Effects of the medical investigation Bijlmermeer aviation disaster on health perception of residents and rescue workers
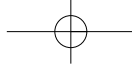Verschuur, M.J.

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Offering a medical examination following disaster exposure does not result in long-lasting reassurance about health complaints
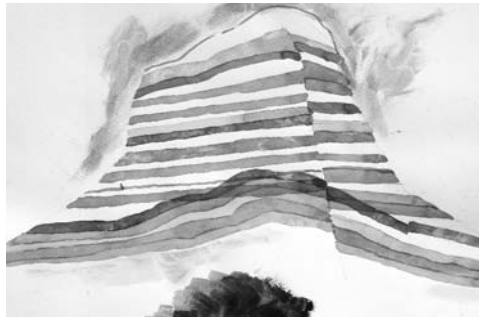
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Abstract

Objective   This study tested the hypothesis that a large-scale provision of an individual medical examination will reduce persistent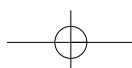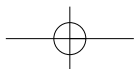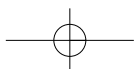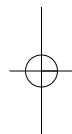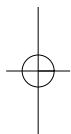 anxiety about health and subjective health complaints after involvement in an aviation disaster with alleged exposure to hazardous chemicals.

Method   There were three measurements: during the medical examination, 6 weeks later during a consultation with the physician and 12 weeks after the first examination. 1736 rescue workers and 339 residents involved in the disaster participated. Standardized questionnaires on health complaints and concerns were administered.

Results   Both groups reported increased health anxiety and somatic sensitivity after 12 weeks. Residents reported more post-traumatic stress symptoms, whereas rescue workers seem to have gained a better quality of life and were somewhat reassured. Participants that attended the consultation with the physician showed increased reassurance scores after six weeks, but at follow-up their worries had increased again. However, non-attendees reported more health anxiety at follow-up. More participants judged participation to have had a positive instead of negative impact on their health.

Conclusion Our study does not indicate that a large-scale medical examination offered after involvement in a disaster has long-lasting reassuring effects, and suggests that such examinations may have counterproductive effects by sensitizing participants for health complaints.

Introduction

The last decades there has been increasing attention for the health consequences of disasters and it has been consistently found that acute stress reactions are a normal and expected response to such a traumatic event [1]. However, it has also become clear that in a significant proportion of individuals psychopathological symptoms such as post-traumatic stress, anxiety, depression, substance abuse and physical (somatization) symptoms may persist for many years [2]. For example, recent studies have shown that the rates of (symptoms of) post-traumatic stress disorder more than one year after disasters range between 16% and 30% [3-7]. Disasters and the associated health consequences also constitute an occupational hazard for rescue workers. Although in general, rescue workers are reported to be relatively healthy (both mentally and physically) compared with other samples from the general population, recent studies have also found long-term health complaints in rescue workers exposed to a disaster in comparison to reference groups of non-exposed col-

leagues [8,9].

These results with respect to the long-term consequences of disasters in both victims and rescue workers underscore the need to develop interventions at disaster sites or in the direct aftermath of a disaster in order to prevent these long-term sequelae [10]. However, the vast majority of research on PTSD prevention up till now has yielded relatively little evidence for the efficacy of various preventive interventions such as psychological debriefing, treatment of acute stress disorder, stepped collaborative care, etc [11]. Even less clinical or empirical data are available about the optimal treatment strategy for victims of disasters or occupationally exposed rescue workers with long-standing mental and physical symptoms. It may be assumed that in these long-standing problems cognitive factors (such as risk perception or health anxiety) are important putative mediators between trauma exposure and persistent health problems [12], especially in toxicological disasters.

As has become increasingly evident from studies in patients who present with symptoms that their physician cannot explain by a known somatic disease, reassurance about risk and disease is best accomplished in a face-to-face relationship in which the physician tries to provide tangible explanations that make sense to the patients and allow them to better manage their symptoms [13]. However, available studies also indicate that these positive reassuring effects may be short lived and that after several weeks health anxiety may re-emerge especially in patients with high levels of health anxiety at baseline [14,15]. Generalizing these findings from primary and specialized medical care to the context of public health, one possible strategy could be to reassure persons with long-standing symptoms after exposure to a disaster about their health situation on the basis of a medical examination addressing their health concerns and anxieties. More specifically, it could be argued that a medical examination will have reassuring effects because persons can present their persistent symptoms, discuss their health anxieties, and after a medical examination will receive an individualized explanation for their symptoms and referral for further examination or treatment if necessary.

Background

On October 4th 1992 a freight Boeing 747 crashed in the Bijlmermeer district of Amsterdam, the Netherlands. The death count totaled 43 (including the plane's crew) and 266 apartments were destroyed. Discussions ensued about the health consequences for surviving residents and rescue workers, fuelled by speculations about the possible toxic cargo of the airplane. These growing uncertainties resembled the concerns among survivors of toxicological disasters [16]. In their article about toxic fear, Boin, van Duin and Heyse described how the Bijlmermeer air disaster developed into a public health crisis [17]. In the years following the crash, survivors began to link a stream of health complaints to the alleged toxic cargo of the plane.

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The unusual long aftermath of speculations about the cause of the crash, the contents of the cargo, the potential hazardous materials, and its health consequences may have affected the psychological and physical well-being of residents and rescue workers [18]. The governmental reaction of crisis termination, combined with a collective underestimation of the possible effects of "toxic fear" resulted in a heightened sense of collective fear. In addition, extensive media coverage about unresolved issues, such as the disappearance of the depleted uranium used as balance weight in the aircraft created fertile ground for further rumors [19]. Instigated by a parliamentary inquiry, political pressure in January 2000 led to a large-scale medical examination for all individuals who considered themselves to be suffering from the consequences of the disaster; the Medical Investigation Bijlmermeer Aviation Disaster. The inquiry committee advised this investigation into possible health problems for residents and rescue workers, if only to quell public concerns created in the preceding eight years. One of the main goals of the project was to reassure those who were involved by offering more insight into their medical condition and into the health consequences of the disaster.

Purpose and research hypotheses
The Medical Investigation Bijlmermeer Aviation Disaster provided a unique opportunity to study whether providing individuals with the possibility of a medical examination indeed reduces anxiety about health as well as subjective complaints among rescue workers and residents. It was hypothesized that a medical examination during which participants could present their symptoms and discuss their concerns and anxieties followed by personalized feedback of a physician during a subsequent consultation would have reassuring effects both in residents and rescue workers. It was also hypothesized that this positive reassuring effect would be more pronounced directly after the medical consultation and would subdue in the weeks following the consultation.

Methods

Design
The full project consisted of several studies of which the purpose and methods are described elsewhere [20,21]. Previous reports of the Medical Investigation Bijlmermeer Aviation Disaster have already shown that exposed rescue workers reported more subjective physical and psychological health complaints than non-exposed colleagues [8,9,22]. However, no consistent significant differences between exposed and non-exposed workers were found with regard to several clinical parameters in urine and blood samples.

The present study is a prospective longitudinal study in both residents and rescue workers assessed at three time points: during the medical examination (baseline), 6 weeks later during the consultation with a physician (post measurement), and 12 weeks after the first examination (follow-up measurement). The last measurement was executed by mail. The research protocol was approved by the Medical Ethics Committee of the Leiden University Medical Center, and all participants gave written informed consent for the use of their data from the medical examination and separately for our study on the effects of participation.

Participants and procedure
The present study took place between December 2000 and April 2003. All individuals who were involved in the disaster (residents as well as rescue workers) could take part in a medical examination, on their own initiative. As such, the study sample consists of a self-selected group of persons concerned about their health. The medical examination consisted of an individual medical examination and a consultation with the physician to discuss the results. The medical examination took around four hours and consisted of filling in questionnaires (assisted by medical assistants and if necessary by professional interpreters), an examination of lung function (forced expiration spirometry), taking blood and urine samples and an anamnesis and physical examination by a doctor. At the consultation after approximately six weeks each participant was given a specific advice based on the findings of the examination, for instance that no grounds had been found for further examination, that a further physical examination by their family doctor was warranted or that the participant might benefit from the special aftercare services set up for this purpose. The examinations took place at a general hospital in Amsterdam. Medical assistants and physicians were specifically trained in discussing health worries and anxieties and giving personalized feedback in this particular group of people involved in the disaster.

Outcome measures
With regard to health concerns the following questionnaires were filled in. The Somatosensory Amplification Scale (SAS) (range 0-40) measures the tendency to experience somatic sensations as intense and harmful [23,24]. The 10-item SAS in this study had a Cronbach's α of .69. From the Illness Attitude Scales developed by Kellner, Abbott, Winslow and Pathak [25], the Health Anxiety subscale (HA) was used to study the degree of worry and anxiety about health [24]. Cronbach's α of the 11 items (range 0-44) in the present study was .90. To measure the extent to which a patient feels reassured by information provided by a physician the Reassurance Questionnaire (RQ) was administered [26]. The 10-item RQ (range 0-40) in this study had an α of .79. In the present study measurements of somatic sensitivity,

health anxiety and lack of reassurance by a physician constitute our operationaliza-
tion of persistent health concerns.

In addition, various aspects of participants' physical and psychological health
were investigated. To measure the general level of psychopathology the 12-item ver-
sion of the General Health Questionnaire (GHQ-12) was used [27,28]. Cronbach's
α for the GHQ-12 (range 0-12) in the present study was .89. Post-traumatic stress
symptoms related to the air disaster were investigated with the Impact of Event
Scale (IES) [29,30]. The IES (range 0-75) is composed of 15 items on experiences
of intrusion and avoidance commonly reported following traumatic events (α=.95).
The Checklist Individual Strength (CIS) measures several aspects of fatigue [31],
including 'Subjective fatigue', 'Concentration', 'Motivation' and 'Activity' (range
20-140). For the current study we used the total score on the CIS (20 items, α=.95),
and the score on the subscale Subjective fatigue (8 items, α=.95). Health-related
quality of life was measured with the EQ-5D, developed by the EuroQol Group [32].
It consists of five dimensions of possible health problems, to be answered with 'no
problems', 'some problems' and 'extreme problems'. The combination of answers
on the dimensions leads to an index-score of quality of life between 0 (equal to
death) and 1 (best imaginable health).

Finally, participants were asked two questions about the influence of participat-
ing in the examination on their psychological and physical condition at that moment
(at baseline, post-test and follow-up). Answers were given on a 5-point Likert scale
ranging from 1 'in a very negative way' to 5 'in a very positive way'.

Statistical analysis

To measure changes in health experience between baseline and follow-up measure-
ments paired sample t-tests were performed. In the subgroup of participants who
attended the consultation with a physician, changes in reassurance and in the impact
on their condition between baseline, post-test and follow-up were analyzed with
repeated measures analyses of variance. Differences in health experience at follow-
up between participants that did or did not attend the consultation were assessed
with analyses of covariance, correcting the follow-up scores for the baseline scores
on each measure. In order to quantify the magnitude of changes standardized, with-
in effect-sizes (Cohen's *d*) were calculated [33].

Results

Sample

1736 rescue workers participated in the present study: 103 fire-fighters, 1231 police officers, 128 accident and wreckage investigators and 274 other rescue workers. 97% of the rescue workers were involved in the disaster by having performed at least one of the following tasks: rescuing people, fire-extinguishing, providing security, providing first aid/support to the injured or workers, cleaning up of destructed area, transport of injured, identification of victims, sorting of wreckage or other tasks in hangar, transport of wreckage, burning of contaminated soil, or other disaster-related tasks. 339 residents who lived in the neighborhood during the disaster also participated. 87% of the residents were exposed to at least one of the following events: being present in struck apartments, witnessing dead or injured people, being in danger of life, becoming injured, having one's apartment damaged, having one's partner or children in danger of life, injured or died, or having other family members died. Of the potential participants in the follow-up measurement 81% (*n*=951) of the rescue workers and 59% (*n*=168) of the residents responded. Rescue workers were randomly selected to take part in this follow-up, while all residents except for those dependent on interpreters were invited. A description of the participants is shown in Table 1. The rescue workers were predominantly male, whereas among residents gender was more or less equally divided. Most rescue workers had completed secondary education, while residents reported more primary education. Almost all rescue workers were of a western ethnicity, whereas more than half of the residents were of a non-western background (mainly Ghanaian, Surinamese and Netherlands Antilles).

Table 1. Demographic characteristics of participants at baseline

	Rescue workers ($n = 1736$)	Residents ($n = 339$)
Age in years: Mean (SD)	44.9 (6.8)	41.4 (11.1)
Gender: No. (%)		
Male	1605 (92.5)	180 (53.1)
Female	131 (7.5)	159 (46.9)
Education[a]: No. (%)		
Primary	431 (26.4)	138 (43.1)
Secondary	827 (50.6)	98 (30.6)
Higher	375 (23.0)	84 (26.3)
Ethnicity[a]: No. (%)		
Western	1682 (97.4)	151 (44.9)
Non-western	45 (2.6)	185 (55.1)

[a] Numbers do not add up because not all the respondents answered these questions, % are valid.

Changes in health experience
Table 2 shows the changes in health experience between the time of the medical examination (baseline) and 12 weeks later (follow-up). Both rescue workers and residents were more sensitive to somatic sensations (SAS) and became more anxious about their health (HA). In addition, residents reported more post-traumatic stress symptoms (IES) 12 weeks after the examination. On the other hand, rescue workers seem to have gained a better quality of life (EQ-5D) and were somewhat reassured (RQ), although they showed more symptoms of fatigue (CIS). All effect-sizes were small or negligible.

Table 2. Changes in health experience between time of examination (baseline) and
12 weeks later (follow-up)

	Rescue workers (*n* = 951)				Residents (*n* = 168)			
	baseline M (SD)	follow-up M (SD)	*t* (950)	*d* a	baseline M (SD)	follow-up M (SD)	*t* (167)	*d* a
GHQ	1.3 (2.4)	1.3 (2.6)	0.2	-.01	4.3 (3.8)	4.6 (4.3)	-1.1	.08
IES	3.4 (7.4)	3.2 (8.2)	0.8	.02	25.1 (19.3)	28.8 (21.1)	-3.1**	.18
CIS	52.1 (26.1)	53.4 (25.5)	-2.3*	.05	80.5 (28.3)	83.8 (27.0)	-1.9	.12
Fatigue	22.7 (13.4)	22.8 (12.2)	-0.3	.01	37.5 (12.9)	37.6 (12.8)	-0.2	.01
EQ-5D	0.86 (0.2)	0.89 (0.2)	-5.9***	.15	0.58 (0.3)	0.59 (0.3)	-0.5	.03
HA	6.4 (6.0)	6.8 (6.3)	-2.6*	.06	14.1 (9.8)	16.7 (10.6)	-3.8***	.25
RQ	7.8 (5.5)	7.0 (4.6)	4.0***	.15	15.6 (7.2)	14.5 (7.2)	1.8	.14
SAS	7.9 (4.3)	8.7 (4.0)	-7.2***	.20	14.7 (6.8)	16.9 (6.5)	-4.3***	.34

M = mean; SD = standard deviation; a *d* = effect-size. *p < .05; **p < .01; ***p < .001. GHQ = General Health Questionnaire; IES
= Impact of Event Scale; CIS = Checklist Individual Strength; Fatigue = Checklist Individual Strength Subjective Fatigue; EQ-5D
= EuroQol-5 Dimensions; HA = Health Anxiety Scale; RQ = Reassurance Questionnaire; SAS = Somatosensory Amplification Scale

Effect of consultation
During the consultation with the physician 6 weeks after the medical examination
(post measurement), the participants had the opportunity to discuss the results of this
examination with the doctor and if appropriate receive advice for further treatment.
Approximately half of the participants that took part in the follow-up made use of
this opportunity (44% (*n*=74) of the residents and 54% (*n*=514) of the rescue work-
ers). Except for higher scores for somatosensory amplification at baseline no other
biographical or clinical differences between participants who did or did not attend
this consultation were observed.
    As Table 3 shows, the main difference at follow-up between those who took part
in the consultation and those who did not was, that non-attendees reported more
health anxiety at follow-up. Rescue workers also showed less reassurance, and more
somatic sensitivity and psychopathology.

Table 3. Differences in health experience at follow-up between participants that did
or did not attend the consultation, corrected for baseline scores

	Rescue workers (n = 951)				Residents (n = 168)			
	attendees	non-attendees	F	d [a]	attendees	non-attendees	F	d [a]
	M (SE)	M (SE)	(1, 948)		M (SE)	M (SE)	(1, 165)	
GHQ	1.1 (0.10)	1.5 (0.10)	6.7*	.17	4.4 (0.41)	4.8 (0.36)	0.5	.11
IES	3.2 (0.28)	3.3 (0.31)	0.1	.01	27.7 (1.67)	29.7 (1.52)	0.8	.14
CIS	52.7 (0.72)	54.2 (0.78)	1.9	.09	82.8 (2.45)	84.6 (2.15)	0.3	.09
Fatigue	22.4 (0.36)	23.2 (0.39)	2.6	.11	37.0 (1.15)	38.2 (1.02)	0.6	.12
EQ-5D	0.89 (0.01)	0.88 (0.01)	0.4	.04	0.59 (0.03)	0.59 (0.03)	0.02	.02
HA	5.9 (0.19)	7.8 (0.21)	45.9***	.44	14.7 (0.94)	18.3 (0.84)	7.8**	.44
RQ	6.4 (0.19)	7.8 (0.21)	22.4***	.31	13.6 (0.73)	15.3 (0.67)	2.9	.27
SAS	8.2 (0.14)	9.3 (0.15)	28.6***	.35	16.9 (0.67)	16.9 (0.60)	0.0	.00

M = mean; SE = standard error; [a] d = effect-size. *p < .05; **p < .01; ***p < .001. GHQ = General Health Questionnaire; IES =
Impact of Event Scale; CIS = Checklist Individual Strength; Fatigue = Checklist Individual Strength Subjective Fatigue; EQ-5D =
EuroQol-5 Dimensions; HA = Health Anxiety Scale; RQ = Reassurance Questionnaire; SAS = Somatosensory Amplification Scale

A repeated measures analysis was executed to trace the effect of the consultation
on changes in reassurance between baseline, post- and follow-up measurements
among the subgroup of participants who took part in the post-measurement. The
results show that while both residents and rescue workers reported increased reas-
surance scores (RQ) at the consultation after six weeks (Mean difference (SE): res-
cue workers 2.94(0.24); residents 4.62(0.83)), this effect was attenuated in the sub-
sequent weeks, and at the follow-up measurement their worries had increased again
(Mean difference (SE): rescue workers -1.47(0.16); residents -2.53(0.66)). All
effect-sizes of the changes in reassurance were small to medium.

Evaluation of medical examination
The subjective evaluation of the medical examination by residents and rescue work-
ers can be found in Table 4. Rescue workers judged the effects of participation in the
examination on their psychological and physical health more positively at the 6-
week visit (post measurement) than before (baseline) or afterwards (follow-up).
After 12 weeks residents indicated that participating in the examination had nega-
tively influenced their psychological and physical condition compared to the post
measurements. All effect-sizes were small. No significant differences were found

between baseline and post-test among the residents.

Most of the participants did not indicate that the medical examination had any impact on their psychological or physical condition at baseline, and more participants judged participation to have had a positive instead of negative impact on their health. Of note is that at baseline only about 2.5% of the residents and about 0.3% of the rescue workers indicated that the examination had had a very negative impact on their mental and/ or physical well-being (results not shown).

Table 4. Impact of participating in examination on physical and psychological condition

	Baseline M (SD)	Post-test M (SD)	Follow-up M (SD)	F (df)	Sign. Post-hoc	Baseline - post d [a]	Post – FU[b] d [a]
Rescue workers ($n = 514$)				(2, 1018)			
Physical condition	3.13 (0.5)	3.27 (0.5)	3.17 (0.5)	14.8***	Post > Baseline, FU[b]	.28	.20
Psychological condition	3.17 (0.5)	3.29 (0.6)	3.16 (0.5)	14.4***	Post > Baseline, FU[b]	.22	.24
Residents ($n = 74$)				(2, 144)			
Physical condition	3.51 (1.0)	3.40 (1.0)	3.08 (1.0)	5.6**	Baseline, Post > FU[b]	.11	.32
Psychological condition	3.37 (0.9)	3.37 (0.9)	3.07 (1.0)	3.5*	Baseline, Post > FU[b]	.00	.32

M = mean; SD = standard deviation; [a] d = effect-size; [b] FU = Follow-up. *p < .05; **p < .01; ***p < .001.

Stability and validity

In the absence of a control group, observed effects could reflect time trends and regression to the mean rather than true effects of the intervention. We therefore investigated whether the results of the present study were affected by time effects or selection-bias by studying the stability of the measurements across different time periods. Participants were included in the present study over a period of approximately 15 months and the order of appointments for the medical examination was not systematically predetermined. Measurements at baseline were divided over four equal time periods of almost four months for the rescue workers and the residents. In this way it was possible to investigate whether any systematic trends over the var-

ious time periods of including study participants could be observed. During the second time episode of the baseline measurement the rescue workers scored higher on fatigue, health anxiety and sensitivity to somatic sensations than the rescue workers during the other three episodes. In addition, residents during the last time episode showed more post-traumatic stress symptoms than residents during the first three time episodes. On all other measures no significant differences between time periods were found, neither in residents nor in rescue workers. These results make it rather unlikely that the present study results are due to systematic trends over time (e.g. a systematic worsening of symptoms and health concerns over time).

Participation in our study was voluntary. 417 rescue workers (19%) and 550 residents (62%) did participate in the individual medical examination, but not in our study. The main reasons not to participate were that the participants were children or were dependent on an interpreter because they did not have sufficient mastery of either Dutch or English to fill in the questionnaires. Because the GHQ, IES, and CIS were also part of the medical examination we were able to compare participants and non-participants on these measures. Non-participants in our study showed more signs of fatigue (CIS), psychopathology (GHQ) and post-traumatic stress symptoms (IES) than participants at the time of the individual medical examination (effect-sizes were small to medium).

In addition, there was no selective loss to follow-up of participants. The only difference between those that took part in the follow-up measurement and those that did not, was that the residents from the latter group at the time of the medical examination had a somewhat better quality of life (EQ-5D) (p=0.007, *d*=.33).

Discussion

The main question of this study was whether the large-scale provision of a medical examination to those involved in an aviation disaster with alleged exposure to hazardous chemicals will reduce persistent anxiety about health and subjective health complaints. We studied 339 individuals who lived close to the disaster site, and 1736 rescue workers who were professionally involved in the disaster. Our results do not suggest that a medical examination consistently results in fewer health complaints and worries in the aftermath of trauma. In both groups higher scores for somatosensory amplification and health anxiety were observed at 12-week follow-up suggesting that a medical examination may increase self-awareness of current physical and mental status and may have counterproductive effects by sensitizing participants for health complaints [34]. In rescue workers scores for reassurance by a physician and health-related quality of life were more positive at follow-up, however a similar effect was not observed in residents. On the contrary, in residents scores for post-

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traumatic stress symptoms at follow-up were even higher than at baseline.

Of note is that only about 50% of the participants made use of the possibility to discuss the results of their medical examination with the physician. In this subgroup scores for reassurance by medical information provided by a physician became more positive over time. However, as hypothesized this effect was more pronounced directly after the consultation and already had largely disappeared 6 weeks later. Nevertheless, health anxiety was more manifest at follow-up among participants that did not attend the consultation. Taken together, these data suggest that a medical examination in itself may not be very helpful. Without a vis-à-vis consultation, a medical examination may have the same inadvertent negative consequences as participation in an epidemiological study without seeing a physician may have [35].

The more positive results on reassurance in patients consulting a physician may be interpreted from what is known about the effects of consultations in medical practice. Results of studies in this area indicate that patients with medically unexplained physical symptoms need explanations for their symptoms rather than simple reassurance [13]. Possibly, the physicians in our study were successful in discussing the results of the medical examinations without reinforcing the opinion that complaints resulted from toxic exposure, while at the same time offering a more convincing alternative explanation (e.g. in terms of stress). Apparently undergoing a medical examination without this personal feedback is not as reassuring in itself.

The temporary nature of this reassuring effect resembles results of studies on medical screening. For example, Rimes and Salkovskis showed that women with a high level of health anxiety showed a short term decrease of anxiety after a favorable test result, but also that after three months health anxiety returned to the level of women with an unfavorable test result [15]. Earlier, in experimental as well as clinical studies it was already shown that participants with a high level of (health) anxiety react differently to reassurance or diagnostic feedback than participants with a low level of (health) anxiety [36,37]. This may also be the reason that overall residents were less reassured than rescue workers, because they manifested higher levels of (health) anxiety predictive of being less susceptible to reassuring medical information by physicians. A total of 63% of the residents and 26% of the rescue workers showed at baseline scores above the clinical cut-off value on the General Health Questionnaire, compared to approximately 27% in the normal population. Especially in residents with long-lasting health concerns and high levels of psychopathology more extensive and therapeutically oriented interventions based on cognitive-behavior therapy principles may be warranted [38,39].

Over the years considerable political and media attention was given to the disaster and its consequences, possibly continuously fuelling health anxiety and concerns [17]. During the examination participants were again confronted with the traumatic events that took place so many years ago and their sequelae. Directly after the med-

ical examination only a very small minority of residents and rescue workers however indicated that participation had had a very negative impact on their mental and physical functioning. Most of the participants were neutral or even moderately positive about their participation. We are not aware of previous studies assessing the impact of a medical examination on mental and physical well-being of disaster victims, but these results concur with results of studies of the risks and benefits of participating in trauma-focused research studies [e.g. 40,41]. These non-patient studies also show that only a small minority of participants do experience strong emotions or more distress than anticipated during the research protocol [42].

Strengths and limitations of the study
To our knowledge our study is unique in investigating the effects of a large-scale provision of a medical examination to people involved in an aviation disaster with alleged exposure to hazardous chemicals. Also, we were able to investigate two relatively large groups of rescue workers as well as residents living in the disaster area. Another strong point of the present study is its prospective design.

The time-lag of more than eight years between the disaster and the data-collection may raise questions concerning the relevance of the results. However, health concerns were still very prevalent [9,22], as has also been previously reported for survivors of (presumed) toxicological disasters [16]. On the other hand, because of the chronicity of the health complaints they may have been more difficult to influence, and it remains unknown what the results might have been if the intervention would have taken place earlier in time.

A second limitation is the uncontrolled nature of our study. In the absence of a control group all observed effects could reflect time trends and regression to the mean. We analyzed the possible influence of time trends by dividing baseline measurements in equal time periods however, and found no evidence for systematic changes in scores for anxiety about health or subjective complaints as a result of passage of time. Given the elevated or even higher scores for complaints and concerns at follow-up regression to the mean is also an unlikely alternative explanation of the present findings. As Norris et al. showed in a review study among 160 samples of disaster victims [1], the general rule was for samples to improve as time passed and symptoms predominantly declined, even with two to 15 years between the two measurements. This makes it likely that our study results can be attributed to participation in the medical examination, particularly because we found differences in outcome between participants that did and did not attend the consultation.

A final limitation concerns the fact that study participants volunteered to have their health checked by a medical doctor. As such, this self-selected group is likely biased because they were probably concerned about their health as a result of the disaster. In a recent study it was shown that the police officers who voluntarily

underwent the medical examination significantly more often reported health complaints and traumatic events than police officers who were invited to participate in an epidemiological study but did not take the medical examination [43]. Study results can therefore not be generalized to involved residents or rescue workers in general.

Conclusion

Offering a large-scale medical examination to people involved in a disaster does not result in long-lasting reassuring effects. Only those participants who personally discussed the results of their medical examination with a physician remained somewhat reassured. This underscores the potential value of a vis-à-vis consultation after a medical examination. Future studies must be more attentive to communication and interaction patterns between doctors and patients, which should promote a reattribution of symptoms and better tolerance for or management of symptoms.

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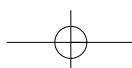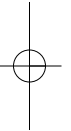
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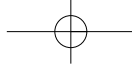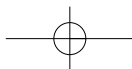
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