

Post- and peritraumatic stress in disaster survivors: an explorative study about the influence of individual and event characteristics across different types of disasters

Anna Grimm^{1*}, Lynn Hulse², Marek Preiss³ and Silke Schmidt¹

¹Department Health and Prevention, University of Greifswald, BRD, Greifswald, Germany;

²Fire Safety Engineering Group, University of Greenwich, Greenwich, UK; ³Prague Psychiatric Centre, Prague, Czech Republic

Background: Examination of existing research on posttraumatic adjustment after disasters suggests that survivors' posttraumatic stress levels might be better understood by investigating the influence of the characteristics of the event experienced on how people thought and felt, during the event as well as afterwards.

Objective: To compare survivors' perceived post- and peritraumatic emotional and cognitive reactions across different types of disasters. Additionally, to investigate individual and event characteristics.

Design: In a European multi-centre study, 102 survivors of different disasters terror attack, flood, fire and collapse of a building were interviewed about their responses during the event. Survivors' perceived posttraumatic stress levels were assessed with the Impact of Event Scale-Revised (IES-R). Peritraumatic emotional stress and risk perception were rated retrospectively. Influences of individual characteristics, such as socio-demographic data, and event characteristics, such as time and exposure factors, on post- and peritraumatic outcomes were analyzed.

Results: Levels of reported post- and peritraumatic outcomes differed significantly between types of disasters. Type of disaster was a significant predictor of all three outcome variables but the factors gender, education, time since event, injuries and fatalities were only significant for certain outcomes.

Conclusion: Results support the hypothesis that there are differences in perceived post- and peritraumatic emotional and cognitive reactions after experiencing different types of disasters. However, it should be noted that these findings were not only explained by the type of disaster itself but also by individual and event characteristics. As the study followed an explorative approach, further research paths are discussed to better understand the relationships between variables.

Keywords: *Emergency psychology; impact of event scale-revised; disaster; hazard; peritraumatic emotion; risk perception; posttraumatic stress*

For the abstract or full text in other languages, please see Supplementary files under Reading Tools online

Received: 17 June 2011; Revised: 29 March 2012; Accepted: 22 April 2012; Published: 28 May 2012

Mass crisis situations such as the 2004 Tsunami, the terrorist attacks in New York, London and Madrid, have had a massive impact on the survivors of these incidents (Galea et al., 2003; Kumar,

Murhekar, Subramanian, Ramachandran, & Gupte, 2007; Miguel-Tobal et al., 2006). Studies conducted on disasters have mainly investigated psychological impairment in the aftermath, such as stress-symptoms and

posttraumatic stress disorder (PTSD) diagnosis, depressive and anxiety disorders at an epidemiological level and their predictors (Galea et al., 2002; Schuster et al., 2001; Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002). The predictors include: Socio-demographic and individual factors, such as female gender (Schlenger et al., 2002), low socio-economic status (Kumar et al., 2007), age (Telles, Sing, & Joshi, 2009), migrant background (Rivière et al., 2008; Rubin, Brewin, Greenberg, Simpson, & Wessely, 2005) and a psychiatric diagnosis of the survivor before the event (Neria et al., 2006). Also, culture is believed to have an influence, on emotional and cognitive processing both during and after the disaster (Freitag, Grimm, & Schmidt, 2010; Steger, Frazier, & Zacchanini, 2008). Considering peritraumatic emotional and cognitive factors, (life) threat, loss of control, and fear have all been reported to be related to posttraumatic stress in cases of natural disasters such as the 2004 Tsunami and the 1999 Marmara earthquake, or in terror attacks such as those on the World Trade Center in 2001 (Basoglu, Kihk, Salcioglu, & Livanou, 2004; Basoglu, Salcioglu, & Livanou, 2002; Hollifield, Hewage, Gunawardena, Kodituwakku, & Weerathnege, 2008; Simeon, Greenberg, Knutelska, Schmeidler, & Hollander, 2003).

Furthermore, characteristics of the disaster, including exposure severity, injuries incurred, and the death of family members or friends during the event, have been found to predict psychological distress, depression and posttraumatic stress in different types of disasters (Galea et al., 2003; Johannesson et al., 2009; Wahlström, Michelsen, Schulman, & Backheden, 2008). Studies have also shown that stress symptoms may diminish the more time passes since the event, which has been demonstrated across a variety of disasters, and even in highly traumatized groups (Sundin & Horowitz, 2003).

Nevertheless, one important factor, the influence of the type of the disaster itself, has not been fully investigated yet. Although there is currently no consensus among experts on how to define a disaster, previous comparisons of different disasters have tended to categorize the events as man-made/technological vs. natural. For example, in a meta-analysis about the epidemiology of PTSD after disasters by Galea, Nandi, and Vlahov (2005), studied events were classified broadly into these two categories of disaster, with the conclusion that PTSD is higher after man-made/technological disasters than after natural disasters. However, such a general classification of disasters poses problems. Firstly, a strict isolation of natural vs. man-made disasters is very difficult. For example, even though the cause of a disaster is natural, such as an earthquake, the reason for the disruption can be man-made such as a weak building structure leading to a collapse of a building (Alexander, 2005). Secondly, characteristics of disasters such as their onset time or environmental stimuli e.g., fire, water, etc. may differ

considerably within these two categories. Therefore, the dichotomous classification “man-made/technological vs. natural” might be better used when considering, say, perceived culpability. Furthermore, there are some, among the social sciences, who would argue that the focus should not be so much on the hazard itself but on the negative consequences following the hazard. In other words, a disaster is an outcome of the vulnerability of society caused by the disruption of an event (Perry, 2007; Quarantelli, 2005). When considering the influence of the disaster type on post-and peritraumatic impact in the current study, it was decided that, given all the aforementioned problems surrounding what is a disaster, an operational definition of “disaster type” would be used, one that categorizes events in a less general way than done previously—that is, based on the direct cause of the negative consequences or disruption (i.e., fire, flood, terror attack, collapse of building)—and that disaster type would be investigated alongside other event and individual characteristics.

Another issue hindering comparisons of the impact of different disaster types is that studies have rarely used the same set of psychological instruments, and there have been sample differences between kinds of disasters. Thus, it is not entirely clear how different crisis situations, and especially which of their inherent characteristics, are relevant factors for the development of PTSD symptoms (Galea et al., 2005). Nor is it clear how these variables might influence survivors’ emotional and cognitive responses during the incident. This is why in the current study different types of disasters were assessed together using the same instruments, and with consideration to the cultural diversity in the sample tested. The sample was drawn from residents of the seven participating centres’ countries. This would allow for a cross-cultural comparison, with country of residence acting as a proxy for culture. However, the participants had to have experienced the disaster in their country of residence. This was so as to avoid possible confounds; experiencing a disaster in a foreign country could lead to increased trauma due to victims not being at home and thus not being familiar with the national emergency services or being exposed to cultural differences in disaster response. On the other hand, experiencing a disaster abroad could have the opposite effect also, as victims would not be confronted with a major loss of property/housing or disruption to their daily routines to the same extent than if they had been at home.

Objective

We hypothesize that the type of disaster, and thus the investigation of its unique characteristics, are important for a better understanding of perceived post- and peritraumatic stress levels in survivors. Additionally personal and situational characteristics are also likely to play a role

in how survivors think and feel during the event. Therefore, in this exploratory study, a selection of individual characteristics (gender, education, age), event characteristics (time since event, fatalities, injuries), peritraumatic emotional and cognitive factors (emotional stress, risk perception) and posttraumatic stress symptoms were assessed across different types of disasters, with data collected from several countries.

Method

The study described in this paper is part of a larger cross-cultural multi-centre research project called BeSeCu (Behaviour, Security, Culture), with the following centres participating: Greifswald, Germany; London, UK; Barcelona, Spain; Warsaw, Poland; Hamburg, Germany; Prague, Czech Republic; Stockholm, Sweden and Izmir, Turkey. The study was approved by all national institutional ethics committees.

Events

Of interest were emergency events that met the following criteria: (1) occurred within approximately 10 years prior to the research interview, concentrated in a particular time and space; (2) concerned an identifiable hazard that posed a physical threat but of a non-infectious kind (i.e., excluding emergency events such as epidemics); (3) the threat was posed to many lives and/or property; (4) the emergency services attended the scene; and (5) a full or partial evacuation of the affected structure(s) was attempted, either by the victims or by official agents. A variety of events occurring in the participating centres' countries met the above criteria: i.e., Czech Republic floods in 2002; collapse of buildings such as the Katowice Trade Hall roof collapse in Poland, 2006 and the collapse of a multi-storey residential building in Spain, 2006; severe fires in multi-storey residential or public buildings across Europe such as the Gothenburg discotheque fire in Sweden, 1998 or a fire in a Hamburg hospital in Germany, 2007; and the 7/7 London bombings in the UK, 2005.

Overall, the average time elapsed since the event was 3.86 years. Most injuries (around half of the participants) had incurred during terror attacks and collapses of buildings. In fires, about 25% and in floods about 10% of participants were injured. Fatalities during the incidents in the direct surrounding of participants were reported in all cases of terrorist attack and collapse of a building and in nearly half of all fire events. Floods were reported as having caused no fatalities in the surrounding of the interviewed victims.

Participants

Recruitment was performed in each centre separately, using a combination of word-of-mouth campaigns and advertising campaigns conducted via the media, self-help

groups and the emergency services. Adult survivors were invited to contact the researchers if they wished to take part in an interview. Participation was restricted to persons who had directly experienced the emergency event—bystanders and relatives of victims were excluded. Also excluded were persons who had survived incidents which turned out not to match all of the aforementioned event criteria. Finally, four participants were excluded due to the fact that the respective disasters did not happen in any of the countries of the participating centres. This left a total of 102 participants in the study. There was an almost even split of females (51.4%) and males (48.6%). Mean age was 49.58 years ($SD = 14.15$). Concerning education, 25.3% of all participants had a university degree, 21.8% were educated to only primary level and 43.7% to secondary education level. The remaining 9.2% had added further education qualifications. Eleven percent of participants had a migrant background but no significant differences were found between migrants and natives regarding gender, age, education, or event type.

Measures and procedure

When participants agreed to take part in the study, a comprehensive interview was conducted about emotional, behavioural, and cognitive responses during the disaster (results of the content of survivors' narratives can be found in Grimm, Hulse, Preiss, & Schmidt, *in press*). Furthermore, a set of psychological instruments were applied and socio-demographic and incident-related characteristics were assessed. The interview procedure borrowed techniques from the cognitive interview (Fisher & Geiselman, 1992) to help participants mentally recreate the past event; the entire interview lasted on average 90 min. After revisiting the event in the interview, participants were asked to retrospectively rate their emotional stress and risk perception at the stage when they realized that they were actually experiencing a disaster. They did this on a 4-point scale with zero indicating no stress/ risk and four indicating high stress/ risk. Asking participants to retrospectively rate their emotions and cognitions a few years after they experienced them is not ideal as their current state and beliefs could bias their recollections of past states (Robinson & Clore, 2002). Nevertheless, there is research which indicates that memory for emotion-related experiences is more resistant to decaying over time (e.g., Burke, Heuer, & Reisberg, 1992; Ritchey, Dolcos, & Cabeza, 2008). Furthermore, there is some experimental evidence that retrospective ratings, at least of emotion, might provide reasonable approximations of momentary ratings (Barrett, 1997). In addition, it was expected that the interview and its context reinstatement memory aids would make the relevant past states more accessible. Thus, while bearing the potential for recall-related biases in mind, the emo-

tional stress and risk ratings were included to explore peritraumatic states.

Current posttraumatic stress was assessed with the Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997) which is employed in order to assess current subjective distress for any specific life event. Also, the IES-R is a widely used measure of posttraumatic stress with satisfactory psychometric properties (Joseph, 2000; Sundin & Horowitz, 2003). It was administered prior to the interview, in order to avoid event recall potentially influencing responses about current state, and was provided in nationally validated versions (Baguena et al., 2001; Juczyński & Ogińska-Bulik, 2009; Maercker & Schützwohl, 1998; Preiss et al., 2004; Sveen et al., 2010). Missing cases on the IES-R (four single items) were calculated using a regression model.

Statistical analysis

In order to detect effects of individual and event characteristics on post- and peritraumatic outcome variables, separate multiple regressions with simultaneous inclusion of predictors were run with IES-R total scores, peritraumatic emotional stress and risk perception as outcome variables. Where reference categories were required, the group with the largest membership was used as the reference (i.e., Education₂, Fire). Before including predictors, correlations between variables were calculated. As none of the variables were highly correlated, all could be included as predictors. Due to the incidence rates of certain disasters varying in different geographical regions, culture was confounded in some cases with type of event. As fires were common across all BeSeCu countries, preliminary analyses of variance were conducted for the IES-R, emotional stress and risk outcomes of fire survivors with culture as the independent variable. Similarly, a series of *t*-tests were conducted on the outcomes of Polish vs. Spanish survivors of collapses of buildings. No significant differences were found on these assessments (all *ps* > 0.17), therefore culture was omitted as a variable from any further analysis.

While the main purpose of the paper was to explore the relationships between the individual and event characteristics and each of the peri- and posttraumatic outcomes, it was nevertheless of interest to also examine the

relationship between the three outcomes. Thus, in addition to the regressions, correlations and a MANCOVA were conducted and followed up with discriminant analysis and canonical correlation analysis. All statistical analyses were conducted with PASW version 18.0.7.

Results

Descriptive results

Mean total IES-R scores plus mean scores of peritraumatic emotional stress and risk perception are shown across different types of disasters in Table 1.

Effects of individual and event characteristics on post- and peritraumatic outcome variables

The individual characteristics gender, age, education and the event characteristics time since event, injuries, fatalities, plus type of event were entered into the regression models simultaneously. The results for the outcome variables posttraumatic stress, peritraumatic emotional stress and peritraumatic risk perception are shown in Tables 2, 3 and 4 respectively. The predictors explained most variance in the assessment of posttraumatic stress ($R^2 = 0.59$ [adjusted $R^2 = 0.54$]), then in the assessment of peritraumatic emotional stress ($R^2 = 0.56$ [adjusted $R^2 = 0.48$]), followed by the assessment of peritraumatic risk perception ($R^2 = 0.42$ [adjusted $R^2 = 0.32$]). While type of event was always a significant predictor, the variables gender and education only predicted two measures each (IES-R scores/emotional stress and emotional stress/risk perception respectively), and injuries, time since event and fatalities were only significant predictors of single measures (the first IES-R scores, the latter two emotional stress).

Relationship between outcome variables across different types of disasters

All outcome variables were significantly intercorrelated; IES-R scores were correlated more highly with peritraumatic emotional stress ($r = 0.49$, $p = 0.000$) than with risk perception ($r = 0.28$, $p = 0.01$). The highest correlation was between the two peritraumatic variables ($r = 0.69$, $p = 0.000$). Given these findings, a MANCOVA was run and confirmed that, even when the relationships between IES-R scores, peritraumatic emotional stress and risk

Table 1. Mean IES-R total, peritraumatic emotional stress, and peritraumatic risk perception scores (and SDs), all across different types of disasters

Scale (range)	All	Fire	Flood	Collapse	Terror attack
Total IES-R (0–96)	30.78 (21.85)	37.94 (21.63)	16.34 (12.93)	54.80 (14.91)	27.62 (15.54)
Emotional stress (0–4)	2.39 (1.02)	2.33 (0.76)	2.14 (0.97)	3.33 (0.82)	3.69 (0.59)
Risk perception (0–4)	2.35 (1.08)	2.26 (0.90)	2.09 (0.99)	2.22 (1.39)	4.00 (0.00)

Table 2. Regression results showing individual and event characteristic predictors of IES-R total scores

	B	SE B	β	T	p
Constant	69.28	14.29	–	4.85	0.000
Gender ^a	7.71	3.25	0.18	2.37	0.02
Age	–0.02	0.12	–0.01	–0.16	0.88
Education ₁ ^b	8.26	4.88	0.14	1.69	0.09
Education ₃ ^b	–3.25	4.43	–0.06	–0.73	0.47
Education ₄ ^b	–1.82	6.10	–0.02	–0.30	0.77
Time since event	–0.00	0.00	–0.08	–0.80	0.43
Injuries ^c	–19.55	4.39	–0.40	–4.46	0.000
Fatalities	–4.14	5.36	–0.09	–0.77	0.44
Flood ^d	–16.15	5.54	–0.35	–2.92	0.01
Terror attack ^d	–16.53	6.69	–0.21	–2.47	0.02
Collapse ^d	10.96	5.44	0.18	2.02	0.05

^aGender *M*(*SD*): Female 35.90(23.11); Male 28.00(20.34).

^bReference category: Education₂.

^cInjuries *M*(*SD*): Yes 50.37(20.43); No 25.01(18.31).

^dReference category: Fire.

perception were taken into account, type of event still had a significant effect on all three outcome variables, Pillai's Trace = 0.59, $F(9, 108) = 2.91$, $p = 0.004$. The MANCOVA was followed up with a discriminant analysis, using type of event as the grouping variable and the post- and peritraumatic outcome variables as independents. This analysis revealed three discriminant functions. The first function explained 51% of the variance (cano-

Table 3. Regression results showing individual and event characteristic predictors of peritraumatic emotional stress

	B	SE B	β	T	p
Constant	3.19	0.91	–	3.51	0.001
Gender ^a	0.60	0.19	0.30	3.11	0.003
Age	–0.01	0.01	–0.13	–1.44	0.16
Education ₁ ^b	0.64	0.26	0.26	2.52	0.01
Education ₃ ^b	0.15	0.24	0.07	0.61	0.55
Education ₄ ^{b,c}	–0.30	0.41	–0.07	–0.72	0.48
Time since event	0.00	0.00	–0.28	–2.22	0.03
Injuries	0.03	0.28	0.01	0.09	0.93
Fatalities ^d	–0.70	0.35	–0.33	–2.01	0.05
Flood ^e	0.43	0.30	0.21	1.41	0.16
Terror attack ^e	1.12	0.37	0.35	3.00	0.004
Collapse ^e	1.00	0.45	0.28	2.23	0.03

^aGender *M*(*SD*): Female 2.77(1.00); Male 2.16(0.91).

^bReference category: Education₂.

^cEducation *M*(*SD*): Primary 2.79(1.12); Secondary 2.28(0.93); Tertiary 2.69(1.03); Further 2.00(0.82).

^dFatalities *M*(*SD*): Yes 3.22(0.78); No 2.12(0.90).

^eReference category: Fire.

nical $R^2 = 0.36$), the second explained 46% (canonical $R^2 = 0.34$), and the third only 3% (canonical $R^2 = 0.03$). In combination, these three discriminant functions significantly differentiated event types, Wilk's Lambda = 0.42, $X^2(9) = 55.03$, $p = 0.000$. When the first function was removed, the second and third functions together were still able to significantly differentiate event types, Wilk's Lambda = 0.65, $X^2(4) = 27.40$, $p = 0.000$. However, the third function on its own was not able to significantly differentiate the groups, Wilk's Lambda = 0.97, $X^2(1) = 1.80$, $p = 0.18$. The correlations between the outcomes and the discriminant functions revealed the following: IES-R scores loaded extremely highly on the first function ($r = 0.95$) but far less on the second and third functions ($r = 0.11$ and $r = 0.28$, respectively); emotional stress loaded very highly on the second function ($r = 0.85$) but more moderately on the first and third functions ($r = 0.41$ and $r = -0.33$, respectively); and risk perception loaded very highly on the second function ($r = 0.88$), moderately on the third function ($r = 0.48$) and almost negligibly on the first function ($r = 0.06$). The group centroids demonstrated that the first function discriminated the event flood from the events fire, terror attack and collapse of a building, the second function discriminated the event terror attack from the events fire, flood and collapse of a building, while the third function discriminated the events fire and terror attack from the events flood and collapse of a building.

Discussion

The current exploratory study is one of the first to compare perceived post- and peritraumatic stress levels of survivors across different types of disasters. Terror attacks, although rated by the public as a high-impact disaster for survivors (Grimm, Hulse, & Schmidt, 2009), was not the disaster evoking the highest posttraumatic stress here. However, unexpectedly high levels of post-traumatic stress were found in this study for collapses of a shopping centre in Katowice and a residential building in Barcelona, and also for fires in residential and public buildings across a number of locations. Considering peritraumatic responses, participants who experienced terror attacks reported the highest levels of emotional stress and risk perception.

At a first glance, the man-made/technological disasters in this sample had a greater post-event influence than did the (single) natural disaster, which is consistent with Galea et al.'s (2005) meta-analysis findings. However, as argued in the introduction, we believe that researchers should take a closer look at event type, beyond this general classification, and that the characteristics of events may better explain these findings. The natural disaster flood was the only event with a long onset; victims were warned about the upcoming threat and able to take

Table 4. Regression results showing individual and event characteristic predictors of peritraumatic risk perception

	<i>B</i>	SE <i>B</i>	β	<i>T</i>	<i>p</i>
Constant	3.77	1.05	–	3.60	0.001
Gender	0.09	0.22	0.04	0.40	0.69
Age	0.00	0.01	0.05	0.47	0.64
Education ^a ₁	0.57	0.31	0.20	1.82	0.07
Education ^a ₃	–0.61	0.29	–0.24	–2.07	0.04
Education ^{a,b} ₄	–0.63	0.50	–0.13	–1.27	0.21
Time since event	0.00	0.00	–0.26	–1.79	0.08
Injuries	–0.34	0.32	–0.13	–1.07	0.29
Fatalities	–0.50	0.37	–0.22	–1.34	0.19
Flood ^c	0.29	0.38	0.13	0.76	0.45
Terror attack ^c	1.65	0.46	0.44	3.56	0.001
Collapse ^c	–0.51	0.44	–0.15	–1.18	0.24

^aReference category: Education₂.

^bEducation *M*(*SD*): Primary 2.64(0.78); Secondary 2.25(1.11); Tertiary 2.22(1.26); Further 1.75(0.96).

^cReference category: Fire.

safety measures which might have resulted in them scoring the lowest in post- and peritraumatic stress. Furthermore, significant differences were found between different types of man-made/technological disasters, which suggest that they might not necessarily have equivalent effects. With regards to the environmental cues of the disaster, we know from the interviews conducted in this study that survivors of disasters with sudden violent cues, such as explosions, reported significantly higher posttraumatic stress (Grimm et al., in press). As such cues characterized the terror attacks and collapses of buildings, it might also explain their survivors' high ratings on the peritraumatic variables.

When taking a look at the influence of predictor variables on post- and peritraumatic stress, the type of event significantly explained variance in all three measures. This was in accordance with our hypothesis. The moderating effect of time on PTSD is well established (Sundin & Horowitz, 2003), therefore our finding that only the rating of peritraumatic emotional stress altered with time passing was unexpected. However, the fact that the score of the peritraumatic measure lowered with time is important to note and suggests that the events were even more stressful originally than was reported here.

The influence of the individual characteristic female gender was related to higher peritraumatic and posttraumatic stress but not to higher risk perception. Regarding the influence of gender on PTSD, current research studies have not come to a definite conclusion. In Sundin & Horowitz (2003) meta-analysis about the use of the IES-R, gender was, in comparison to the type of traumatic event, relatively insignificant. However, it needs to be considered that this meta-analysis included all types of

traumatic events, not just disasters. Brewin, Andrews, and Valentine (2000) found in their meta-analysis that female gender is a modest risk factor for PTSD. When the type of traumatic event was taken into account, studies of disasters showed the lowest impact of gender in comparison to studies of other non-combat/war events. Regarding the present study's results for other socio-demographic factors, age had no significant influence either on post- or on peritraumatic stress, while education had a little influence on both peritraumatic variables. Meta-analysis results have revealed that age and education effects on posttraumatic stress can be smaller or less consistent in certain groups (Brewin et al., 2000) and this may in part account for the results here.

Although Koren, Hemel, and Klein (2006) suggest in their review article that peritraumatic factors such as perceived threat to one's life during the trauma are increased by bodily injuries incurred during the traumatic event, being injured did not have a significant effect on the peritraumatic variables here. However, a significant relationship was established between posttraumatic stress and being injured during a disaster. Koren et al. (2006) have concluded that PTSD symptoms increase if survivors are injured during a traumatic event, but that the relationship between PTSD and injuries is a complex one, which can be further explained by the factors pain, disfigurement, social isolation, hospitalization and medical procedures; factors that were not considered in this study. Other event characteristics, such as fatalities, were related to higher peritraumatic emotional stress but not to posttraumatic stress in the current study. In an investigation of Bloody Sunday, Shevlin and McGuigan (2003) found highest IES-R mean scores in the immediate family of victims who lost their lives. In our sample there were no reports of losing family members, however there were reports of other fatalities occurring during the event. Johannesson et al. (2009) found that both types of death exposure, the loss of relatives and seeing many dead bodies, contributed to posttraumatic distress after the Tsunami in 2004. Therefore we believe that this variable is of relevance. However, it is likely that the magnitude of exposure to dead bodies was lower in our studied disasters than in the Tsunami of 2004.

Previous research has found negative peritraumatic emotional and cognitive states (e.g., fear, thinking one's life is in danger, loss of control, dissociation) to be good predictors of posttraumatic stress (Basoglu et al., 2002; Basoglu et al., 2004; Hollifield et al., 2008; Ozer, Best, Lipsey, & Weiss 2003; Simeon et al., 2003). Thus, we are left with the question of why in this study events that, according to self-reports, evoked the highest stress and perceived risk at the time did not lead onto the highest level of later stress. The correlations revealed that the outcome variables were positively related to one another but to differing extents. While the peritraumatic measures

were quite closely related—perhaps understandably, given they share a moment in time—and current posttraumatic stress and peritraumatic emotional stress were moderately related, peritraumatic risk perception was not so strongly related to current posttraumatic stress. These results suggest that some aspect(s) of the emotional states experienced during the event may carry over and/or be shared with a survivor's later current state but that the perceived risk at the time of the event may not inevitably induce a stressful state for some time to come afterwards. It could be argued that a realistic appraisal of risk during the situation, irrespective of whether the risk was perceived as high or low, might help in dealing with the circumstances afterwards. Alternatively, the effect of perceived risk might be moderated by the survivors' coping strategies (or lack of).

The discriminant analysis looked into the relationships between the outcome variables further, in the context of their ability to discriminate type of event. The analysis revealed three discriminant functions. The IES-R loaded the most on the first function while emotional stress loaded more moderately and risk perception barely at all. This function accounted for most variance. In contrast, the two peritraumatic measures loaded highly on the second function (which accounted for slightly less variance) and the IES-R made little contribution here. Risk perception was the measure that loaded most on the third function but this function was not good, at least not on its own. Of note, each function differentiated event types differently. These findings then provide further evidence that, despite being related, the three outcome measures are not simply interchangeable. It appears that when assessing the effects of different types of event on disaster survivors measuring peritraumatic states can be useful as can measuring posttraumatic states, but a better assessment is achieved when the relative contribution of each state is combined.

Ultimately, several limitations of this study have to be taken into account. It has to be remembered that the IES-R, although a good indicator of posttraumatic stress, was not used to diagnose PTSD and several predictors relevant for the psychological outcome of survivors, such as pre-event psychological morbidity and peritraumatic detachment, were therefore not included. Thus, how our findings fit within what is already known about predictors of actual PTSD requires further research. As commonly reported in disaster research, recruitment strategy and inclusion criteria led to a purposive sample (Stallings, 2007). This means that the different sample sizes per disaster were affected somewhat by the different incidence rates of each disaster type across Europe, which also led to the fact that the variables type of event and culture were somewhat confounded. One of the strengths of the study, to only include survivors of real life-threatening events, has as a consequence reduced the

overall sample size even further and contributed to the uneven sample sizes across events. Both issues have meant a reduction in the power of the study and might prohibit a generalization of the presented findings. Finally, Steger et al. (2008) found terrorism worries significantly differed between Spanish and American students. This was not entirely explained by symptoms of PTSD or exposure to terror attacks, instead indicating cultural differences. Although we did not find any influence of culture on perceived post- and peritraumatic stress levels, tendencies for cross-cultural differences in talking about the traumatic event in this sample have been reported elsewhere (Freitag et al., 2010), and thus evidence would suggest that culture should remain a consideration in this field of research. For future studies with larger, more heterogeneous samples it might be worth operationalizing the variable culture not as country of residence but as a function of other cultural aspects such as race (Norris, Perilla, Ibanez, & Murphy, 2001); many countries in Western Europe are common in this respect and this might also explain our non-significant findings for culture.

Conclusion

In conclusion, an explorative approach was taken to study post- and peritraumatic reactions to different types of disasters, including a test of the influence of a selection of individual and event characteristics. The results suggest that the type of event people experience with its specific situational factors has an influence on post- and peritraumatic reactions. Therefore two future research paths are suggested: the first would be to replicate and extend this study with a larger sample, still using a methodology that allows for direct comparisons across different types of disasters. Such a study would benefit from including more individual and event characteristics (e.g., being trapped during the event, social affiliation, etc.) and examining their relative effects on post- and peritraumatic outcomes but also their relative prevalence in each type of event. Secondly, as our results showed, people's emotions and cognitions during the event may be influenced by disaster characteristics, just as their emotions and cognitions may be affected afterwards. Therefore we believe that it is worth having a closer look at event characteristics and how these interact with individuals' peritraumatic responses. We know from interviews with survivors of disasters that survivors with lower current posttraumatic stress were more often able to actively manage their escape by preparing for evacuation or contacting emergency services in order to plan their rescue or seek information about how to behave (Grimm et al., in press). Also, social affiliation and the place people are in at the moment of the disaster could be relevant factors in the influence of the type of event. Prati, Catufi, and Pietrantonio (2012) showed that persons

who were in the company of their families were less likely to flee the endangered place as being in their homes during the disaster was also related to a higher feeling of safety. Therefore we believe that an inclusion of peritraumatic behavioural responses during disasters will further understanding of post- and peritraumatic stress.

Acknowledgement

The paper was written by Anna Grimm, Lynn Hulse, Marek Preiss and Silke Schmidt on behalf of the BeSeCu-group. The project BeSeCu (contract 218324) is funded under the European Union Framework 7 Security initiative. The authors acknowledge the co-operation of their project partners: Ernst-Moritz-Arndt University Greifswald, Department of Health and Prevention, Germany (project co-ordinator); University of Greenwich, FSEG, UK; Institute of Public Security of Catalunya, Spain; Hamburg Fire and Emergency Service Academy, Germany; MTO Psykologi, Sweden; Prague Psychiatric Centre, Czech Republic; Main School of Fire Service, Poland; Hamburg Fire and Emergency Service Academy, Germany and Association of Emergency Ambulance Physicians, Turkey; University of Bologna, Italy; in undertaking this work and in allowing the project findings to be published.

Conflict of interest and funding

There is no conflict of interest in the present study for any of the authors.

References

- Alexander, D. (2005). An interpretation of disaster in terms of changes in culture, society and international relations. In R. W. Perry, & E. L. Quarantelli (Eds.), *What is a disaster – New Answers to old Questions* (pp. 25–38). Philadelphia: Xlibris Corporation.
- Baguena, M., Villarroya, E., Belena, A., Diaz, A., Roldan, C., & Reig, R. (2001). Propiedades psicometricas de la version espanola de la Escala Revisada de Impacto del Estresor (EIE-R) [Psychometric properties of the Spanish version of the Impact of Event Scale—Revised (IES-R)]. *Analisis y Modificacion de Conducta*, 27, 581–604.
- Barrett, L. F. (1997). The relationships among momentary emotion experiences, personality descriptions, and retrospective ratings of emotion. *Personality & Social Psychology Bulletin*, 23(10), 1100–1110.
- Basoglu, M., Kihk, C., Salcioglu, E., & Livanou, M. (2004). Prevalence of post-traumatic stress disorder and comorbid depression in earthquake survivors in Turkey: An epidemiological study. *Journal of Traumatic Stress*, 17(2), 133–141.
- Basoglu, M., Salcioglu, E., & Livanou, M. (2002). Traumatic stress response in earthquake survivors in Turkey. *Journal of Traumatic Stress*, 15(4), 269–276.
- Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, 68(5), 748–766.
- Burke, A., Heuer, F., & Reisberg, D. (1992). Remembering emotional events. *Memory and Cognition*, 20(3), 277–290.
- Fisher, R. P., & Geiselman, R. E. (1992). *Memory-enhancing techniques for investigative interviewing: The cognitive interview*. Springfield, IL: Charles C Thomas.
- Freitag, S., Grimm, A., & Schmidt, S. (2010). Talking about traumatic events: A cross-cultural investigation. *Europe's Journal of Psychology*, 1, 40–61.
- Galea, S., Ahern, J., Resnick, H., Kilpatrick, D., Bucuvalas, M., Glod, J., et al. (2002). Psychological sequelae of the September 11 terrorist attacks in New York City. *New England Journal of Medicine*, 346(13), 982–987.
- Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of posttraumatic stress disorders after disasters. *Epidemiologic Reviews*, 27, 78–91.
- Galea, S., Vlahov, D., Resnick, H., Ahern, J., Susser, E., Gold, J., et al. (2003). Trends of probable posttraumatic stress disorder in New York City after the September 11 Terrorist Attacks. *American Journal of Epidemiology*, 158(6), 514–524.
- Grimm, A., Hulse, L., Preiss, M., & Schmidt, S. (in press). Behavioural, cognitive and emotional responses in European disasters: Results of survivor interviews. *Disasters: The Journal of Disaster Studies, Policy and Management*.
- Grimm, A., Hulse, L., & Schmidt, S. (2009). Risk perception and psychological reactions in public crisis situations using the example of terror attacks. *Bundesgesundheitsblatt*, 52(12), 1129–1140.
- Hollifield, M., Hewage, C., Gunawardena, C. N., Kodituwakku, P., & Weerathnege, K. (2008). Symptoms and coping in Sri Lanka 20–21 months after the 2004 Tsunami. *The British Journal of Psychiatry*, 192, 39–44.
- Johannesson, K. B., Michel, P.-O., Hultman, C. M., Lindam, A., Arnberg, F., & Lundin, T. (2009). Impact of exposure to trauma on posttraumatic stress disorder symptomatology in Swedish Tourist Tsunami survivors. *The Journal of Nervous and Mental Diseases*, 197(5), 316–323.
- Joseph, S. (2000). Psychometric evaluation of Horowitz's Impact of Event Scale: A review. *Journal of Traumatic Stress*, 13(1), 101–113.
- Juczyński, Z., & Ogińska-Bulik, N. (2009). Pomiar zaburzeń po stresie traumatycznym—polska wersja Zrewidowanej Skali Wpływu Zdarzeń. *Psychiatria*, 6(1), 15–25.
- Koren, D., Hemel, D., & Klein, E. (2006). Injury increases the risk of PTSD: An examination of potential neurobiological and psychological mediators. *CNS Spectrums*, 11(8), 616–624.
- Kumar, M. S., Murhekar, M. V., Subramanian, T., Ramachandran, V., & Gupte, M. D. (2007). Prevalence of posttraumatic stress disorder in a coastal fishing village in Tamil Nadu, India, after the December 2004 Tsunami. *American Journal of Public Health*, 97(1), 99–101.
- Maercker, A., & Schützwohl, M. (1998). Assessing the psychological sequelae of stress: The Impact of Event Scale-Revised Version (IES-R). *Diagnostica*, 44, 130–141.
- Miguel-Tobal, J. J., Cano-Vindel, A., Gonzales-Ordi, H., Iruarrizaga, I., Rudenstine, S., Vlahov, D., et al. (2006). PTSD and depression after the Madrid March 11 train bombings. *Journal of Traumatic Stress*, 19, 69–80.
- Neria, Y., Gross, R., Olfson, M., Gameroff, M. J., Wickramaratne, P., Das, A., et al. (2006). Posttraumatic stress disorder in primary care one year after the 9/11 attacks. *General Hospital Psychiatry*, 28(3), 213–222.
- Norris, F. H., Perilla, J. L., Ibanez, G. E., & Murphy, A. D. (2001). Sex differences in symptoms of posttraumatic stress: Does culture play a role? *Journal of Traumatic Stress*, 14(1), 7–28.
- Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin*, 129(1), 52–73.
- Perry, R. W. (2007). What is a disaster? In H. Rodriguez, E. L. Quarantelli, & R. R. Dynes (Eds.), *Handbook of disaster research* (pp. 1–15). New York, NY: Springer.

- Prati, G., Catufi, V., & Pietrantonio, L. (2012). The Umbria-Marche earthquake: Emotional and behavioral reactions to earth tremors. *Disasters: The Journal of Disaster Studies, Policy and Management*. DOI: 10.1111/j.1467-7717.2011.01264.x
- Preiss, M., Mohr, P., Kopeček, M., Melanová, V., Janečka, V., Rodriguez, M., et al. (2004). Trauma a stress osm měsíců po povodních v roce 2002. *Psychiatrie*, 8, 180–186.
- Quarantelli, E. L. (2005). A social science research agenda for the disasters of the 21st century: Theoretical, methodological and empirical issues and their professional implementation. In R. W. Perry, & E. L. Quarantelli (Eds.), *What is a disaster—New answers to old questions* (pp. 325–396). Philadelphia, PA: Xlibris Corporation.
- Ritchey, M., Dolcos, F., & Cabeza, R. (2008). Role of amygdala connectivity in the persistence of emotional memories over time: An event-related fMRI investigation. *Cerebral Cortex*, 18, 2494–2504.
- Rivière, S., Schwoebel, V., Lapierre-Duval, K., Guinard, A., Gardette, V., & Lang, T. (2008). Predictors of symptoms of posttraumatic stress disorder after the AZF chemical factory explosion on 21 September 2001 in Toulouse, France. *Journal of Epidemiology and Community Health*, 62, 455–460.
- Robinson, M. D., & Clore, G. L. (2002). Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychological Bulletin*, 128(6), 934–960.
- Rubin, G. J., Brewin, C. R., Greenberg, N., Simpson, J., & Wessely, S. (2005). Psychological and behavioural reactions to the bombings in London on 7 July 2005: Cross sectional survey of a representative sample of Londoners. *British Medical Journal*, 331(7517), 606–611.
- Schlenger, W. E., Caddel, J. M., Ebert, L., Jordan, K., Rourke, K. M., Wilson, D., et al. (2002). Psychological reactions to terrorist attacks: Findings from the National Study of Americans' Reactions to September 11. *Journal of the American Medical Association*, 288(5), 581–588.
- Schuster, M. A., Bradley, D. S., Jaycox, L. H., Collins, R. L., Marshall, G. N., Elliot, M. N., et al. (2001). A national survey of stress reactions after the September 11, 2001, terrorist attacks. *New England Journal of Medicine*, 345(20), 1507–1512.
- Shevlin, M., & McGuigan, K. (2003). The long-term psychological impact of Bloody Sunday on families of the victims as measured by The Revised Impact of Event Scale. *British Journal of Clinical Psychology*, 42, 427–432.
- Silver, R. C., Holman, A., McIntosh, D. N., Poulin, M., & Gil-Rivas, V. (2002). Nationwide longitudinal study of psychological responses to September 11. *Journal of the American Medical Association*, 288(10), 1235–1244.
- Simeon, D., Greenberg, J., Knutelska, M., Schmeidler, J., & Hollander, E. (2003). Peritraumatic reactions associated with the World Trade Centre Disaster. *American Journal of Psychiatry*, 160, 1702–1705.
- Stallings, R. A. (2007). Methodological issues. In H. Rodriguez, E. L. Quarantelli, & R. R. Dynes (Eds.), *Handbook of disaster research* (pp. 55–82). New York, NY: Springer.
- Steger, M. F., Frazier, P. A., & Zaccanini, J. L. (2008). Terrorism in two cultures: Stress and growth following September 11 and the Madrid Bombings. *Journal of Loss and Trauma*, 13, 511–527.
- Sundin, E., & Horowitz, M. (2003). Horowitz Impact of Event Scale Evaluation of 20 years use. *Psychosomatic Medicine*, 65, 870–876.
- Sveen, J., Low, A., Dyster-Aas, J., Ekselius, L., Willebrandt, M., & Gerdin, B. (2010). Validation of a Swedish version of the Impact of Event Scale-Revised (IES-R) in patients with burns. *Journal of Anxiety Disorders*, 24, 618–622.
- Telles, S., Singh, N., & Joshi, M. (2009). Risk of posttraumatic stress disorder and depression in survivors of the floods in Bihar, India. *Indian Journal of Medical Sciences*, 63, 330–334.
- Wahlström, L., Michelsen, H., Schulman, A., & Backheden, M. (2008). Different types of exposure to the 2004 Tsunami are associated with different levels of psychological distress and posttraumatic stress. *Journal of Traumatic Stress*, 21(5), 463–470.
- Weiss, D. S., & Marmar, C. R. (1997). The impact of event scale-revised. In J. P. Wilson, & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399–411). New York, NY: Guilford Press.

***Anna Grimm**

Department Health and Prevention
 Institute of Psychology
 University of Greifswald
 Robert-Blum-Straße 13
 DE-17487 Greifswald
 Germany
 Tel: 49-3834-86-3800
 Fax: 49-3848-86-3801
 Email: gesundheit.praevention@uni-greifswald.de