected residents presented more psychological and physical problems, in spite of matching with controls on socio-economic status, gender and age. Adverse health outcomes in the aftermath of disasters often originate in poor social circumstances that already existed

before the disaster. In addition, disasters tend to happen in socially deprived areas with residents presenting more health problems or in areas that are particularly vulnerable to the effects of natural disasters<sup>35,36</sup>. On the other hand, the type of health insurance turned out to be an insufficient proxy for the socio-economic status of affected residents and members of the control group.

In this study, we did not have any information about whether the affected residents were directly exposed or not. We are aware that this is an opportunistic study which was limited by practical problems often encountered in disaster research. In this case, due to privacy regulations it was not possible to explore the 'individual exposure'. To overcome this problem two external sources were used: persons were either marked as affected in the patient registration of their FP (using the zip-codes of the affected area or because being affected was mentioned in the patient – practitioner encounter), or were registered in the database of the municipal Information and Advice Centre (IAC); residents were for example registered here for acquiring a new house and for financial compensation. Indirectly, there is evidence that affected residents were directly exposed to the disaster. After this disaster, besides surveillance in family practice, a survey was conducted using questionnaires. It was possible to combine the two databases (questionnaires and EMRs from family practice) for 994 affected residents (31.5% of the study group used here). On average, these persons reported 10.4 stressful experiences during the disaster (e.g. saw smoke, heard the explosions, saw the explosions, felt the shockwave, saw dead bodies) and analyses of SCL-90-R subscales and Rand-36 subscales showed that having encountered stressful experiences during the disaster was significantly associated with more problems on all subscales<sup>37</sup>. In another study on 649 affected residents (20% of our study group), 75% of them had high scores (>25) on the Impact of Event Scale<sup>38</sup>. These results were not confirmed in the control group. Finally, in a secondary analysis, it was found that prevalence rates of the control group resembled those of the general Dutch population, while the affected residents had higher rates on several health problems<sup>39</sup>.

We may conclude that indirect evidence confirms that the labelling of the study groups reflects a distinction between individual exposure among the affected residents and no exposure among members of the control group.

Psychological problems were combined in one cluster, which might have resulted in loss of specific information. The choice of clustering patient's problems was decided in order to prevent coincidental differences due to the limited numbers of patients. On the other hand, symptoms of PTSD, anxiety disorder and major depression, which are all co-morbid with each other, were included in the cluster.

A risk of overrepresentation of post-disaster psychological problems could not be excluded. After all, the FPs in the study knew their patients and who was an affected resident and who was not. On the other hand, they knew whether a problem that was attributed by the affected resident to the disaster, was presented in reality before the disaster as well<sup>35</sup>. Moreover, recall bias could be avoided by the use of EMRs. Finally, the FPs were trained in the ICD-10 classification system and they received feedback on the quality of their registrations.

## **Conclusions**

In conclusion, the Fireworks Disaster appears to have dispersed its impact equally among male and female affected residents of all ages. In specific terms, neither women nor any particular age group were at increased risk of suffering the detrimental health effects of this man-made disaster in a residential area. In other studies concerning this specific disaster, it was found that having a pre-disaster history of psychological problems and disorders appeared to be the most important risk factor for post-disaster psychological as well as physical health problems<sup>25-27</sup>. In the first three years post-disaster being relocated due to the disaster appeared to be another strong indicator for disaster-related health problems. Risk factors which appear in 'normal' primary care (gender, age, insurance type, ethnicity) did not have any extra effect of the disaster: post-disaster differences between these groups may be explained by pre-disaster differences.

After disasters family practitioners do not have to focus specifically on gender or on any age group post-disaster, but especially on those with psychological problems before the disaster and patients who lost their houses and personal belongings. As Freedman mentioned<sup>40</sup>, after disaster 'family practitioners are key agents for providing information, remaining

empathic, encouraging patients to seek and accept assistance (...) and repeatedly checking on disaster victims for up to (at least) 12 months'

Our study is one of the first which used a pre-post design and a longitudinal and controlled design, using existing registries in family practice. It is important that this alternative design will be implemented after another disaster, collecting exposure data as well.

## References

1. 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.
2. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, alcohol use, and perceived safety after the terrorist attack on the pentagon. *Psychiatr Serv* 2003;**54**:1380-2.
3. Joh H. Disaster stress of the 1995 Kobe earthquake. *Psychologia: International J Psychol Orient* 1997;**40**:192-200.
4. Karanci NA, Alkan N, Aksit B, Sucuoglu H, Balta E. Gender differences in psychological distress, coping, social support and related variables following the 1995 Dinal (Turkey) earthquake. *North Am J Psychology* 1999;**1**:189-204.
5. Norris FH, Perilla JL, Ibanez GE, Murphy AD. Sex differences in symptoms of posttraumatic stress: Does culture play a role? *J Trauma Stress* 2001;**14**:7-28.
6. Salcioglu E, Basoglu M, Livanou M. Long-term psychological outcome for non-treatment-seeking earthquake survivors in Turkey. *J Nerv Ment Dis* 2003;**191**:154-60.
7. Steinglass P, Gerrity E. Natural disasters and post-traumatic stress disorder: Short-term versus long-term recovery in two disaster-affected communities. *J Applied Soc Psychol* 1990;**20**:1746-65.
8. Ginexi EM, Weihs K, Simmens SJ, Hoyt DR. Natural disaster and depression: a prospective investigation of reactions to the 1993 midwest floods. *Am J Community Psychol* 2000;**28**:495-518.
9. Phifer JF. Psychological distress and somatic symptoms after natural disaster: differential vulnerability among older adults. *Psychol Aging* 1990;**5**:412-20.
10. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol* 2000;**68**:748-66.
11. Tolin DF, Foa EB. Sex differences in trauma and posttraumatic stress disorder: a quantitative review of 25 years of research. *Psychol Bull* 2006;**132**:959-92.
12. Thompson MP, Norris FH, Hanacek B. Age differences in the psychological consequences of Hurricane Hugo. *Psychol Aging* 1993;**8**:606-16.
13. Boscarino JA, Galea S, Ahern J, Resnick H, Vlahov D. Utilization of mental health services following the September 11th terrorist attacks in Manhattan, New York City. *Int J Emerg Ment Health* 2002;**4**:143-55.
14. Knight BG, Gatz M, Heller K, Bengtson VL. Age and emotional response to the Northridge earthquake: a longitudinal analysis. *Psychol Aging* 2000;**15**:627-34.
15. Norris FH, Murrell SA. Prior experience as a moderator of disaster impact on anxiety symptoms in older adults. *Am J Community Psychol* 1988;**16**:665-83.
16. Ferraro FR. Psychological resilience in older adults following the 1997 flood. *Clinical Gerontologist* 2003;**26**:139-43.

17. Norris FH, Kaniasty K, Conrad ML, Inman GL, Murphy AD. Placing age differences in cultural context: A comparison of the effects of age on PTSD after disasters in the United States, Mexico, and Poland. *J Clinical Geropsychol* 2002;**8**:153-73.
18. Ohta Y, Araki K, Kawasaki N, Nakane Y, Honda S, Mine M. Psychological distress among evacuees of a volcanic eruption in Japan: A follow-up study. *Psychiatry Clin Neurosci* 2003;**57**:105-11.
19. Ticehurst S, Webster RA, Carr VJ, Lewin TJ. The psychosocial impact of an earthquake on the elderly. *Int J Geriatric Psychiatry* 1996;**11**:943-51.
20. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol* 2000;**68**:748-66.
21. Roorda J, van Stiphout WA, Huijsman-Rubingh RR. Post-disaster health effects: strategies for investigation and data collection. Experiences from the Enschede firework disaster. *J Epidemiol Community Health* 2004;**58**:982-7.
22. van der Linden MW, Westert GP, de Bakker DH, Schellevis FG. Symptoms and diseases in the population and in general practice (in Dutch). In. NIVEL,Utrecht/RIVM,Bilthoven, 2004.
23. Schellevis FG, Westert GP, de Bakker DH. The actual role of general practice in the Dutch health-care system: results of the Second Dutch National Survey of General Practice. *Journal of Public Health* 2005;**13**:265-9.
24. Lamberts H, Wood M. *International Classification of Primary Care*. Oxford, Oxford University Press, 1987:1-9.
25. Soeteman RJ, Yzermans CJ, Kerssens JJ, Dirkzwager AJ, Donker GA, van den Bosch WJ, van der Zee J. The course of post-disaster health problems of victims with pre-disaster psychological problems as presented in general practice. *Fam Pract* 2006;**23**:378-84.
26. Soeteman RJ, Yzermans CJ, Kerssens JJ, Dirkzwager AJ, Donker GA, Ten Veen PM, van den Bosch WJ, van der Zee J. Health problems presented to family practices in the Netherlands 1 year before and 1 year after a disaster. *J Am Board Fam Med* 2007;**20**:548-56.
27. Yzermans CJ, Donker GA, Kerssens JJ, Dirkzwager AJ, Soeteman RJ, Ten Veen PM. Health problems of victims before and after disaster: a longitudinal study in general practice. *Int J Epidemiol* 2005;**34**:820-6.
28. Warheit GJ, Zimmerman RS, Khoury EL, Vega WA, Gil AG. Disaster related stresses, depressive signs and symptoms, and suicidal ideation among a multi-racial/ethnic sample of adolescents: a longitudinal analysis. *J Child Psychol Psychiatry* 1996;**37**:435-44.
29. Stuber J, Resnick H, Galea S. Gender disparities in posttraumatic stress disorder after mass trauma. *Gen Med* 2006;**3**:54-67.
30. Pulcino T, Galea S, Ahern J, Resnick H, Foley M, Vlahov D. Posttraumatic stress in women after the September 11 terrorist attacks in New York City. *J Womens Health (Larchmt)* 2003;**12**:809-20.
31. Bromet EJ, Havenaar JM, Gluzman SF, Tintle NL. Psychological aftermath of the Lviv air show disaster: a prospective controlled study. *Acta Psychiatr Scand* 2005;**112**:194-200.

32. Weissman MM, Neria Y, Das A, Feder A, Blanco C, Lantigua R, Shea S, Gross R, Gameroff MJ, Pilowsky D, Olfson M. Gender differences in posttraumatic stress disorder among primary care patients after the World Trade Center attack of September 11, 2001. *Gen Med* 2005;**2**:76-87.
33. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol* 2000;**68**:748-66.
34. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol* 2000;**68**:748-66.
35. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
36. Rubonis AV, Bickman L. Psychological impairment in the wake of disaster: the disaster-psychopathology relationship. *Psychol Bull JID - 0376473* 1991;**109**:384-99.
37. Dirkzwager AJ, Grievink L, van der Velden PG, Yzermans CJ. Risk factors for psychological and physical health problems after a man-made disaster. Prospective study. *Br J Psychiatry* 2006;**189**:144-9.
38. van der Velden PG, Yzermans CJ, Kleber RJ, Gersons BP. Correlates of mental health services utilization 18 months and almost 4 years postdisaster among adults with mental health problems. *J Trauma Stress* 2007;**20**:1029-39.
39. Yzermans CJ, Dirkzwager AJE, Kerssens JJ, Cohen-Bendahan CC, ten Veen PMH. Gevolgen van de Vuurwerkramp Enschede voor de gezondheid (in Dutch). In: Utrecht, NIVEL, 2006.
40. Freedy JR, Simpson WM, Jr. Disaster-related physical and mental health: a role for the family physician. *Am Fam Physician* 2007;**75**:841-6.

### Additional file 1

Musculoskeletal and digestive symptoms in percentage of five age groups of affected residents and members of the control group visiting their FP at least once per year, one year pre-disaster (year 0) and five years post-disaster (year 1 through 5)

	Age groups									
	age 5-14		age 15-24		age 25-44		age 45-64		age 65+	
	A	C	A	C	A	C	A	C	A	C
<b>Musculoskeletal symptoms</b>										
Pre-dis year 0	7,9	7,2	23,4	17,8	26,6	21,2	30,2	28,7	31,3	25,2
Post-dis year 1	12,3	10,9	26,0	16,8	28,1	23,1	34,0	26,6	29,9	24,1
year 2	11,0	10,6	19,2	20,8	29,1	21,5	31,2	24,9	29,0	26,6
year 3	12,6	10,6	21,6	21,1	26,8	21,7	30,2	24,8	33,5	27,9
year 4	11,0	12,1	19,7	17,3	25,3	23,2	25,5	25,1	27,4	24,5
year 5	11,3	13,6	18,1	17,1	25,1	20,7	29,7	24,1	27,4	22,7
<b>Digestive symptoms</b>										
Pre-dis year 0	4,2	7,6	11,7	9,3	14,2	12,6	14,5	12,3	19,4	17,3
Post-dis year 1	7,0	5,8	13,4	7,9	17,0	11,2	16,1	14,2	19,6	17,7
year 2	6,1	9,0	12,9	7,2	14,2	10,5	16,3	12,0	18,1	19,3
year 3	7,5	7,3	10,8	9,0	15,3	11,3	15,8	13,6	21,8	21,4
year 4	8,4	7,3	12,0	10,7	15,2	13,0	17,8	14,8	24,2	21,2
year 5	7,5	9,0	12,0	14,0	12,6	10,4	16,8	15,0	19,8	19,7

A Affected residents.

C Control group.



# Chapter

# 7

## **Does disaster affect immigrant victims more than non-immigrant victims in Dutch general practice**

### **A matched cohort study**

Rik J.H. Soeteman  
C. Joris Yzermans  
Peter M.M. Spreeuwenberg  
Tina Dorn  
Jan J. Kerssens  
Wil J.H.M. van den Bosch  
Jouke van der Zee

---

Journal of Public Health 2009; 17: 27-32

## Abstract

**Background** In literature, immigrant victims appear to be more vulnerable to health effects of a disaster than indigenous victims. Most of these studies were performed without pre-disaster measurement and without using a control group.

**Aim** The objective of the study is to monitor differences between two groups of victims, Turkish immigrants and indigenous Dutch, in utilisation and morbidity as presented in general practice after a man-made disaster.

**Methods** A matched cohort study was performed with pre-disaster (one year) and post-disaster (four years) measurements of patients from 30 general practices in Enschede. Turkish victims (N=303) and Dutch victims (N=606), matched on age, gender and socio-economic status were included. Main outcome measures were psychological problems and physical symptoms as recorded by the general practitioner, using the International Classification of Primary Care (ICPC).

**Results** The Turkish victims showed higher utilisation than the Dutch victims prior to the disaster. In the first post-disaster year, both groups of victims showed an increase in utilisation, but the increases did not differ significantly. The Turkish group showed no significantly greater increase than the Dutch group in the five most prevalent clusters of health problems (psychological, respiratory, skin, musculoskeletal and digestive).

**Conclusion** The Turkish victims in general practice were as vulnerable as the Dutch victims for the effects on their health of this man-made disaster. Differences between Turkish and native Dutch victims of this man-made disaster can largely be explained by the differences that existed already before the disaster.

**Keywords:** disasters, ethnicity, morbidity, longitudinal studies, general practice

## **Introduction**

Turkish migrants first arrived in the Netherlands in the 1960s and a new generation settled in later decades in order to reunite with their compatriots. They had lived in a rural area and entered a country with a different culture and habits while they were separated from their families at home. In general, they performed unskilled jobs that were rejected by the native Dutch population.

This study monitored the impact of a major disaster on the health of this migrant group, an important minority in the city. The disaster took place on May 13, 2000 in the city of Enschede, which is located in the Eastern part of the Netherlands. A fireworks depot situated in a residential neighbourhood exploded on that day, killing 18 residents and 4 fire-fighters and injuring around 1,000 other people. Some 1,200 victims, one-third of them with Turkish backgrounds, lost their homes and had to be relocated for a long period. A total of approximately 12,000 people - residents, passers-by and rescue workers - were affected by the disaster.

The present study examined the health problems of Turkish victims on the basis of the electronic medical records (EMRs) kept by general practitioners (GPs). Turkish immigrants in the Netherlands are known to have higher utilisation rates of general practice than the native population<sup>1-3</sup> and they present more digestive, eye, musculoskeletal, respiratory and skin problems than the indigenous Dutch inhabitants<sup>4</sup>. In addition, they more often present with psychological problems<sup>4,5</sup>.

In a Dutch interview-based study, primary findings with Turkish immigrants were that need and predisposing factors as mental and physical health and socio-demographic characteristics predicted health care consumption<sup>6</sup>. Moreover, migrant specific factors were found among these Turkish immigrants. If the acculturation process (integration of ones own culture and the new one of the host country) was not successful, specific characteristics (being insecure about ones own cultural roots, no social relations with Dutch people) were associated with the presence of mental disorders.

The disaster literature shows that ethnic minority groups have been described with higher rates of post-disaster mental health problems than other groups<sup>7-14</sup>. However, these studies did not make use of pre-disaster

assessments. It has therefore been unclear, whether post-disaster health differences between immigrant and non-immigrant groups can be attributed to the disaster experience or already existed before the event.

The current population-based study offered a unique opportunity of studying the health of the Turkish disaster victims. They could be followed prior to and following the disaster due to the circumstance that general practitioner records already were operational before the disaster occurred. As a consequence, pre-disaster baseline data on health were available and pre-post comparisons could be made. The objective of this study was to examine whether Turkish victims presented stronger increases of GP utilisation and health problems following this disaster than indigenous Dutch victims.

The research questions of the present study were:

1. Do Turkish and Dutch victims present increases of contacts in general practice services in a period following the Enschede Fireworks Disaster and do they present more problems and symptoms?
2. Do Turkish victims demonstrate greater increases in contacts in general practice services and in presenting problems and symptoms than Dutch victims?

## **Methodology**

### ***General Practitioners***

In the Netherlands, every citizen is registered with one GP, who acts as a gatekeeper to secondary care. As a result, victims of this disaster and their medical histories were already known to their GPs in the period prior to the disaster and it was possible to collect data for this study relating to one year prior to the disaster. All GPs participating in the study were already using a computerized information system.

All 60 GPs in the town of Enschede were invited to participate and 44 of them agreed to do so. The sixteen GPs who did not participate gave three different reasons; six expected an increase in workload, nine had no victims in their practices, and one did not use an electronic data system.

### ***Patients***

Persons were marked as victims in their GPs' patient registers by the zip code of their home at the disaster date and when they were registered in the database of the municipal Information and Advice Center (IAC). At the IAC, people were registered as victims on the basis of the municipal identity register or when they considered themselves victims. They all received a research number (barcode), through which they could be monitored anonymously in the GPs' database. Victims' immigrant status was documented at the IAC. The victims were registered as being Turkish whenever they had been born in Turkey, or one or both parents had been born there. Victims were excluded (for both groups) if they belonged to other immigrant groups than the Turkish. Victims of all ages were included in the study, and they had to be registered with their GP's practice during the entire study period from May 13, 1999 until May 13, 2004.

People in the Netherlands with lower or middle incomes (64% of the general population) were covered by a public health insurance scheme until 2006<sup>5</sup>. The fact that the type of insurance was recorded in the GPs' patient records provided us with a crude indicator of socio-economic status (SES). We matched for the characteristics of age, gender and insurance type. A minimum of two Dutch victims was required for each Turkish victim, in order to create an appropriate availability of matches on all three covariates. Finally, 303 Turkish victims (and 606 Dutch ones as references) were included and monitored for five years.

Patients were informed about their GPs' participation in this study by posters and leaflets in the waiting room and could object to the use of their anonymized data (but nobody did). Data collection was performed in accordance with the privacy protection procedures of the Dutch Data Protection Authority<sup>15</sup>.

### ***Procedures***

Dutch general practitioners use the International Classification of Primary Care<sup>16</sup>, a multiaxial classification system that allows registering diagnoses as well as problems and symptoms.

Symptoms and diagnoses recorded during patient contacts were extracted for the purposes of this study and were grouped in clusters, viz. the psychological, respiratory, skin, musculoskeletal, and digestive clusters.

These clusters were organ-based and were known to be the most prevalent<sup>4,5</sup>.

### ***Statistical analysis***

The study period started one year before the disaster occurred and lasted for four years post-disaster. Demographic data on the two victim groups were compared using Chi-square tests. Utilisation was calculated on an annual basis as the mean number of contacts (face to face and by telephone). The model compared differences in prevalence rates of each post-disaster year compared with the pre-disaster baseline year. The prevalence rates for health problems in the six most prevalent clusters were calculated as the percentage of victims, Turkish and Dutch, visiting their GP for those health problems at least once in a one-year period.

The data were analyzed using a multilevel model for repeated measurements (level 1, measurement occasion; level 2, person; level 3, general practice). In the random part, the influence of the GPs was modelled as one overall between GP variance at the highest level. At the level below that, i.e. the person level, the error variance for each occasion was modelled together with all the co-variances between the occasions, which controls for the autocorrelation between measurement occasions within persons. In the fixed part, five measurement occasion intercepts were estimated for both groups. The three control covariates (age, gender, insurance) were also modelled as fixed effects and centered around their means.

A Poisson regression model was used for utilisation. The models for morbidity were suitable as logistic models. All analyses were performed with MLWIN2.02, using penalized quasi-likelihood (PQL) with second order and an extra dispersion parameter. Contrasts with a Wald test were used to test the hypothesis that prevalence rates and utilisation observed in Turkish victims increased by a higher rate than in Dutch victims.

## **Results**

The Turkish immigrant group and the Dutch group were equal regarding socio-demographic factors (Table 7.1).

Table 7.1: Characteristics of victims registered on their GP's list between May 1999 and May 2004

Groups of patients	Dutch N=606	Turkish N=303
% Male	51.2	51.2
Mean age in years	29.9	29.6
% Low/middle SES	91.7	91.7
% Forced relocation	24.8	27.7
% No contact	2.6	1.3

SES = Socio-Economic Status, as indicated by insurance type.

No contact = did not contact GP during study period.

Turkish victims had higher pre-disaster utilisation than Dutch victims, and both groups of victims showed significant increases during the first year post-disaster ( $p < 0.001$ , Table 7.2). The utilisation in both groups in the second, third and fourth years was higher than pre-disaster, but the increase seen in Turkish victims in the second and fourth years post-disaster was not significantly greater than the increase observed in Dutch victims. This means that the disaster had an equal impact on both groups.

Table 7.2: Utilisation rate by Dutch and Turkish victims as mean number of contacts with GPs per year, from one year pre-disaster until four years post-disaster (years 1 through 4)

Utilisation	Dutch	Turkish	P-value Turkish vs. Dutch
Pre-disaster year 0	3.5	5.6	
Post-disaster year 1	4.1***	6.8***	0.752
year 2	4.1**	6.2	0.502
year 3	4.1**	6.6**	1
year 4	4.0*	6.2	0.59

\*  $p < 0.05$ , year compared with year 0.

\*\*  $p < 0.01$ , year compared with year 0.

\*\*\*  $p < 0.001$ , year compared with year 0.

Both groups of victims displayed significant post-disaster increases of psychological problems ( $p < 0.001$ , Table 7.3) in all four years, with a peak in the first year. But, when these increases observed in Dutch victims and in Turkish victims were compared to each other no significant differences were found again. In the year prior to the disaster, Turkish victims presented fewer psychological problems than the Dutch victims.

After the disaster had occurred, the Turkish victims showed two changes in the physical symptoms that were presented to the GP. One concerned a significant decrease in respiratory symptoms in the first year post-disaster as compared with the pre-disaster year. This deviation from the pre-disaster baseline differed significantly from the increase found in Dutch victims ( $p < 0.05$ ). In addition, a significant increase in musculoskeletal symptoms was seen in Turkish victims during the first post-disaster year, although this increase was not significantly larger when compared with the increase of the Dutch victims. No significant post-disaster increases were found for symptoms of the digestive system and the skin for either of the groups. In the pre-disaster year, Turkish victims showed a higher extent of all symptoms than the Dutch.



Table 7.3: Prevalence rates (%) of psychological problems, respiratory, skin, musculoskeletal, and digestive symptoms in Dutch and Turkish victims attending their GP at least once per year, from one year pre-disaster (year 0) until four years post-disaster (years 1 through 4).

	Dutch	Turkish	p-value Turkish vs. Dutch
<b>Psychological</b>			
Pre-disaster year 0	21.0	12.4	
Post-disaster year 1	57.1***	41.7***	1
year 2	39.3***	24.7***	0.823
year 3	46.5***	25.5***	0.173
year 4	37.9***	20.0***	0.247
<b>Respiratory</b>			
Pre-disaster year 0	17.8	27.9	
Post-disaster year 1	18.2	20.7*	0.048§
year 2	19.4	26.5	0.406
year 3	16.2	24.8	0.841
year 4	16.1	23.4	0.624
<b>Skin</b>			
Pre-disaster year 0	18.5	21.8	
Post-disaster year 1	14.8	19.8	0.532
year 2	18.5	23.7	0.617
year 3	16.3	25.0	0.162
year 4	18.3	21.4	1
<b>Musculoskeletal</b>			
Pre-disaster year 0	19.8	31.2	
Post-disaster year 1	22.7	38.7*	0.442
year 2	21.9	30.5	0.439
year 3	19.8	33.2	0.663
year 4	18.1	26.8	0.617
<b>Digestive</b>			
Pre-disaster year 0	12.1	23.2	
Post-disaster year 1	11.8	29.5	0.119
year 2	11.8	25.1	0.584
year 3	11.1	26.6	0.267
year 4	13.8	25.4	0.888

\* p<0.05, year compared with year 0.

\*\* p<0.01, year compared with year 0.

\*\*\* p<0.001, year compared with year 0.

§ p<0.05, Turkish compared with Dutch.

## Discussion

The aim of our study was to explore whether victims of Turkish background had more GP contacts and presented significantly more health problems in the aftermath of a man-made disaster than native Dutch victims. We considered the number of contacts in general practice, psychological problems, and physical symptoms as outcome measurements; all related to their pre-disaster baseline levels. The post-disaster increases on utilisation of general practice services and on psychological problems and physical symptoms were comparable in Turkish and in Dutch victims, whereas the Turkish had higher levels than the Dutch prior to and following the disaster. The finding of an equivalent association between experiencing the disaster and health problems between immigrants and indigenous contradicts the conclusions of many studies<sup>8,10,11,13,14,17</sup>, which demonstrated that ethnic minority groups were more at risk of psychological problems. The question, however, is how to explain this finding? A major methodological difference between these studies and the present one is that they did not use a pre-disaster measurement. In our study, we had baseline pre-disaster data to our disposal in a prospective design. If we had commenced our analysis after the disaster, we would quickly have assumed that the disaster had a greater effect on the Turkish victims than on the Dutch victims, an erroneous conclusion easily drawn from cross-sectional results.

In this study, we demonstrated stronger increases of GP utilisation and psychological problems for both victim groups than in another, shorter-term study on the same disaster<sup>18</sup>, which may be explained by the fact that the mean age of the victims in our study was 10 years younger. Younger disaster victims are generally more vulnerable than elderly victims, as stated by Norris in her review<sup>7</sup>. An explanation for this finding may be 'the inoculation theory': when people get older they become more experienced and have better skills to cope with unexpected life events<sup>19-22</sup>. On the other hand, in a third study on the Fireworks Disaster population, which was controlled for pre-disaster utilisation, no differences due to (younger) age were found for all victims<sup>23</sup>. The lack of control groups of unaffected Dutch and Turkish patients in the current study should be noted in this context too. This was due to the immigrant status being just a variable with the IAC data and not present in the EMR of the GPs, so that we were unable to relate

utilisation and morbidity to the natural development of “normal” immigrants in general practice acting as controls. Moreover, it should be mentioned that the number of contacts in general practice in the Netherlands had increased throughout the study period<sup>24</sup>, matching the increase seen in the Dutch and Turkish victims studied here. Therefore, the supposed long-lasting increased prevalence rates in our study run parallel with this increase in Dutch general practice. In this context, we have to be thoughtful about the time span of disaster-related health effects of our study.

The significant decrease in respiratory symptoms in Turkish victims in the first post-disaster year may be related with the finding that the Turkish already had a high pre-disaster level of these symptoms, higher than the Dutch victims. However, respiratory symptoms were not found among the health effects of large-scale earthquakes on Turkish victims<sup>25-29</sup>. Only one disaster study on Turkish victims found “trouble in getting breath” as a somatisation symptom<sup>30</sup>, and we may not conclude, therefore, that the decrease in respiratory symptoms was culturally influenced, since so little is known about this as a disaster-related finding. The significant decrease in the Turkish victims is a remarkable finding, nevertheless.

The higher level of utilisation and extent of physical symptoms in the Turkish victims in the year prior to the disaster was a confirmation of the results of other studies (see Introduction). Some studies suggest an underlying “ethnic factor”<sup>4</sup> as an explanation (genetic factors, specific living and working conditions, the way of presenting problems and doctor-patient communication). Others assume a “condition migrante”<sup>31,32</sup> meaning the conflicts of living between two (religious) cultures, social isolation and being uprooted, the perception of illness, low socio-economic status and discrimination. These factors are summarized in the concept of “acculturation”: a dynamic competition between two cultures. Studies often point at socio-economic differences between the immigrant group and the indigenous population<sup>2</sup>. Finally, in our study, the extent of pre-disaster psychological problems of the Turkish victims was lower when compared to the Dutch victims, which is in contradiction to other studies<sup>4,5,33</sup>. We assume that this phenomenon (fewer psychological problems and more physical symptoms) may be interpreted as somatization<sup>6,32</sup>: psychological distress expressed by physical symptoms.

## Conclusions

Although pre-disaster differences exist between victims belonging to the Turkish minority in the Netherlands and ethnic Dutch victims, Turkish disaster victims appear to react as strong as Dutch victims do to a man-made disaster. This idea is supported by one of the participating GPs who, informally, stated the following: “My Turkish patients were already in a bad condition in the period prior to the disaster. They needed more help than the Dutch before the disaster and after it as well.” It is obvious that disasters tend to occur more frequently in socially deprived areas<sup>34,35</sup>. Adverse health outcomes in the aftermath of disasters probably originate in the deprivation pre-disaster.

The results of our study plead for an extra effort in assistance if members belonging to any ethnic minority group present more health problems than native citizens. This will concern the provision of supplemental psychological and social help, including the employment of GPs and supporting personnel. This should have been implemented not only after a disaster<sup>36</sup> but irrespective of any disaster. In our opinion, this will apply for Turkish immigrants in north-western Europe, but not for other groups such as Moroccan immigrants, who present with other utilisation patterns and other symptoms and problems<sup>36</sup>. The findings of this study demonstrate that general practice can play an important role in detecting health problems presented by both native inhabitants and immigrants prior to and following a disaster. The possibility of retrieving pre-disaster data is a crucial issue in assessing the assumed vulnerability to present health problems of immigrant groups in the aftermath of a disaster.

## References

1. Deville WLJM, Uiters E, Westert GP, Groenewegen PP. Perceived health and consultation of GPs among ethnic minorities compared to the general population in the Netherlands. In: *Morbidity, performance and quality in primary care. Dutch general practice on stage*. Oxford, Radcliffe, 2006:85-96.
2. Stronks K, Ravelli AC, Reijneveld SA. Immigrants in the Netherlands: equal access for equal needs? *J Epidemiol Community Health* 2001;**55**:701-7.
3. Uiters E, Deville WL, Foets M, Groenewegen PP. Use of health care services by ethnic minorities in The Netherlands: do patterns differ? *Eur J Public Health* 2006;**16**:388-93.
4. Weide MG, Foets M. Migrants in family practice: their symptoms and diagnoses differ from the Dutch (in Dutch). *Ned Tijdschr Geneesk* 1998;**142**:2105-9.
5. van der Linden MW, Westert GP, de Bakker DH, Schellevis FG. Symptoms and diseases in the population and in general practice (in Dutch). 2004. NIVEL, Utrecht/RIVM, Bilthoven.
6. Kamperman AM, Komproe IH, de Jong JT. Migrant mental health: a model for indicators of mental health and health care consumption. *Health Psychol* 2007;**26**:96-104.
7. 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.
8. Bolin R, Klenow DJ. Older people in disaster: a comparison of black and white victims. *Int J Aging Hum Dev* 1988;**26**:29-43.
9. Fothergill A, Maestas EG, Darlington JD. Race, ethnicity and disasters in the United States: a review of the literature. *Disasters* 1999;**23**:156-73.
10. Galea S, Vlahov D, Tracy M, Hoover DR, Resnick H, Kilpatrick D. Hispanic ethnicity and post-traumatic stress disorder after a disaster: evidence from a general population survey after September 11, 2001. *Ann Epidemiol* 2004;**14**:520-31.
11. Garrison CZ, Bryant ES, Addy CL, Spurrier PG, et al. Posttraumatic stress disorder in adolescents after Hurricane Andrew. *J Am Acad Child Adolesc Psychiatry* 1995;**34**:1193-201.
12. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consult Clin Psychol* 1998;**66**:883-92.
13. Lonigan CJ, Shannon MP, Finch AJ, Daugherty TK. Children's reactions to a natural disaster: Symptom severity and degree of exposure. *Adv Behav Res Ther* 1991;**13**:135-54.
14. Perilla JL, Norris FH, Lavizzo EA. Ethnicity, culture, and disaster response: Identifying and explaining ethnic differences in PTSD six months after Hurricane Andrew. *J Soc Clin Psychol* 2002;**21**:20-45.
15. Roorda J, van Stiphout WA, Huijsman-Rubingh RR. Post-disaster health effects: strategies for investigation and data collection. Experiences from the Enschede firework disaster. *J Epidemiol Community Health* 2004;**58**:982-7.
16. Lamberts H, Wood M. *International Classification of Primary Care*. Oxford, Oxford University Press, 1987:1-9.

17. Drogendijk AN, van der Velden PG, Kleber RJ, Christiaanse BBA, Dorrestein SM, Grievink L, Gersons BPR, Olff M, Meewisse ML. Turkish victims of the Enschede firework disaster: A comparative study (in Dutch). *Gedrag en Gezondheid* 2003;**31**:145-62.
18. Soeteman RJ, Yzermans CJ, Kerssens JJ, Dirkzwager AJ, Donker GA, van den Bosch WJ, van der Zee J. The course of post-disaster health problems of victims with pre-disaster psychological problems as presented in general practice. *Fam Pract* 2006;**23**:378-84.
19. Ferraro FR. Psychological resilience in older adults following the 1997 flood. *Clinical Gerontologist* 2003;**26**:139-43.
20. Knight BG, Gatz M, Heller K, Bengtson VL. Age and emotional response to the Northridge earthquake: a longitudinal analysis. *Psychol Aging* 2000;**15**:627-34.
21. Norris FH, Murrell SA. Prior experience as a moderator of disaster impact on anxiety symptoms in older adults. *Am J Community Psychol* 1988;**16**:665-83.
22. Thompson MP, Norris FH, Hanacek B. Age differences in the psychological consequences of Hurricane Hugo. *Psychol Aging* 1993;**8**:606-16.
23. Soeteman RJH, Yzermans CJ, Spreeuwenberg P, Lagro-Janssen TALM, van den Bosch WJHM, van der Zee J. Changes in the pattern of service utilisation and health problems of women, men and various age groups following a destructive disaster: a matched cohort study with a pre-disaster assessment. <http://www.biomedcentral.com/1471-2296/9/48>
24. Verheij RA, te Brake H, Abrahamse HA, van den Hoogen H, Braspenning J, van Althuis T. Netherlands Information Network of General Practice. Facts and figures about general practitioner care in the Netherlands. <http://www.LINH.nl> . 2006. Utrecht/Nijmegen: NIVEL/WOK, 2006. Visited 2007/03/08.
25. Basoglu M, Salcioglu E, Livanou M. Traumatic stress responses in earthquake survivors in Turkey. *J Trauma Stress* 2002;**15**:269-76.
26. Basoglu M, Kilic C, Salcioglu E, Livanou M. Prevalence of Posttraumatic Stress Disorder and Comorbid Depression in Earthquake Survivors in Turkey: An Epidemiological Study. *J Trauma Stress* 2004;**17**:133-41.
27. Kilic C, Ulusoy M. Psychological effects of the November 1999 earthquake in Turkey: an epidemiological study. *Acta Psychiatr Scand* 2003;**108**:232-8.
28. Livanou M, Basoglu M, Salcioglu E, Kalendar D. Traumatic stress responses in treatment-seeking earthquake survivors in Turkey. *J Nerv Ment Dis* 2002;**190**:816-23.
29. Tural U, Coskun B, Onder E, Corapcioglu A, Yildiz M, Kesepara C, Karakaya I, Aydin M, Erol A, Torun F, Aybar G. Psychological consequences of the 1999 earthquake in Turkey. *J Trauma Stress* 2004;**17**:451-9.
30. Karanci AN, Rustemli A. Psychological consequences of the 1992 Erzincan (Turkey) earthquake. *Disasters* 1995;**19**:8-18.
31. Berry JW. Acculturation and psychological adaptation: An overview. In: *Journeys into Cross-Cultural Psychology*. Amsterdam, Swets & Zeitlinger, 1994:129-41.
32. Knipscheer JW. Cultural convergence and divergence in mental health care. Empirical studies on mental distress and help-seeking behaviour of Surinamese, Ghanaian, Turkish and Moroccan migrants in the Netherlands. 131-52. 2000. Veenendaal, Universal Press.

33. Dirkzwager AJ, Yzermans CJ, Kessels FJ. Psychological, musculoskeletal, and respiratory problems and sickness absence before and after involvement in a disaster: a longitudinal study among rescue workers. *Occup Environ Med* 2004;**61**:870-2.
34. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
35. Rubonis AV, Bickman L. Psychological impairment in the wake of disaster: the disaster-psychopathology relationship. *Psychol Bull JID - 0376473* 1991;**109**:384-99.
36. den Ouden DJ, Dirkzwager AJ, Yzermans CJ. Health problems presented in general practice by survivors before and after a fireworks disaster: associations with mental health care. *Scand J Prim Health Care* 2005;**23**:137-41.

# 7

*Health problems of Enschede residents in the aftermath of the Fireworks Disaster*



# Chapter

# 8

## **Discussion and conclusions**

Jacob Hendrik Soeteman



## Discussion and conclusions

This thesis dealt with health consequences in the aftermath of the Enschede Fireworks Disaster. The aim of the study was to assess post-disaster health problems in affected general practice patients and to distinguish specific risk groups in order to offer the general practitioner (GP) tools in dealing with health problems presented by victims of the disaster.

Almost all previous studies in the field of disaster research provided data of one or several cross-sectional measurements, without a pre-disaster assessment and/or without a reference or control population. The data of these studies were obtained post-disaster by standardised interviews or by self-reported questionnaires.

When pre-disaster data were available, by coincidence, this was in the case of an ongoing study. Most of these studies with pre-disaster data investigated samples of specific groups such as rescue workers<sup>1,2</sup>, children<sup>3-5</sup>, adolescents<sup>6,7</sup>, adults<sup>8,9</sup>, the elderly<sup>10</sup> or combinations of other age groups<sup>11-15</sup>. No studies were published with a pre-disaster design focussing on a population as a whole (the community). Finally, of all studies using a pre-disaster measurement only a few were able to use a longitudinal design<sup>1,15</sup>.

At Enschede, after the Fireworks Disaster, a unique design was effected, in which data could be extracted from the electronic medical records (EMR) of patients in general practice. In the Netherlands every citizen is obliged on the list of just one GP, who acts as a gatekeeper to secondary care. This offered a special opportunity of collecting health problems, not only after the disaster had happened, but also from before the disaster. After all, data on utilisation and morbidity in the years prior to the disaster had been routinely registered by the Enschede general practitioners at every patient's contact. Therefore, psychological problems and physical symptoms could be measured using the International Classification of Primary Care (ICPC) longitudinally.

Data were available of, almost, the total population of victims because 89% of them were included in the first year post-disaster. It was expected that victims would present more and other health problems after the disaster than before and that their utilisation of general practice services would increase also. Next to this, based on the international literature, relocation due to the disaster, a history of psychological problems, female gender,

immigrant background and age were examined as possible risk factors for increased post-disaster health problems and service utilisation. Victims of a disaster with any of these characteristics run a disaster-related risk of presenting post-disaster health problems<sup>16</sup>. In our study with pre-disaster data, we examined if these risk factors were recognizable and related to the disaster. If not, mental health professionals and GPs would not have to focus on health problems of these groups after future disasters.

More specifically, the present study consisted of a longitudinal surveillance of a cohort of general practice patients, containing victims as well as persons unaffected by the disaster, for a period of one year pre-disaster to one to five years post-disaster, depending on the specific study and its research question.

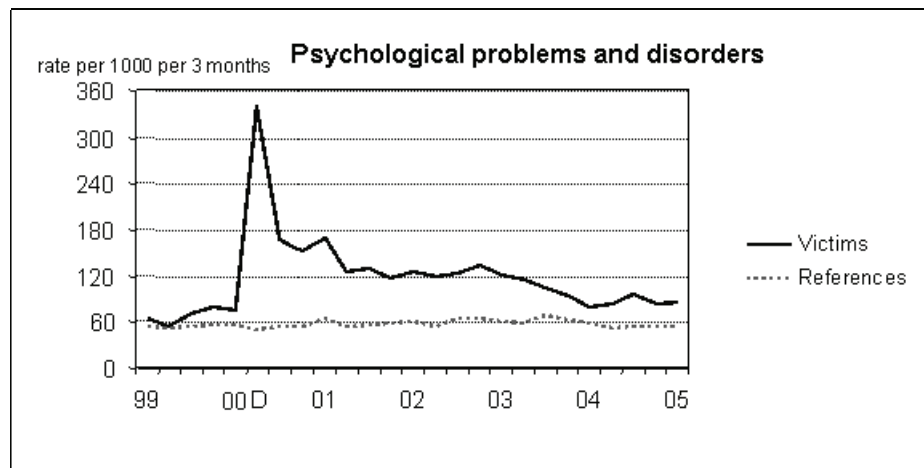
In this chapter, the morbidity presented to the GP, the utilisation of general practice services and the assignment of possible risk groups will be summarised related to the research questions. Methodological considerations and general conclusions are discussed and finally, recommendations are formulated.

## **Main findings**

### **Question 1**

What are the effects of the Enschede Fireworks Disaster on morbidity presented in general practice and on the utilisation of general practice services in a pre- and post-disaster study comparing victims and references?

Figure 8.1: The course of psychological problems for victims (upper line) and references (lower line) in a period from one year before to five years post-disaster, expressed in prevalence rates per 1000 persons per three months



D = disaster date.

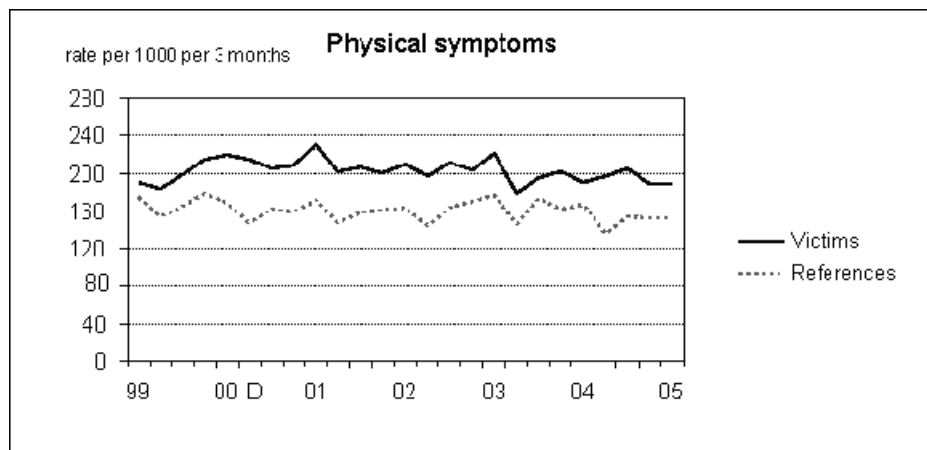
From: Yzermans CJ, et al. Gevolgen van de vuurwerkramp in Enschede voor de gezondheid. Utrecht: NIVEL, 2006 [in Dutch].

Apart from acute health problems directly related to the disaster (fractures, burns), a strong and significant amount of psychological problems was found in the first year post-disaster for all victims, compared to pre-disaster figures and to reference groups which were matched for gender, age and level of socio-economic status (Figure 8.1)\*.

\* For the readers' benefit data from chapter 5 have been extended to a five years study period.

Only small effects were found in the first year post-disaster concerning physical symptoms (Figure 8.2)\* or diseases. Victims presented statistically significant elevated levels of musculoskeletal and digestive symptoms or diseases after the disaster.

Figure 8.2: The course of physical symptoms for victims (upper line) and references (lower line) in a period from one year before to five years post-disaster, expressed in prevalence rates per 1000 persons per three months



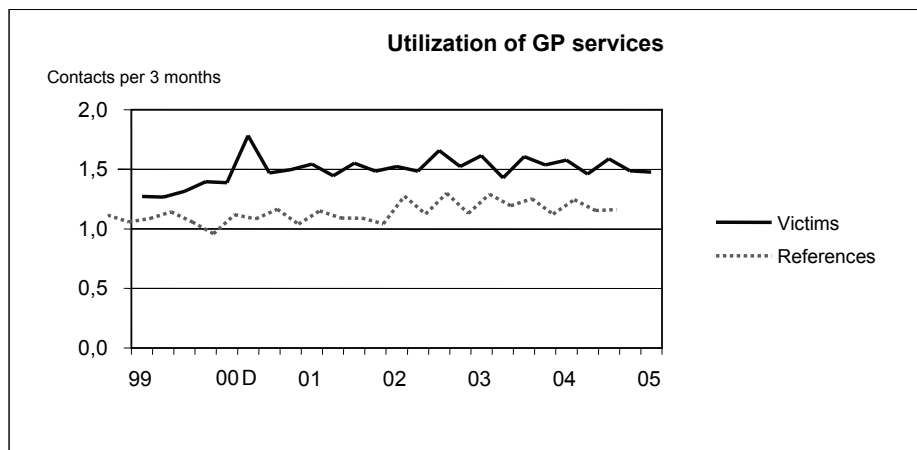
D = disaster date.

From: Yzermans CJ, et al. Gevolgen van de vuurwerkramp in Enschede voor de gezondheid. Utrecht: NIVEL, 2006 [in Dutch].

\* For the readers' benefit data from chapter 5 have been extended to a five years study period.

In utilisation of general practice services, victims showed an instant post-disaster increase (Figure 8.3)\*, with the exception of victims with pre-disaster psychological problems who showed no immediate post-disaster increase.

Figure 8.3: The utilisation of general practice services for victims and references in a period from one year before to five years post-disaster, expressed in number of GP contacts per 1000 persons per three months



D = disaster date.

From: Yzermans CJ, et al. Gevolgen van de vuurwerkramp in Enschede voor de gezondheid. Utrecht: NIVEL, 2006 [in Dutch].

## Question 2

How long do disaster-related effects persist on morbidity presented in general practice and on the utilisation of general practice services in the course of time?

\* For the readers' benefit data from chapter 5 have been extended to a five years study period.

After the peak of psychological problems in the first year post-disaster, a strong decrease was found in the second year however, the amount of problems still remained higher when compared to the baseline level prior to the disaster. This phenomenon was observed up till five years post-disaster (Figure 8.1). Regarding physical symptoms, victims showed slightly raised levels of especially musculoskeletal and digestive symptoms or diseases. These levels did not change in a period of two-and-a-half years, nor within five years (Figure 8.2).

All victims demonstrated an increased utilisation of general practice services in the first two years post-disaster, except for children and the elderly.

### **Question 3**

Which risk groups can be distinguished in presenting morbidity?

Three types of victims were found to be at risk for presenting disaster-related psychological problems:

- Victims with a history of psychological problems in the year previous to the disaster demonstrated the strongest risk of presenting psychological problems in the aftermath of the Fireworks Disaster.
- Victims who were forced to relocate due to the loss of their dwelling and all personal belongings. Relocation not only meant that a victim lost his home and neighbourhood but these victims often had suffered from the highest exposure rates.
- Relocated victims with a history of psychological problems demonstrated the highest risk of all victims. They already belonged to a vulnerable part of the population at the specific moment of losing their homes and properties due to the devastating impact of the disaster.

Person-related risk factors such as female gender, age, immigrant status and socio-economic status appeared to show no higher risk in presenting psychological problems than non-exposed references with the same characteristics. The only explanation for this result is that these risk factors just appear in the open population as well, irrespective of the disaster. In other words: these patient characteristics are a risk factor in every population. Because of the robust design of our study it was possible to conclude that no extra, disaster-related burden was seen by the GP for those



groups of patients.

The presentation to the GPs of physical symptoms following the disaster was moderately influenced by two factors:

- a. a history of pre-disaster psychological problems, which had the strongest effect on presenting symptoms or diseases post-disaster,
- b. being a victim.

This meant that a history of psychological problems had more effect on presenting physical symptoms or diseases post-disaster than experiencing the disaster.

## Comparison with other (disaster-)studies

### *Health problems*

As stated before, the possibility of studying health problems in general practice following this disaster offered us a unique opportunity: we were able to merge a longitudinal study and to combine the data with a pre-disaster baseline assessment. Moreover, in all studies except one (chapter 6, about immigrant status) we could use reference or control groups.

The major health effects of the Fireworks Disaster were found in the victims' presentation of psychological problems and in utilisation of general practice services, especially in the first year post-disaster and subsequently followed by a decrease. This is in line with other longitudinal disaster studies which repeatedly reported increased health problems during the first year after an event<sup>17-23</sup>, followed by a decline in the following years. In her review, Norris found that 79% of all longitudinal studies showed a decline after the first year measurement<sup>16</sup>. Thus, we conclude that the course of psychological problems we found, with a major effect in the first year following the disaster and a subsequent decrease corresponds with general findings in literature. Of course there were several exceptions on this rule, especially after disasters where noxious goods were released or persons thought they were (Chernobyl, Bijlmermeer plane crash, 9-11 Terrorist attacks) and/or when authorities fail to reassure the population (Three Miles Island, Bijlmermeer plane crash).

### ***Risk factors***

Three major risk groups were found on presenting psychological problems: those victims who had to relocate due to the effects of the disaster, victims presenting psychological problems to the GP in the year previous to the disaster and victims with both risk factors.

#### *Relocation*

In previous studies, although only in the aftermath of natural disasters, relocation due to a disaster was found to be a risk factor as well for the presentation of psychological problems in affected adults, female and the elderly, meaning that relocation had an overwhelming impact on various groups of victims<sup>24-26</sup>. In the present study, it was by far the strongest risk factor, for more health problems and a higher utilisation of general practice services in the first year post-disaster.

#### *History of psychological problems*

There is overwhelming evidence that victims with a history of pre-disaster psychological problems show higher levels of post-disaster psychological problems and a higher utilisation of general practice services<sup>3,4,9,11,27-29</sup>. Our findings affirm these results for the morbidity presented, while our study design was more robust than the designs used in most of the other studies. Most studies depend on self-report or cross-sectional questionnaires/interviews. Our results do not affirm the evidence of a higher utilisation in this group.

We did not find studies in which both relocation and disturbed pre-disaster psychological functioning were measured as risk factors. Therefore we can not compare with other results, whether our finding that relocation was the strongest predictor, stronger than a history of pre-disaster psychological problems was also confirmed elsewhere.

#### *Gender, age & ethnicity*

In the present study, all victims, including presumed risk groups (females, victims of various age groups, and immigrants) showed an increase of psychological problems in the first months after the disaster. However, the impact of the disaster was comparable for males and females, younger victims and the elderly and immigrants and autochthons. This is in contrast

with previous other studies on gender, age and immigrant status that all showed these were disaster-related risk factors. This discrepancy can be explained by substantial methodological differences between our study and previous studies<sup>16,30</sup>. In our study, pre-disaster health problems at baseline were known because the GP's already registered each patient contact before the disaster occurred. Already existing pre-disaster differences between assumed risk-groups and reference-groups appeared to exist again after the disaster, following parallel lines. Therefore, female victims, (middle) aged and immigrants were no risk groups for more symptoms and/or utilisation post-disaster, because we were able to include pre-disaster data.

### *Physical symptoms*

The amount of physical symptoms post-disaster was more influenced by a pre-disaster history of psychological problems than by the disaster itself. This finding is in contradiction with studies which found being exposed to a disaster was the principal factor in causing post-disaster physical symptoms<sup>9,13,31-36</sup>. We have no sufficient explanation for this discrepancy, especially because some of these studies also used pre-disaster data<sup>13,32,37</sup>. On the other hand, in general, a strong relation has been proven between (sub threshold) psychiatric disorders or psychological distress and the development of physical symptoms<sup>38,39</sup>.

Most disaster studies that showed a relationship between disaster exposure and physical symptoms did not control for psychological problems such as depression, anxiety and PTSD. Several studies have shown that the effect of disaster exposure diminishes or even disappears when controlled for psychological problems. To date, depression and anxiety have seldom been studied as risk factors for post-disaster physical symptoms. Despite this, a strong association between depressive and anxious feelings and physical symptoms was found among victims of the Fireworks Disaster. Two percent of victims with 0 or 1 physical symptom had a high score for depression while 89 percent of victims with fifteen or more symptoms had a high score for depression. Although this association was also found in the reference group, the association was stronger among victims<sup>40</sup>.

With respect to the relationship between psychological and physical health, causality can go both ways; i.e. depression can result in a physical disease, and having a medical (chronic) disease can result in depression.

Recently it was concluded that intrusion and avoidance (so called posttraumatic symptoms), depression, anxiety and sleeping problems were important perpetuating factors for physical symptoms among victims of the Fireworks Disaster and these factors mediated the association between traumatic stress and physical symptoms<sup>41</sup>.

### ***Utilisation of health services***

In our study an extended increase of post-disaster utilisation of general practice services was found. Most studies hitherto focussed on utilisation of specific health services. Increases in utilisation of mental health services were self-reported by the victims as found in studies using a variety of methodologies such as telephone surveys<sup>42</sup>, questionnaires<sup>43</sup> or standardised interviews<sup>44</sup>.

Only one study that could use the same study design as we did specifically examined utilisation of general practice services. Victims of the catastrophic Volendam discotheque fire (those with as well as without burns), in the first year after the fire had a higher utilisation of GP services than their unaffected peers<sup>45</sup>. In our study, increased utilisation of general practice services was found in all victims, with the exception of victims with a history of pre-disaster psychological problems, who had already more contacts with the GP in the pre-disaster period. In another study on the same Fireworks Disaster it was concluded that frequent *and* infrequent attenders to general practice showed the same type of post-disaster psychological problems. They only differed in the frequency of contacting the GP<sup>46</sup>.

### ***Other studies on the Fireworks Disaster***

Several studies, not being the subject of this thesis, were executed on the Enschede Fireworks Disaster. In a study on the course of health problems two-and-a-half years post-disaster identical results were found: relocated victims and victims with pre-disaster psychological problems showed the highest risk of presenting post-disaster psychological problems. Moreover, relocated victims showed an excess of medically unexplained physical symptoms (MUPS) especially in a period of increased media attention about the sentence of the two managers of the fireworks depot<sup>47</sup>.

In another study on adult victims, data of pre-existing psychological problems in general practice and post-disaster psychological and physical

problems presented to the general practitioner were analysed. Again, pre-disaster psychological problems were associated with psychological and physical problems presented to the general practitioner and with self reported health problems<sup>48</sup>.

Finally, in a study on children and adolescents, forced relocation and pre-disaster psychological problems turned out to be risk factors for psychological and physical problems following the Fireworks Disaster <sup>49</sup>. In general, these studies showed, similar to our studies, strong disaster-related effects on psychological morbidity and smaller effects on the (extra) presentation of physical symptoms.

## Methodological considerations

In this paragraph, some methodological considerations will be discussed and the strength and limitations of our studies will be described.

### *GP's judgement*

The GP's judgement to classify the patient's symptoms and problems was potentially influenced by knowing the patient was a victim and therefore may have caused a GP's bias. Thus, problems may have been attributed to the disaster by the GP. This phenomenon cannot be ruled out when overlooking the huge post-disaster increase of psychological problems. However, we assume that this effect will weaken in the course of time, although there is not much evidence on the subject. On the other hand, no increase of physical symptoms was found after the disaster, however the GPs followed two refresh courses on (medically unexplained) physical symptoms as a potential side effect of psychological distress due to a disaster.

Patient related social problems in general practice appear to influence medical decision making, e.g. extra time for consultation, advice, prescription of psychotropic drugs, (defensive) referral in 17% of all consultations in a large multipractice survey<sup>50</sup>.

Another issue is that registration of the patients' problems may imply a reduction of reality: it is obvious that not all health problems are profoundly registered by the GP. Ultimately, a 10 minute consultation is a confined possibility of discussing all patients' problems. However, within these 10 minutes the GP will register the most prominent and current problem(s) of the victim.

#### *Pre-disaster differences*

Differences between victims and controls already existed before the disaster occurred: victims presented more psychological and physical problems than references in spite of the matching of references on socio-economic status, gender, age and general practice. In this respect, the procedure to distinguish on insurance type as a proxy for socio-economic status possibly was not a precise enough choice. Therefore, the pre-disaster differences we found may be explained by still existing differences in SES. Moreover, disasters tend to happen in socially deprived areas with residents presenting more health problems than residents in socially well developed areas<sup>51</sup>. On the other hand, by matching on the level of (general) practices we did our utmost to diminish (pre-disaster) differences between groups.

We do not judge our results are excessively influenced by these problems. On the one hand all post-disaster results were compared to pre-disaster baseline data (for victims as well as for references) and on the other hand we were able to use pre-disaster data and most other researchers were not.

#### *Victims and their references*

Two considerations played a role in the choice of references being residents of the same practice and town as the victims. Firstly, the phenomenon of inter-doctor variation could be avoided because victims and unexposed references were patients in the same (matched) practices. Secondly, possible regional differences in social and cultural characteristics of exposed victims with controls from another region, with other characteristics, were prevented. On the other hand, an effect of the disaster on unexposed references was still possible. To give an example, research on the World Trade Centre attacks showed that exposure or loss due to the attacks was not the only predictor of psychological effects: '9-11', being a national trauma, had an impact on U.S. inhabitants all over the country<sup>52,53</sup>.

One remark has to be made on the study with victims of Turkish origin. In this study, no references were available because ethnicity is not a variable of the patients Electronic Medical Records. In this respect, an increase of 10.7% utilisation of general practice services in Turkish and 16.2% in Dutch victims in the period 1999 - 2004 seemed rather substantial. However, utilisation in LINH, (the Dutch national general practice sentinel network) representing the trend of a representative cohort of general practice patients in the Netherlands, demonstrated a five years increase in utilisation of general practice services of 11.4%, indicating a similar trend<sup>54</sup>.

### ***Strengths***

The strongest points of our study were the availability of a pre-disaster measurement and a very long (at least in disaster research) study period of six years. Moreover, control- or reference groups could be used because data on these groups too were available in the GPs' EMR. This enabled us to assess pre-disaster morbidity and utilisation of general practice services of victims and references. And thus, normal pre-existing differences between groups within the population were included in our post-disaster findings. In this respect, we assume that the fact that the generally accepted risk groups of gender, age and immigrant-status were not proven to be a risk group when pre-disaster baseline data were used.

The longitudinal monitoring design offered the chance to follow victims in every day general practice. Thus, the long term impact of the study could be assessed. Moreover, a large number of victims (89%) could be included in the studies. It was possible to relate the presented morbidity (=numerator) to the practice population (=epidemiological denominator) which is known from the GPs' database.

Moreover, the results were not influenced by recall-bias and the studies were no burden for the victims as is the case when questionnaires are used in surveys, especially in the first months post-disaster when victims are trying to regain control over their lives again. Finally, it was possible, as a side-effect, to inform the GPs regularly during the course of the study about (patterns of) symptoms and developments in risk groups, so post-disaster health care could be (re-)directed. Every three months, the researchers informed the GPs, on the population level.

## Conclusions

A post-disaster increase of general practice utilisation and morbidity was found in almost all investigated groups of victims. Most prominent differences were found in utilisation of general practice services and in psychological morbidity. Among the victims attended by the Fireworks Disaster, three specific risk groups were identified:

1. Victims who had to relocate due to damage and loss of dwellings by the disaster being the strongest separate risk factor, at least in the first years post-disaster.
2. Victims who presented psychological problems pre-disaster.
3. Victims with both these risk factors combined presenting the highest risk of all victims.

Immigrant status (Turkish ethnicity), female gender, (middle) age and socio-economic status did not appear to be risk factors for extra post-disaster morbidity and utilisation. In this respect, the enclosure of a pre-disaster measurement played a crucial role.

## Recommendations

### *Future research*

Longitudinal surveillance of large scale general practice populations including pre-disaster health problems turned out to be a promising method in disaster research. Using this design, researchers, policymakers and (primary- and mental health-) caregivers are enabled to trace possible risk groups among large groups of victims, to follow their presentation of health problems in the course of time and to evaluate the successfulness of interventions after future disasters. In future studies, we need to develop interventions regarding victims who were forced to relocate and/or victims who presented with pre-disaster psychological problems, which can easily be traced in the electronic medical records. Evaluative studies need to be executed about the success of interventions and about the role research plays in the recovery process of victims in the years following a disaster. The latter point is of interest since it appeared in a study 8 years after the Bijlmermeer plane crash that participation in an epidemiological study could result in an



increased awareness of somatic sensations, enhancement of health worries and lowered reassurability by physicians<sup>55</sup>.

Our results confirm that victims have to be followed before and after future disasters in order to study patterns of utilisation and morbidity. The use of existing registries is crucial here because using them is no extra burden for the victims. In addition, we have to focus more specifically on other psychological disorders than Posttraumatic Stress Disorder alone, e.g. depression and anxiety and on physical symptoms (in the co-morbidity of psychological problems or not).

Immigrant status has to be introduced in the EMR as a standard demographic characteristic. Moreover, other measures will have to be developed for assessing socio-economic status because after 1-1-2006 it is no longer possible in the Netherlands to use insurance type as a proxy. The introduction of the civil service number in general practice may play an important role, of course with respect to full privacy issues.

Another problem in using existing registries alone is the lack of data about (the degree of) exposure as experienced by the victims. These data are not available in the EMRs or patient records. That is why we propose to organize surveys, accompanying surveillance in general practice: one survey within weeks after a disaster, especially when the disaster had a toxicological origin (or when thought to be noxious by the victims) to record the exposition of every victim. A second survey may be implemented after 6-9 months about self-reported symptoms and problems and about demographic characteristics. In the meantime (first 6 months) it is not necessary to bother the victims, while they are trying to regain control over their lives.

### ***Policy***

It will be clear, that future research has to focus on large scale surveillance because of the wide-spread effect of disasters. Research will have to aim on detecting health problems of all victims in general and specifically on the tracing of risk groups. Additionally, supposed risk groups can be monitored for several years.

Extra financial and administrative support should be provided to mental health care and primary care. In general practice, this support has to aim on

a wide range of facilities, i.e. extra personnel, administrative employees and refreshment courses.

However, not being the subject of this thesis, hospitals (especially Accident and Emergency departments), community doctors, mental health workers, and pharmacists will have to be supported too. They will be overloaded in times of severe post-disaster pressure. Moreover, extra support facilitates participation of healthcare workers in research after disasters.

### *General practice*

In any disaster the general practitioner will be confronted with an acute phase and an aftermath phase. He or she has to participate in the distress of both phases. In this respect, the general practitioner has no free choice when a disaster occurs. The environment is struck and many affected patients will ask for help. On the other hand, the role of the general practitioner after any disaster will offer him/her a unique opportunity to prove his position of most nearby and trusted medically skilled caregiver in the community.

We believe that general practice is rather well suited for this task, especially in health care systems where every citizen is on the list of just one GP (the GP knows 'his' patient for a long time). Of course, the acute phase is hard to cope with because GPs are hardly prepared or trained for such an occasion and will often be victimised themselves. On the other hand, simple training of GPs' skills can reduce their feelings of insecurity<sup>56,57</sup>.

Instantly after any disaster in general practice three lists of the victims have to be constructed in the EMR:

1. The victims and their household members.
2. Relocated victims (or another specific disaster-related burden).
3. Victims with a history of psychological problems.

These lists will serve as a reminder in general practice in order to keep the general practitioner and the employees alert when these victims visit the practice. However, a risk of stigmatisation using such a policy is hard to avoid. We do not promote outreaching activities in general practice as previous findings were inconclusive<sup>58,59</sup>.

In the aftermath phase, the GP is well suited to address the physical and mental health needs of victims and to refer them towards mental health services if necessary. The GP is the expert for medical problems and is well known to the patient. Especially in the first months post-disaster GPs can be

key agents in lessening post-disaster physical and mental health reactions. Key points include providing information, remaining empathic, encouraging victims to seek and accept assistance, advocating self-determination to the extent feasible and reminding persons of how they may have successfully coped with previous life events<sup>60</sup>.

The acute and chronic physical and mental health issues that most commonly occur after disaster are within the scope of practice for GPs<sup>16</sup>. After a disaster he has to concentrate on all sorts of patients, exposed or not, relocated or not or with or without a history of psychological problems. Besides, after the acute phase, a lot of victims (the majority) finds a way to deal and cope with the experiences and will succeed in regaining control over their lives again. As our studies illustrate the burden in general practice of extra utilisation and disaster-related morbidity disappears largely after twelve months, although everyone knows examples of disasters with a long, troublesome aftermath, especially after disasters with noxious goods and/or distrust in authorities<sup>17,36,44,61</sup>.

## References

1. Alexander DA. Stress among police body handlers. A long-term follow-up. *Br J Psychiatry* 1993;**163**:806-8.
2. Alexander DA, Wells A. Reactions of police officers to body-handling after a major disaster: A before-and-after comparison. *Br J Psychiatry* 1991;**159**: 547-555:547-55.
3. Asarnow J, Glynn S, Pynoos RS, Nahum J, Guthrie D, Cantwell DP, Franklin B. When the earth stops shaking: earthquake sequelae among children diagnosed for pre-earthquake psychopathology. *J Am Acad Child Adolesc Psychiatry* 1999;**38**:1016-23.
4. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consult Clin Psychol* 1998;**66**:883-92.
5. Reijneveld SA, Crone MR, Verhulst FC, Verloove-Vanhorick SP. The effect of a severe disaster on the mental health of adolescents: a controlled study. *Lancet* 2003;**362**:691-6.
6. Khoury EL, Warheit GJ, Hargrove MC, Zimmerman RS, Vega WA, Gil AG. The impact of hurricane Andrew on deviant behavior among a multi-racial/Ethnic sample of adolescents in Dade county, Florida: A longitudinal analysis. *J Trauma Stress* 1997;**10**:71-91.
7. Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. *J Pers Soc Psychol* 1991;**61**:115-21.
8. Escobar JI, Canino G, Rubio-Stipec M, Bravo M. Somatic symptoms after a natural disaster: a prospective study. *Am J Psychiatry* 1992;**149**:965-7.
9. Bromet EJ, Havenaar JM, Gluzman SF, Tintle NL. Psychological aftermath of the Lviv air show disaster: a prospective controlled study. *Acta Psychiatr Scand* 2005;**112**:194-200.
10. Lin MR, Huang W, Huang C, Hwang HF, Tsai LW, Chiu YN. The impact of the Chi-Chi earthquake on quality of life among elderly survivors in Taiwan: A before and after study. *Quality of Life Research: Int J Qual Life Aspects Treatment, Care and Rehabilitation* 2002;**11**:379-88.
11. Ginexi EM, Weihs K, Simmens SJ, Hoyt DR. Natural disaster and depression: a prospective investigation of reactions to the 1993 midwest floods. *Am J Community Psychol* 2000;**28**:495-518.
12. Norris FH, Murrell SA. Prior experience as a moderator of disaster impact on anxiety symptoms in older adults. *Am J Community Psychol* 1988;**16**:665-83.
13. Phifer JF. Psychological distress and somatic symptoms after natural disaster: differential vulnerability among older adults. *Psychol Aging* 1990;**5**:412-20.
14. Reijneveld SA. The impact of the Amsterdam aircraft disaster on reported annoyance by aircraft noise and on psychiatric disorders. *Int J Epidemiol* 1994;**23**:333-40.
15. Knight BG, Gatz M, Heller K, Bengtson VL. Age and emotional response to the Northridge earthquake: a longitudinal analysis. *Psychol Aging* 2000;**15**:627-34.

16. 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.
17. Bromet EJ, Parkinson DK, Dunn LO. Long-term mental health consequences of the accident at Three Mile Island. *Int J Mental Health* 1990;**19**:48-60.
18. Dalglish T, Joseph S, Yule W. The Herald of Free Enterprise disaster. Lessons from the first 6 years. *Behav Modif* 2000;**24**:673-99.
19. Ohta Y, Araki K, Kawasaki N, Nakane Y, Honda S, Mine M. Psychological distress among evacuees of a volcanic eruption in Japan: A follow-up study. *Psychiatry Clin Neurosci* 2003;**57**:105-11.
20. Phifer JE, Norris FH. Psychological symptoms in older adults following natural disaster: nature, timing, duration, and course. *J Gerontol* 1989;**44**:S207-S217.
21. Shaw JA, Applegate B, Schorr C. Twenty-one-month follow-up study of school-age children exposed to Hurricane Andrew. *J Am Acad Child Adolesc Psychiatry* 1996;**35**:359-64.
22. Steinglass P, Gerrity E. Natural disasters and post-traumatic stress disorder: Short-term versus long-term recovery in two disaster-affected communities. *J Appl Soc Psychol* 1990;**20**:1746-65.
23. Ursano RJ, Fullerton CS, Kao TC, Bhartiya VR. Longitudinal assessment of posttraumatic stress disorder and depression after exposure to traumatic death. *J Nerv Ment Dis* 1995;**183**:36-42.
24. Mecocci P, Di Iorio A, Pezzuto S, Rinaldi P, Simonelli G, MaggioD, Montesperelli P, Longo A, Cherubini A, Chiarappa N, Abate G, Senin U. Impact of the earthquake of September 26, 1997 in Umbria, Italy on the socioenvironmental and psychophysical conditions of an elderly population. *Aging-Clinical & Experimental Research* 2000;**12**:281-6.
25. Najarian LM, Goenjian AK, Pelcovitz D, Mandel F, Najarian B. The effect of relocation after a natural disaster. *J Trauma Stress* 2001;**14**:511-26.
26. Riad JK, Norris FH. The influence of relocation on the environmental, social, and psychological stress experienced by disaster victims. *Environment and Behavior* 1996;**28**:163-82.
27. Basoglu M, Salcioglu E, Livanou M. Traumatic stress responses in earthquake survivors in Turkey. *J Trauma Stress* 2002;**15**:269-76.
28. Caldera T, Palma L, Penayo U, Kullgren G. Psychological impact of the hurricane Mitch in Nicaragua in a one-year perspective. *Soc Psychiatry Psychiatr Epidemiol* 2001;**36**:108-14.
29. Salcioglu E, Basoglu M, Livanou M. Long-term psychological outcome for non-treatment-seeking earthquake survivors in Turkey. *J Nerv Ment Dis* 2003;**191**:154-60.
30. Norris FH. Range, magnitude and duration of the effects of disasters on mental health: review update 2005. <http://www.redmh.org> . 2006.
31. Bromet EJ, Gluzman S, Schwartz JE, Goldgaber D. Somatic symptoms in women 11 years after the Chernobyl accident: prevalence and risk factors. *Environ Health Perspect* 2002;**110 Suppl 4**:625-9.

32. Dirkzwager AJ, Yzermans CJ, Kessels FJ. Psychological, musculoskeletal, and respiratory problems and sickness absence before and after involvement in a disaster: a longitudinal study among rescue workers. *Occup Environ Med* 2004;**61**:870-2.
33. Escobar JI, Canino G, Rubio-Stipec M, Bravo M. Somatic symptoms after a natural disaster: a prospective study. *Am J Psychiatry* 1992;**149**:965-7.
34. McFarlane AC, Atchison M, Rafalowicz E, Papay P. Physical symptoms in post-traumatic stress disorder. *J Psychosom Research* 1994;**38**:715-26.
35. van den Berg B, Grievink L, Yzermans CJ, Lebre E. Medically Unexplained Physical Symptoms in the aftermath of disasters, a review. *Epidem Reviews* 2005;**27**:92-106.
36. Donker GA, Yzermans CJ, Spreeuwenberg P, van der Zee J. Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *Br J Gen Pract* 2002;**52**:917-22.
37. Escobar JI, Canino G, Rubio-Stipec M, Bravo M. Somatic symptoms after a natural disaster: a prospective study. *Am J Psychiatry* 1992;**149**:965-7.
38. Hotopf M, Mayou R, Wadsworth M, Wessely S. Temporal relationships between physical symptoms and psychiatric disorder. Results from a national birth cohort. *Br J Psychiatry* 1998;**173**:255-61.
39. Simon G, Gater R, Kisely S, Piccinelli M. Somatic symptoms of distress: an international primary care study. *Psychosom Med* 1996;**58**:481-8.
40. van den Berg B, Grievink L, Stellato RK, Yzermans CJ, Lebre E. Symptoms and related functioning in a traumatized community. *Arch Intern Med* 2005;**165**:2402-7.
41. van den Berg B, Grievink L, van der Velden PG, Yzermans CJ, Stellato RK, Lebre E, Brunekreef B. Risk factors for physical symptoms after a disaster: a longitudinal study. *Psychol Med* 2008;**38**:499-510.
42. Boscarino JA, Galea S, Ahern J, Resnick H, Vlahov D. Utilization of mental health services following the September 11th terrorist attacks in Manhattan, New York City. *Int J Emerg Ment Health* 2002;**4**:143-55.
43. Farhood LF, Nouredine SN. PTSD, depression, and health status in Lebanese civilians exposed to a church explosion. *Int J Psychiatry Med* 2003;**33**:39-53.
44. Shariat S, Mallonee S, Kruger E, Farmer K, North C. A prospective study of long-term health outcomes among Oklahoma City bombing survivors. *J Okla State Med Assoc* 1999;**92**:178-86.
45. Dorn T, Yzermans CJ, Kerssens JJ, Spreeuwenberg PM, van der Zee J. Disaster and subsequent healthcare utilization: a longitudinal study among victims, their family members, and control subjects. *Med Care* 2006;**44**:581-9.
46. Donker GA, van der Velden PG, Kerssens JJ, Yzermans CJ. Infrequent attendance in general practice after a major disaster: a problem? A longitudinal study using medical records and self-reported distress and functioning. *Fam Pract* 2008.
47. Yzermans CJ, Donker GA, Kerssens JJ, Dirkzwager AJ, Soeteman RJ, Ten Veen PM. Health problems of victims before and after disaster: a longitudinal study in general practice. *Int J Epidemiol* 2005;**34**:820-6.

48. Dirkzwager AJ, Grievink L, van der Velden PG, Yzermans CJ. Risk factors for psychological and physical health problems after a man-made disaster. Prospective study. *Br J Psychiatry* 2006;**189**:144-9.
49. Dirkzwager AJE, Kerssens JJ, Yzermans CJ. Health problems in children and adolescents before and after a man-made disaster. *J Am Acad Child Adolesc Psychiatry* 2006;**45**:94-103.
50. Gulbrandsen P, Fugelli P, Sandvik L, Hjortdahl P. Influence of social problems on management in general practice: multipractice questionnaire survey. *BMJ* 1998;**317**:28-32.
51. Rubonis AV, Bickman L. Psychological impairment in the wake of disaster: the disaster-psychopathology relationship. *Psychol Bull JID - 0376473* 1991;**109**:384-99.
52. Schuster MA, Stein BD, Jaycox L, Collins RL, Marshall GN, Elliott MN, Zhou AJ, Kanouse DE, Morrison JL, Berry SH. A national survey of stress reactions after the September 11, 2001, terrorist attacks. *N Engl J Med* 2001;**345**:1507-12.
53. Silver RC, Holman EA, McIntosh DN, Poulin M, Gil-Rivas V. Nationwide longitudinal study of psychological responses to September 11. *JAMA* 2002;**288**:1235-44.
54. Verheij RA, te Brake H, Abrahamse HA, van den Hoogen H, Braspenning J, van Althuis T. Netherlands Information Network of General Practice. Facts and figures about general practitioner care in the Netherlands. <http://www.LINH.nl> . 2006. Utrecht/Nijmegen: NIVEL/WOK, 2006. Visited 2007/03/08.
55. Verschuur MJ, Spinhoven P, van Emmerik AA, Rosendaal FR. Participation in a trauma-focused epidemiological investigation may result in sensitization for current health problems. *Soc Psychiatry Psychiatr Epidemiol* 2008;**43**:132-9.
56. Somers GT, Maxfield N, Drinkwater EJ. General practitioner preparedness to respond to a medical disaster. Part II: Ability and training. *Aust Fam Physician* 1999;**28 Suppl 1**:S10-S14.
57. Somers GT, Maxfield N, Drinkwater EJ. General practitioner preparedness to respond to a medical disaster. Part I: Skills and equipment. *Aust Fam Physician* 1999;**28 Suppl 1**:S3-S9.
58. Mitchell AM, Sakraida TJ, Kameg K. Critical incident stress debriefing: implications for best practice. *Disaster Manag Response* 2003;**1**:46-51.
59. Fullerton CS, Ursano RJ, Vance K, Wang L. Debriefing following trauma. *Psychiatr Q* 2000;**71**:259-76.
60. Freedy JR, Simpson WM, Jr. Disaster-related physical and mental health: a role for the family physician. *Am Fam Physician* 2007;**75**:841-6.
61. Bromet EJ, Havenaar JM. Mental health consequences of disasters. In: *Psychiatry in society*. 2002:241-61.





## **Summary**



## **Summary**

This thesis deals with the health effects on a general practice population after the fireworks disaster in Enschede, the Netherlands, on 13 May, 2000. On this sunny Saturday afternoon, awesome explosions in a fireworks depot devastated a residential area. Four fire-fighters and 19 residents were killed and nearly 1,000 persons were wounded. About 1200 victims lost their homes and personal belongings and had to be relocated for years.

Dutch government declared the event to be a national disaster. The extent and impact of the disaster urged the government to offer support to the regional authorities and health care providers:

- an information and advice centre (IAC) was established;
- a registration system of victims was created;
- an integrated approach was facilitated for dealing with the psychosocial consequences of the disaster and
- long-term monitoring of health problems was initiated, using two types of study: a) a population survey was launched in which self-report questionnaires were filled in by affected residents three weeks, 18 and 45 months post-disaster and b) a longitudinal survey in general practice was started using the electronic medical records of the victims.

In this thesis the general practice study is presented to analyse the course of symptoms, problems and diseases over a period starting one year pre-disaster to maximal five years post-disaster. The thesis consists of four studies on utilization and morbidity based on electronic registrations of 44 Enschede general practitioners, the author of this thesis being one of them.

Aims of this thesis were to measure the health effects of the fireworks disaster on the victimized general practice population as a whole and on various subgroups among them. The number of contacts per patient with general practice and the health problems presented (physical as well as psychological) were important elements of the analysis.

**Chapter 1** provides findings from the international literature about health problems often seen after disasters.

Disaster studies on various kinds of populations, using various kinds of instruments and study designs show that, besides the short term effects of disasters (physical injuries and deaths) in the *immediate* phase, disasters may have long term psychological and physical health effects in the *aftermath* phase. These aftermath health problems, being the subject of this thesis, appear to be expressed mainly in the first year post-disaster. In many studies several risk groups, e.g. victims with pre-disaster psychological problems, victims with a higher disaster exposure, female gender, young age and immigrant status, are discussed.

In our study, the above mentioned groups of victims were monitored in general practice with the use of pre-disaster morbidity as baseline data. The possibility to use pre-disaster data is rare in literature and based on the unique Dutch healthcare system in which the general practitioner has a central position. In Dutch general practice, patients are registered on a fixed list in just one practice of his choice. Therefore, every GP is supposed to be well informed about 'his' patient's health status. Using their electronic medical records facilitates before – after comparisons, besides the use of a robust reference group of not (or less) affected fellow-residents.

In **Chapter 2** the role of seven Enschede GPs during and after the disaster is described using interviews with each of them. They all suffered damage to their dwellings or practices or were involved in providing medical assistance after the disaster took place.

The disaster made a deep impression: they all reported feelings of insecurity instantly after the disaster with their new and unexpected role as a care provider in an emergency setting.

In the consulting room, doctor and patient often felt a mutual understanding by talking about the disaster, they both had gone through.

A remarkable phenomenon was that all doctors considered themselves as hardly being struck by the disaster in spite of the rather severe damage that most of them had suffered. One of them talked about the "I'm all right-syndrome".

In **Chapter 3** the design of the study and the difficulties encountered during the implementation in general practice are described. The process of the recruitment of the GPs and the infrastructure to retrieve data is reported in detail. Most Enschede GPs, all working with an electronic registration system agreed to participate in the study. We were able to retrieve pre- and post-disaster data on health problems of victims and non-affected references. Patients were labelled as a victim if they were residents of the affected area (zip-code) or when they presented disaster related health problems, according to the GP's judgement.

In our study, the International Classification of Primary Care (ICPC) was used as a uniform system to register and classify symptoms and diagnoses presented by the victims and references. All 44 participating GPs were trained in the use of the ICPC.

The privacy procedures were rather complicated as patient data had to be separated from the medical data, while – at the same time – mutations in the epidemiological denominator (because of relocation, death) had to be kept up to date. A privacy procedure was developed through which the researchers were able to use anonymized data.

The most striking issue appeared to be the assignment of the victim status; various databases -GP and IAC- were used, while the similarities between them were rather low.

In **Chapter 4** the morbidity presented to the practitioners in the period from one year pre- to one year post-disaster was analyzed. The research questions aimed at finding an increase of health problems and at confirming the existence of potential risk factors - such as forced relocation, a history of psychological problems, female gender, younger age and socioeconomic status (SES) - as determinants of increased numbers of health problems in the first year after the disaster.

Increases were found in psychological health problems and in musculoskeletal symptoms.

Victims who had to relocate and victims with a history of psychological problems in the pre-disaster period appeared to be at risk for presenting psychological problems.

Contrary to the expectations females, younger persons and those with lower SES appeared to have no disaster-related contribution to post-disaster psychological problems.

In **Chapter 5**, the course of psychological problems and physical symptoms during two-and-a-half years following the disaster is presented, compared to pre-disaster baseline data. Two groups of victims are constructed: a group of victims with and a group without a history of psychological problems. A victim was included in the first group when (s)he had presented any psychological problem to the GP in the year before the disaster. The main hypothesis was that victims with pre-disaster psychological problems would react stronger to the disaster – in terms of morbidity and health care utilization - than victims without.

However, victims with pre-disaster psychological problems demonstrated no increase of utilization, compared with the utilization pre-disaster. They already had the highest pre-disaster utilisation figures. The victims without a history of psychological problems indeed showed a significant increase in utilisation of general practice services after the disaster.

In an additional analysis on the effect of the disaster and, separately, the influence of a history of psychological problems on presenting post-disaster psychological problems and physical symptoms was calculated. Psychological problems presented by victims were mostly caused by exposure to the disaster; physical problems mostly by pre-disaster psychological problems.

In **Chapter 6** disaster-related utilization and morbidity of the assumed risk groups females and middle aged are analysed. In this matched cohort study, five years' post-disaster data of general practice patients are related to pre-disaster data. Groups of female and male victims, subdivided in five age groups were constructed. Similar reference groups were constructed and matched with the affected residents on gender and age. Health insurance was measured as a proxy for socioeconomic status.

Using logistic regression analysis, differences and trends in average utilization rate and percentages of health problems were investigated for each group. All groups of victims showed significant post-disaster increases in psychological problems and in utilization. These statistically significant

differences appeared to be similar for female and male victims, and between the five age groups. This means, that neither being female, nor age was a separate risk factor for post-disaster health problems: the number of health problems after the disaster relatively resembles pre-disaster.

In **Chapter 7**, health problems and utilisation of immigrants affected by the disaster and presumed to be at risk of presenting post-disaster health problems, are examined and compared with figures of born Dutch victims. In this matched cohort study, utilisation and morbidity in a four years post-disaster period are related to the pre-disaster figures of both groups of victims.

Post-disaster increases were found in utilisation and in psychological morbidity for both groups. These increases did not differ statistically significant, indicating that Turkish victims were not more vulnerable regarding health effects to this disaster than Dutch victims. On the other hand it was concluded that utilization and physical morbidity figures were much higher for the immigrants pre- as well as post-disaster.

In the final **Chapter 8**, findings on health problems and risk factors of this man-made disaster are summarized and related to the international literature. In general, most victims recovered after a first year post-disaster increase of health problems and GP utilization. Victims who had to relocate, victims with a history of psychological problems and especially victims that combined both characteristics were at risk of presenting post-disaster psychological and physical health problems. The supposed (extra) risks for females, middle aged victims and those with an immigrant status were not confirmed in this study.

Monitoring of health problems after disasters, using existing registries is a design not often used in literature. The availability of pre-disaster data, the use of control- or reference groups, the number of victims included and the longitudinal surveillance of large scale general practice populations are considered to be strong qualities of the studies in this thesis.

Finally, recommendations for policymakers, general practitioners and research workers are formulated. These recommendations aim at future large scale surveillance of victims because of the wide-spread incidence of disasters. Moreover, researchers and public health workers have to focus on

interventions for some specific risk groups which can be easily traced in the electronic medical records, e.g in the case of Enschede: relocated victims and victims with a history of psychological problems. General practice is well suited for this task and may play a major role in caring for victims and in registration of the effects in the medical records.



## **Samenvatting**



## **Samenvatting**

In dit proefschrift worden de effecten beschreven van de Vuurwerkcramp in Enschede op de gezondheid van huisartspatiënten. Op de zonnige zaterdagmiddag van 13 mei 2000 explodeerde een vuurwerkopslagplaats midden in een Enschedese woonwijk die daardoor geheel werd verwoest. Vier brandweerlieden en 19 bewoners verloren daarbij het leven en bijna 1000 personen raakten gewond. Ongeveer 1200 slachtoffers raakten hun huis en persoonlijke bezittingen kwijt en moesten gedurende een aantal jaren in andere, tijdelijke, behuizingen elders worden ondergebracht.

De Nederlandse regering verklaarde de gebeurtenissen in Enschede tot een nationale ramp. De grote impact leidde ertoe, dat de regering ondersteuning aanbood aan de regionale autoriteiten, aan de gezondheidszorginstellingen en aan de getroffen bevolking:

- een gemeentelijk Informatie en Adviescentrum (IAC) werd opgericht: één loket voor alle problemen (behalve de medische);
- een registratie systeem voor het in kaart brengen van de slachtoffers werd ingericht;
- een integraal samenwerkingsverband van alle betrokken zorgverleners werd opgericht teneinde de psychosociale gevolgen van de ramp adequaat en uniform het hoofd te kunnen bieden.
- lange termijn monitoring van gezondheids problemen werd opgezet waarbij twee typen studie werden uitgevoerd: a) een populatie studie waarbij op drie tijdstippen vragenlijsten bij slachtoffers werden afgenomen, drie weken, 18 en 45 maanden na de ramp, en b) een longitudinale studie met gebruikmaking van de elektronische medische gegevens van slachtoffers en niet-slachtoffers van huisartsen, bedrijfsartsen en werkers in de ambulante geestelijke gezondheidszorg. De resultaten van beide typen onderzoek werden met regelmaat gepresenteerd aan beleidsmakers en zorgverleners.

In dit proefschrift komen de resultaten van de studie in de huisartspraktijk aan de orde. Het beloop van klachten, problemen en ziektes zoals gepresenteerd door huisartspatiënten gedurende één jaar voor en maximaal vijf jaar na de ramp werd geanalyseerd. Het proefschrift bestaat uit vijf studies, beschreven in vijf verschillende hoofdstukken, over (ontwikkelingen in)

zorggebruik en morbiditeit, die zijn gebaseerd op de elektronische registraties van 44 Enschedese huisartsen. De auteur van dit proefschrift maakte deel uit van deze groep. Voorts wordt in een hoofdstuk van het proefschrift het wel en wee van een aantal door de ramp getroffen Enschedese huisartsen beschreven in de nasleep van de ramp.

Doel van de studies in dit proefschrift was om de gezondheidseffecten van de vuurwerkramp op de Enschedese populatie als geheel en op verscheidene subgroepen hierbinnen in kaart te brengen. Het aantal contacten per patiënt met de huisarts ('zorggebruik') en de gepresenteerde gezondheidsproblemen, zowel psychische als lichamelijke ('morbiditeit'), waren belangrijke elementen bij de analyses.

In **hoofdstuk 1** van dit proefschrift worden bevindingen gepresenteerd uit de internationale literatuur over gezondheidsproblemen zoals die vaak worden gezien na rampen.

Studies na diverse rampen, met uiteenlopende populaties gebruikten verschillende soorten instrumenten en studie designs. Zij beschreven, behalve directe effecten als lichamelijke verwondingen en overlijden in de *acute* fase ook het voorkomen van psychische en lichamelijke effecten op de middellange en lange termijn. Gezondheidsproblemen in deze *latere* fase vormen het onderwerp van dit proefschrift.

In meerdere studies werden risicogroepen beschreven zoals slachtoffers met psychosociale problemen voorafgaand aan de ramp, slachtoffers die ernstig zijn blootgesteld aan een ramp, en kenmerken als het vrouwelijke geslacht, jongere leeftijd, en immigranten status. De meeste van deze studies zijn gebaseerd op gegevens die na de ramp zijn verzameld.

Door de unieke positie van de huisarts(-praktijk) in het Nederlandse gezondheidszorgsysteem, was het mogelijk om in deze studie een vergelijking te maken met de periode voor de ramp en met diverse groepen niet getroffen stadsgenoten. In de Nederlandse huisartspraktijk waren de patiënten ingeschreven in één praktijk. Zo kon verondersteld worden dat de huisarts de ingeschreven populatie al kende voor de ramp plaatsvond en dat hij goed geïnformeerd was over de gezondheidstoestand van "zijn" patiënten. Het elektronisch medisch dossier, waarin de huisartsen hun bevindingen registreerden, maakte het mogelijk om de gezondheid van hun

patiënten voor en na de ramp te vergelijken.

Zo konden wij een aantal uit de literatuur bekende risicogroepen onderzoeken met dien verstande dat gegevens van één jaar voor de ramp konden dienen als uitgangswaarde voor het in kaart brengen van zorggebruik en morbiditeit na de ramp. Zouden veronderstelde risico groepen inderdaad met deze robuuste opzet nog steeds een extra risico op zorggebruik en morbiditeit laten zien?

In **hoofdstuk 2** wordt de rol van zeven Enschedese huisartsen tijdens en na de ramp beschreven aan de hand van interviews met ieder van hen. Zij hadden allen schade ten gevolge van de ramp geleden aan hun prive woningen of aan hun praktijken en waren betrokken bij het bieden van medische hulp na de ramp.

De ramp maakte grote indruk op de huisartsen: zij rapporteerden gevoelens van onzekerheid tijdens en direct na de ramp. Zij moesten een nieuwe en gedwongen rol vervullen als hulpverlener bij een grootschalige rampsituatie. In de spreekkamer bleken de dokter en de getroffen patiënt een wederzijds gevoel van begrip te hebben bij het spreken over de ramp. Zij hadden beiden hetzelfde meegemaakt.

Een opmerkelijk fenomeen was dat alle dokters zichzelf als nauwelijks getroffen beschouwden ondanks de vrij ernstige schade die de meeste van hen hadden geleden. Een van hen sprak met enige ironie over het “mij mankeert niets - syndroom”.

In **hoofdstuk 3** worden het design van de studie en de praktische moeilijkheden bij het opzetten en uitvoeren ervan besproken. De meeste Enschedese huisartsen, allen werkend met een elektronisch registratie systeem, stemden in met medewerking aan het onderzoek. Het proces van het betrekken van de huisartsen bij het onderzoek en het binnenhalen van de data wordt gedetailleerd beschreven. Wij waren in staat gegevens over gezondheidsproblemen van getroffen en niet getroffen patiënten van voor en van na de ramp aan hun registratie systemen te onttrekken. De patiënten werden bij de huisarts als slachtoffer geruiterd, wanneer zij in het getroffen gebied (postcode) woonden, wanneer zij gezondheidsproblemen presenteerden, die een relatie met de ramp hadden naar het oordeel van hun huisarts, of wanneer zij zich via het gemeentelijke IAC als slachtoffer hadden

aangemeld.

In onze studie werd de International Classification of Primary Care (ICPC) als een uniform classificatiesysteem gebruikt voor de registratie van klachten en diagnoses zoals gepresenteerd door slachtoffers en de referentie groep. Alle 44 deelnemende huisartsen werden getraind in het gebruik van de ICPC.

De privacy procedures waren tamelijk ingewikkeld, omdat de persoonsgegevens van patiënten gescheiden moesten worden van de medische data, terwijl – tegelijkertijd – mutaties in het patiëntenbestand (tengevolge van verhuizing of overlijden) actueel moesten worden gehouden. Er werd een privacy procedure ontwikkeld, waardoor de onderzoekers adequaat met de geanonimiseerde data konden omgaan. Het meest opmerkelijke probleem van de implementatie van het onderzoek was de toekenning van de slachtoffer status. Patiënten konden namelijk via verschillende bestanden, dat van de huisarts of dat van het IAC, worden gekenmerkt als slachtoffer. De slachtoffers afkomstig uit de genoemde bronnen, de huisarts dan wel het IAC, toonden flinke onderlinge verschillen in demografische kenmerken en psychische morbiditeit.

In **hoofdstuk 4** tot en met **7** worden morbiditeit en zorggebruik van Enschedese huisartspatiënten, slachtoffers en niet slachtoffers, geanalyseerd. De onderzoeksvragen richten zich op het vinden van toenames van gezondheidsproblemen in het eerste jaar na de ramp en op de aanwezigheid van potentiële risicofactoren. Deze betreffen gedwongen verhuizing ten gevolge van de ramp, het hebben van psychische problemen voorafgaand aan de ramp, vrouwelijk geslacht, leeftijd, Turkse afkomst, en het hebben van een lagere socio-economische status (SES). Al deze factoren werden gevonden in de literatuur op rampengebied als determinanten van een toename van gezondheidsproblemen na de ramp.

In onze studie werden vrouwen vergeleken met mannen, Turkse slachtoffers met Nederlandse. Tevens werden vijf verschillende leeftijdscategorieën vanaf 5 jaar tot en met een 65+ groep tegen elkaar afgezet. Het type ziektekostenverzekering (ziekenfonds versus particulier) werd gebruikt als een proxy (benadering) voor sociaal-economische status.

Het valt op in de studie, dat alle groepen getroffen binnen de totale populatie, (veronderstelde) risicogroep of niet, een stijging van morbiditeit laten zien. De ramp heeft dus een breed effect en lijkt geen enkele groep te ontzien. Toenames in morbiditeit werden gevonden voor psychische gezondheidsproblemen en voor symptomen van het bewegingsapparaat.

Slachtoffers met al bestaande psychische problemen voor de ramp en slachtoffers die tengevolge van de ramp moesten verhuizen bleken een sterk toegenomen risico op het presenteren van psychische problemen na de ramp te hebben. Wanneer slachtoffers beide risico factoren hadden, zij hadden psychische problemen voor de ramp én zij moesten verhuizen, bleken zij een nóg groter risico op het presenteren van psychische klachten na de ramp te hebben.

Voorts werd bij alle getroffen groepen een stijging in hun zorggebruik gevonden. Er was wel één uitzondering bij deze bevinding. Slachtoffers die in het jaar voorafgaand aan de ramp bij de huisarts waren geweest met psychische problemen lieten geen stijging in hun zorggebruik na de ramp zien. Zij zaten kennelijk al aan hun plafond met hun bezoeken aan de huisarts voordat de ramp plaatsvond. Daardoor was een verdere stijging na de ramp niet mogelijk. Hun tegenpolen, de slachtoffers zonder een voorgeschiedenis van psychische problemen, lieten na de ramp wel een stijging zien in zorggebruik. Zij reageerden op dit gebied dus wél op de ramp.

Een opmerkelijk resultaat was de invloed van een historie van psychische problematiek op de presentatie van lichamelijke symptomen. Slachtoffers met zo'n achtergrond presenteerden meer lichamelijke symptomen dan slachtoffers zonder psychische problemen in de voorgeschiedenis.

De ramp trof niet specifiek een bepaalde sekse of leeftijdsgroep: mannen en vrouwen en alle leeftijdsgroepen maakten tijdelijk meer gebruik van de diensten van de huisarts en presenteerden daarbij meer psychische problemen en lichamelijke symptomen. Op grond van de internationale literatuur werd tevoren verwacht, dat vooral vrouwen en personen van middelbare leeftijd meer zorggebruik zouden hebben en meer gezondheidsproblemen zouden presenteren. Wij konden dit niet bevestigen.

Ook bij de vergelijking van Turkse en Nederlandse slachtoffers kwam een zelfde beeld naar voren. Na de ramp werden gelijke toenames gevonden van zorggebruik en psychische morbiditeit bij beide groepen. De van origine

Turkse slachtoffers waren dus niet kwetsbaarder voor de gevolgen van deze ramp dan de Nederlandse slachtoffers. Anderzijds bleek wel, zowel voor als na de ramp, dat zorggebruik en morbiditeit (uitzondering: psychische problemen voor de ramp) bij de Turkse immigranten veel hoger was dan bij de autochtone getroffen.

In het laatste **hoofdstuk 8** worden de bevindingen van deze studie over gezondheidsproblemen en risicofactoren in de nasleep van de Vuurwerk-ramp samengevat en gerelateerd aan bevindingen uit de literatuur. In het algemeen herstelden de slachtoffers spoedig na de piek in zorggebruik en gezondheidsproblemen gedurende het eerste jaar. Slachtoffers die moesten verhuizen, slachtoffers met een voorgeschiedenis van psychische problemen, en in het bijzonder slachtoffers met beide karakteristieken hadden een verhoogd risico op psychische en lichamelijke klachten. Het vrouwelijke geslacht, middelbare leeftijd en immigranten status werden in dit proefschrift niet als risicofactor voor een toename van gezondheidsproblemen na deze ramp aangetoond.

Het langjarig monitoren van gezondheidsproblemen na de Vuurwerk-ramp, het gebruik van controle- of referentiegroepen, het grote aantal geïncludeerde slachtoffers en het gebruik van gegevens van voor de ramp kunnen worden beschouwd als sterke punten van de studies uit dit proefschrift. Wij denken dat het ter beschikking hebben van gegevens voordat de ramp plaatsvond heeft bijgedragen aan meer inzicht in risicogroepen.

Tot slot worden aanbevelingen geformuleerd voor beleidsmakers, huisartsen en onderzoekers. Deze aanbevelingen richten zich op het grootschalig toepassen van monitoring (in de huisartspraktijk) van slachtoffers vanwege de grote gezondheidseffecten van rampen binnen populaties en haar verschillende subgroepen. Onderzoekers en werkers in de gezondheidszorg, inclusief huisartsen, zullen zich moeten concentreren op risico groepen, die relatief eenvoudig zijn op te sporen via het elektronisch medisch dossier zoals bij slachtoffers die gedwongen moesten verhuizen door de ramp en slachtoffers met een voorgeschiedenis van psychische problemen.



De huisartspraktijk is voor deze taken goed toegerust en kan een hoofdrol spelen in de zorg voor slachtoffers en bij de registratie in het elektronisch medisch dossier van de effecten van een ramp.



## **Dankwoord**



## **Dankwoord**

Vele personen hebben meegewerkt bij het tot stand komen van dit proefschrift. Zij hebben moeten omgaan met een huisarts, een medicus practicus, die denkt in termen van problemen en oplossingen. Ik heb moeten leren abstract te denken, te redeneren en te formuleren, zoals dat in een onderzoek gaat. De meeste van jullie zullen dit herkend hebben en onze ontmoetingen zijn er door gekleurd. Heel veel dank hiervoor.

Jouke van der Zee, Wil van den Bosch en Joris IJzermans, promotores en copromotor: Jullie hebben mij altijd gesteund. Altijd doorgegaan, gelezen, ruimte gemaakt, suggesties gedaan.

Jouke, je leerde mij om te schrijven, een verhaal te vertellen binnen het kader van een artikel. Jij wist altijd waar ik mee bezig was en je was zeer toegankelijk voor vragen.

Wil, jij gaf mij zicht op de grote lijnen: jij leerde mij met ruwe schetsen tot de essentie te komen van wat ik wilde vertellen. Je bleef altijd positief en steunend.

Joris, mijn co-promotor: het moet zijn geweest of je opnieuw promoveerde, twee stappen vooruit en weer één achteruit. Steeds bleef je kritisch lezen bij de zoveelste versie van een artikel, nadenken, feedback geven. Soms waren wij het niet eens. Toch zijn we blijven praten, discussiëren. Heel veel dank voor al je steun.

De leden van de manuscript commissie, Anne Speckens, Koos van der Velden en François Schellevis, dank voor jullie enthousiaste medewerking en reflecties bij het beoordelen van mijn proefschrift.

Yvonne Luyten- de Thouars: jij was de onmisbare schakel met de voor mij onbekende patiënt in het bestand van de huisarts. Dit is gelukt zonder enige klacht over schending van de privacy. Geweldig!

Binnen de stimulerende omgeving van het NIVEL waren er vele mensen die hebben mee geholpen, die altijd klaar stonden om een vraag te beantwoorden. Petra ten Veen, jij hebt het data beheer gedaan, een gigantisch karwei. En je was een heel prettige kamergenoot. Jan Kerssens, dank voor al je

bewerkingen. Jouw vraag was altijd: wat is je vraagstelling? Ook Peter Spreeuwenberg, dank voor al je uitleg, je vele geduld wanneer ik iets methodologisch niet begreep. Tina Dorn, toen ik vast liep met het Immigranten artikel, heb jij mij weer vlot getrokken. Anja Dirkzwager, dank voor je meeschrijven bij het eerste grote artikel, dank voor je heldere formuleringen. Mattijn Morren, dank voor commentaar bij het schrijven van artikelen, als altijd zeer to the point. Noor Breuning en Anne-Vicky Carlier, jullie stonden altijd voor mij klaar bij het opzoeken en rubriceren van vele artikelen. Karin Stoeten, dank voor je hulp, wanneer ik met Word in de knoop kwam. Karin Spijkers, Jolanda van den Bosch, Pauline Slottje, Marion Biermans, Ruth van Nispen, Celina Cohen-Bendahan, Annemarie Meiberg, Dirk-Jan den Ouden en Jolanda Groenendijk dank voor jullie steun binnen de 'rampen groep'. Gé Donker, het was leuk om een steunende en kritische collega-huisarts binnen het NIVEL te hebben.

Richard van Kruysdijk, jij maakte een beeldende omslag. Mieke van Leeuwe, jij corrigeerde/vertaalde mijn teksten. Marian Brouwer, jij verzorgde een mooie lay-out.

Toine Lagro-Janssen, in het kader van het gender age artikel ben jij gaan meeschrijven. Onze bijeenkomsten op de afdeling huisartsgeneeskunde in Nijmegen waren inspirerend en richting gevend.

Bewoners van het getroffen gebied, hulpverleners en alle andere betrokkenen bij de ramp: jullie hebben iets meegemaakt, wat aan een buitenstaander moeilijk is te vertellen. Jullie zijn er door heen gekomen en het leven gaat door, hoewel gekleurd door de ramp. Bewust wil ik het woord slachtoffer hier niet meer gebruiken. Jullie zijn slachtoffer van de ramp geweest, maar dit was gelukkig tijdelijk. Heel veel dank voor jullie medewerking bij dit onderzoek.

En Enschedese huisartsen, dank voor jullie consciëntieuze registraties van alle gezondheidsproblemen gedurende vijf lange jaren in een stad die door een ramp werd getroffen. Bovendien waren jullie steeds ruim vertegenwoordigd bij de rapportages in het Dish Hotel. In het bijzonder dank ik de collega's die met mij zitting hadden in de commissie die na de Vuurwerk-ramp de huisartsen vertegenwoordigde: Henk Broekman, Gaele van der Sluis, Ton Davids, Rieuwert van Doesburgh, Frans Derks-van Gemert, Jacqueline Noltes en Ilse Böklerink.

Huisartsen en assistentes van Gezondheidscentrum Veldpoort. Jullie hebben vaak rekening met mij gehouden, omdat ik afwezig was of niet beschikbaar. Veel dank voor jullie geduld.

Miriam: In Vieux-Dun in de Morvan hebben wij heel wat afgepraat. Jij probeerde lijn te brengen in mijn, soms, verwarde gedachten. Jij richtte mijn focus op mijzelf en ik leerde te kiezen en mijn gedachten beter te verwoorden. En steeds ging ik met nieuwe inspiratie terug naar Nederland.

Eveline: Ons gezin kon vele malen jouw huis in de Morvan gebruiken. Wij voerden er talloze gesprekken met Miriam aan de keukentafel. Ook hebben jij en ik samen in Enschede gediscussieerd over het proefschrift. Jij leerde mij breed te denken: iedere kritische gedachte is een kans, een verbreding van mijn horizon.

Hans en Cisca: Hele zaterdag avonden hebben wij zitten bomen over de problemen van deze wereld in het algemeen en van dit proefschrift in het bijzonder. Helaas hebben wij niet alle wereldproblemen kunnen oplossen. Het proefschrift is er nu wél mede dank zij jullie liefdevolle en kritische meedenken.

Michiel, Joost en Piet-Jan, veel dank voor het meelezen, het opsporen van fouten en het stroomlijnen van de taal. Jullie waren meer tot steun dan jullie dachten.

Dirk en Jette, mijn kinderen. Toen ik begon in 2001 waren jullie 12 en 10 jaar. Jullie hadden geen idee waar je aan begon met je vader. Je werd afgevoerd naar de Morvan in je vakantie. De afgelopen jaren hebben we samen veel meegemaakt. Op succes momenten waren we samen blij. Maar ook op de moeilijke momenten waren jullie aanwezig: Dirk met geduld en empathie, Jette met je onbevangen maar o zo heldere vragen.

Jeanine, mijn lief én associé! Je hebt ruim 5 jaren de praktijk voor het grootste deel gedaan, zodat ik tijd aan mijn proefschrift kon besteden. Jij had het er wel eens zwaar mee, maar ging altijd door. Daarnaast bleef je mij volgen. Ook wanneer ik mij afsloot voor de buitenwereld, bleef jij belangstellend, kritisch en bovenal dichtbij.





## **Curriculum Vitae**



## **Curriculum Vitae**

Rik Soeteman werd op 25 augustus 1956 te Den Haag geboren.

Na het VWO aan de Koninklijke Scholengemeenschap Apeldoorn ging hij aan de universiteit van Groningen geneeskunde studeren. Tijdens zijn studie was hij actief in een organisatie die zomerkampen organiseerde voor jongeren. Aan het einde van zijn studie deed hij het keuze co-schap revalidatie. Hij koos uiteindelijk voor het, generalistische, huisartsenvak.

Na zijn studie werkte hij twee jaar als junior-onderzoeker bij de vakgroep huisartsgeneeskunde van de Rijks Universiteit Groningen. Hij verzorgde onder andere de dataverzameling in een aantal huisartspraktijken bij een onderzoek naar het beloop van nieuwe psychosociale klachten in de huisartspraktijk. In deze periode werkte hij al co-auteur mee aan een artikel.

Na het voltooien van de huisartsenopleiding in 1988 ging hij werken als huisarts in een associatief verband met zijn echtgenote in het gezondheidscentrum Veldpoort te Enschede. Binnen de huisartsengroep was hij actief als FTO coördinator en als voorzitter.

Op 13 mei 2000 vond de Enschedese vuurwerkramp plaats. Zijn ervaring in het onderzoek in de huisartspraktijk was de reden dat hij zitting nam in een coördinatie commissie van de Enschedese huisartsen, die hulp aan getroffen praktijken ging opzetten. Vanuit deze commissie ging hij in 2001 bij het NIVEL onderzoek doen naar gezondheidsklachten van huisartspatiënten.

Rik Soeteman speelt regelmatig een pot hockey en doet aan hardrennen. Hij is getrouwd met Jeanine Waaijer en heeft twee kinderen, Dirk en Jette.