



The impact of disaster work on community volunteers: The role of peri-traumatic distress, level of personal affectedness, sleep quality and resource loss, on post-traumatic stress disorder symptoms and subjective health



Sigrídur B. Thormar^{a,*}, Berthold P.R. Gersons^b, Barbara Juen^c, Maria Nelden Djakababa^d, Thorlakur Karlsson^e, Miranda Olff^{b,d}

^a Center for Anxiety Disorders, Department of Psychiatry, Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands

^b Arq Psychotrauma Expert Group – Centrum 45, Amsterdam, The Netherlands

^c Department of Psychology, University of Innsbruck, Innsbruck, Austria

^d Department of Psychiatry, Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands

^e Department of Psychology, Reykjavík University, Reykjavík, Iceland

ARTICLE INFO

Article history:

Received 18 February 2014

Received in revised form 21 August 2014

Accepted 25 October 2014

Available online 1 November 2014

Keywords:

Disaster

Volunteer

PTSD

Subjective health

Sleep

Peri-traumatic distress

Loss of resources

ABSTRACT

Disaster work has shown to cause PTSD symptoms and subjective health complaints in professional emergency personnel. However, very little is known about how disaster work affects community volunteers.

This first time longitudinal study examined factors contributing to post-traumatic stress disorder symptoms (PTSD) and subjective health complaints in volunteers working in an earthquake setting. At six and eighteen months post disaster, a sample of 506 Indonesian Red Cross volunteers were assessed using the Impact of Event Scale-Revised and the Subjective Health Complaints Inventory. Factors analyzed in relation to the outcomes included: peri-traumatic distress, level of personal affectedness by the disaster, sleep quality and loss of resources as a consequence of the disaster.

At 18 months post-disaster the findings showed high levels of PTSD symptoms and subjective health complaints. Quality of sleep was related to both outcomes but resource loss only to PTSD symptoms. Neither peri-traumatic distress nor level of affectedness by the disaster (external versus directly affected volunteers), were predictive of symptoms. This study indicates that characteristics of disaster work e.g. low quality of sleep, may be an important contributor to PTSD symptoms and subjective health complaints in volunteers.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Approximately 13 million people volunteer for the International Red Cross and Red Crescent Movement worldwide, delivering services to vulnerable people with no expectation of financial or material gain. When a disaster strikes, these volunteers respond immediately and work for weeks or months on the disaster site. Their main tasks are to remove the deceased, rescue the trapped and/or injured, re-establish water and sanitation, distribute food and non-food items to the community, work in a public kitchen or

aid warehouse, handle logistics, provide first aid and psychosocial support to the affected and locate missing community members (IFRC, 2014). Although most volunteers have been trained and prepared for these tasks, some of them are ad hoc volunteers, without any formal connection to the aid agency and when their contribution to the post-disaster relief work ceases, volunteers return to their homes sometimes with no further contact with the aid agency. To date, there is a paucity of literature on the impact of disaster work on volunteers, probably the largest group active in disaster work (Thormar et al., 2010). However, it is well established that working in disaster affected regions is strenuous on professionals such as police officers, fire fighters, humanitarian workers and the military (Cardozo et al., 2012; Chan & Huak, 2004; Chang et al., 2003; Fullerton, Ursano, & Wang, 2004; Galea, Nandi, & Vlahov, 2005; King, King, Foy, Keane, & Fairbank, 1999; Marmar et al., 2006; Morren, Yzermans, van Nispen, & Wevers, 2005; Norris et al., 2002;

* Corresponding author at: Department of Psychiatry, Amsterdam Medical Center, University of Amsterdam, Meibergdreef 5, 1105 AZ Amsterdam, The Netherlands. Tel.: +31 354 6166437.

E-mail address: s.b.thormar@amc.uva.nl (S.B. Thormar).

Witteveen et al., 2007) where the most commonly reported complaints are PTSD symptoms (Chan & Huak, 2004; Chang et al., 2003; Fullerton et al., 2004; King et al., 1999; Norris et al., 2002) and although less studied, subjective health complaints (Morren et al., 2005; Witteveen et al., 2007). The prevalence of PTSD symptoms has varied from 5% to 40% in this group (Galea et al., 2005) and studies vary considerably with respect to the nature of the disaster, relevant health outcomes and type of disaster work (Morren et al., 2005).

Several factors potentially affect the impact of disaster work on volunteers. First, if the volunteer is part of the affected community, he or she may have been personally affected and experienced considerable loss of resources. As examined by Hobfoll's Conservation of Resources Theory (COR) resource loss predicts psychopathology resulting from disasters and posits that resource loss is a major predicting factor after such events. The theory is based on a single underlying motivational component that implies that individuals will strive to obtain, retain and/or protect what they value and stress occurs when resources are threatened, lost, or investment of resources is not congruent with output. Consistent with this theory, studies on disaster survivors have found resource loss to be one of the strongest predictors of psychological distress (Benight et al., 1999; Hobfoll, 1991; Hobfoll, Tracy, & Galea, 2006; Hobfoll, Hall, & Canetti, 2012) but no study has looked at this in community volunteers who may be a selective group of disaster survivors.

Secondly, the exposure of community survivors to the disaster can elicit peri-traumatic distress which is the level of distress (intense fear, helplessness or horror) experienced during and immediately after an event and has been shown to be related to post-trauma psychopathology in community survivors after a disaster (Brunet, Boyer, Weiss, & Marmar, 2001; Norris et al., 2002), in police and other first responders (Marmar et al., 2006). However, recent studies have questioned the effect of peri-traumatic distress on PTSD development (Friedman, Resick, Bryant, & Brewin, 2011).

Thirdly, some of the volunteers may be indirectly affected by the disaster through their family, friends and neighbours being affected while other volunteers may come from neighbouring cities with no ties to the afflicted area. To our knowledge, the level of personal affectedness in disaster volunteers has not previously been examined in relation to PTSD symptoms or subjective health complaints but level of proximity to the area has previously been shown to predict symptoms of PTSD in disaster survivors (Wang et al., 2000). Furthermore, volunteers that encounter more distressing experiences during disaster work have been found to have higher levels of mental health problems and health care utilization (Morren et al., 2005).

Fourth, sleep disturbances can be common, especially in the first weeks following a disaster, when volunteers work in shifts and take turns resting and often work long hours in unsafe, physically demanding settings. This is done in order to make the best use of time so that secondary losses due to the disaster can be prevented, e.g. more loss of lives or property. In addition to this tents are often the only means of shelter or refuge for the volunteers, especially in developing countries, if they are available at all. Sometimes volunteers may resort to sleeping on the streets or in between humanitarian aid parcels. Because of this unfortunate scenario, many volunteers experience severe sleep disturbance and we assume this to be a potent risk factor for PTSD symptom development in the volunteers. Studies have repeatedly found that sleep disturbance is associated with greater risk for development of depression and anxiety (Breslau, Roth, Rosenthal, & Andreski, 1996; Chang, Ford, Mead, Cooper-Patrick, & Klag, 1997; Ford & Kamerow, 1989) as sleep is frequently disrupted in the aftermath of a traumatic event (Van Liempt, Vermetten, de Groen, & Westenberg, 2007). Recent literature suggests that disturbed REM or non-REM sleep can contribute to maladaptive stress and trauma responses

Table 1
Yogyakarta volunteers' demographics.

	N	%
Gender	471	
Male	350	74.3
Female	121	25.7
Age	458	
35 and older	67	14.6
30–34 years old	56	12.2
25–29 years old	155	33.8
Younger than 25 years old	180	39.3
Education	410	
Junior high < 15 years old	20	4.9
Senior high < 18 years old	227	55.4
Post-senior high skill education	52	12.7
University education	111	27.1

Note: Data was missing on some demographics.

and may act as a modifiable risk factor for poor psychiatric outcomes such as PTSD symptoms (Ford & Kamerow, 1989; Germain, 2013; Van Liempt, Westenberg, Arends, & Vermetten, 2011). Furthermore, the quality of sleep, associated with general work related stress, has been shown to be an important variable in the development of PTSD symptoms in police officers (Neylan et al., 2002).

The aim of this study was to assess levels of PTSD symptoms and subjective health complaints in Red Cross volunteers working in Yogyakarta, Indonesia, in the aftermath of an earthquake in a longitudinal setting post six and eighteen months. Based on the above-mentioned literature, we assessed the contribution of demographics, peri-traumatic distress, level of personal affectedness by the disaster, quality of sleep and resource loss to psychopathology at 18 months. We hypothesized that peri-traumatic distress level of affectedness, reduced sleep quality and resource loss would be related to PTSD symptoms and subjective health complaints. Factors previously unstudied in this population. We also hypothesized that resource loss might be a mediator between peri-traumatic distress and post-traumatic stress symptomatology.

2. Method

2.1. Participants and setting

On May 27, 2006, at 5:53 AM, an earthquake of 6.3 on the Richter scale struck the provinces of Yogyakarta and Central Java. More than 6000 people were killed, 37,000 injured and hundreds of thousands lost their homes, with the overall damage estimated at 3.1 billion US\$ (FAO, 2007). The Indonesian Red Cross (PMI) responded with community volunteers to attend to over 200,000 civilians as well as to remove the deceased. For this study, the PMI managed to track down 506 of the 877 of these volunteers. The volunteers are a diverse group of community members, some trained as PMI volunteers and others that joined in response to the disaster (see Table 1 for demographics).

2.2. Measures

Symptom levels of Post-Traumatic Stress were measured using the Impact of Event Scale – Revised (IES-R) (Weiss & Marmar, 1997) at 6 and 18 months, a self-report measuring subjective distress in the past 7 days in relation to a particular event. The 22 items correspond to 14 of the 17 DSM-IV symptoms of PTSD symptoms with a total score ranging from 0 to 88, with low scores indicating low distress. A cut-off score (at 33) was used to indicate high symptom levels of PTSD symptoms in this study (Creamer, Bell, & Failla, 2003). The IES-R demonstrated high internal consistency at both 6 months (Cronbach's $\alpha = .88$) and 18 months ($\alpha = .91$). This scale

is the most commonly used tool measuring post-traumatic effects internationally (Lim et al., 2009), demonstrating adequate psychometric properties in western and eastern cultures (Perera-Diltz et al., 2009; Weiss, 2007).

Subjective health complaints were measured using the Subjective Health Complaints Inventory (SHC) (Eriksen, Ihlebaek, & Ursin, 1999) at 6 and 18 months post-earthquake. With 29 questions, the scale measured severity of complaints in the last month on a 5-point Likert scale from 0 to 4 ranging from “not at all” to “seriously” (Eriksen et al., 1999). The value of the subscales is computed by dividing the sum of items by the number of items. Cronbach’s α was .92 for the total scale, categorized into five factors: musculoskeletal, pseudo-neurology, gastrointestinal problems, allergy, and flu (Cronbach’s α = .85, .83, .80, .69, and .73 respectively). The inventory has shown to be valid in different cultures (Hjellset, Ihlebaek, Borge, Eriksen, & Hostmark, 2010; Ihlebaek, Brage, & Eriksen, 2007; Torsheim et al., 2006; Wilhelmsen et al., 2007).

Loss of resources were measured at 18 months using the occurrence measure on the Traumatic Exposure Severity Scale (TESS) (Elal & Slade, 2005). It assesses dimensions of exposure to an earthquake in adults with 28 items organized into 5 factors: resource loss, damage to home and goods, personal harm, concern for significant others and exposure to the grotesque. Cronbach’s alpha on the resource loss subscale was α = .76 and for the total scale, α = .83. The answers are based on a yes/no response. The questions of the loss of resource scale measured whether, post-earthquake, the volunteer had needed to spend the nights somewhere other than in their home; whether they had lacked food, water, clothes and shelter or suffered financial difficulties and received financial aid.

Peri-traumatic distress was measured with the Peri-traumatic Distress Inventory (PDI) was measured at 6 months. With 13 items, it measures (retrospectively) the quality and intensity of emotional responses experienced during and immediately after a critical incident (range 0–52) (Brunet, Weiss, et al., 2001). It was developed to obtain a quantitative measure of the level of distress experienced. The response format is a 5-point Likert scale ranging from 0 to 4 (0 = not at all to 4 = extremely true). The PDI demonstrated high internal consistency for the total scale at 6 months (Cronbach’s α = .81) and has been validated in the Asian culture with high internal consistency, acceptable reliability and high concurrent validity (Nishi et al., 2009).

Sleep was measured at 6 months using the sleep quality subscale of the Symptom Checklist-90R (SCL-90R) (Derogatis, 1977). It has 3 items, rated over the last week, and includes difficulties falling asleep, awakening too early in the morning, and restless or disturbed sleep (Cronbach’s α = .69). Lower ratings indicate lower quality of sleep. The SCL-90-R is a self-report instrument widely used to assess psychopathology in community and medical samples (Bonicatto, Dew, Soria, & Seghezze, 1997; Rao, Poland, & Ming-Lin, 2012; Tomioka, Shimura, Hidaka, & Kubo, 2008). Hours of sleep (at 6 months) was also measured with four categories: 2–4 h, 4–6 h, 6–8 h, and more than 8 h per night.

Level of personal affectedness was used to divide the volunteers into three different groups according to their level of affectedness. It was assessed with one question at 6 months: Do you consider yourself to be an (a) external helper coming from outside the area, (b) external helper but also personally affected due to family or close friends being affected, or (c) directly affected helper.

2.3. Procedure

After the board of the Indonesian Red Cross gave approval for the study and provided access to the volunteers, the questionnaire was piloted with 30 volunteers who worked on post-tsunami operations in 2004 for feasibility and cultural appropriateness. After

feasibility and cultural appropriateness was established, invitation to join the study was made by the local Red Cross branch. Next, volunteers were introduced to the study procedure in introductory meetings and offered the right to decline participation before and after giving informed consent. Finally, the questionnaire was translated into Bahasa Indonesian by bilingual Indonesian trauma psychologist and re-translated to control for any problems with translations. The data presented in this report were collected from January 2007 until January 2008.

2.4. Data analysis

We assessed the relation between key covariates using ANOVA and multiple regression with IES-R and SHC as outcomes. Correlation between outcomes was max .48, variance in one outcome explained by the other not exceeding 25%. The following variables were entered in six steps in a hierarchical regression analysis predicting the outcomes in order of importance (using the Bonferroni correction to reduce the chances of type 1 errors) based on support found for them in the literature: Step 1: demographics (gender) (neither age nor education were significant in relation to the outcomes); Step 2: PTSD at 6 months; Step 3: peri-traumatic distress; Step 4: quality of sleep; Step 5: hours of sleep and Step 6: loss of resources. The assumption of no multi-collinearity was not violated as the correlation between the independent variables were all well below r = .80. In addition, tolerance was well above .200 in all cases (the range was .940–.975), which indicates also the absence of multi-collinearity. In addition to no multi-collinearity, three assumptions of multiple regressions for each of the two outcomes were assessed. First, the Durbin–Watson test of independence of errors was well above 1 and below 3 in all cases (the range was 1.81–2.03). Second, inspecting regression standardized scatterplot of the residuals and predicted values ($zresid/zpred$) for each outcome revealed no indication of heteroscedasticity. Finally, the normal plot of the regression standardized residuals showed that the errors were sufficiently close to a normal distribution in all cases.

3. Results

3.1. Subjects

In total, 877 volunteers were active in the operation. The PMI managed to contact 518 volunteers for this study. There were 12 volunteers who declined participation for undisclosed reasons, leaving 506 for the first assessment (350 male). The majority of the tested volunteers were male, younger than 30 years old with a mid-level education (Table 1).

At the 18 months measurement, the participation rate was 78%. No difference was found between participants and drop-outs on demographics and outcomes. For PTSD symptoms: $t(468) = .406$, $p = .685$; for subjective health complaints: $t(450) = .561$, $p = .575$.

Table 2 shows the prevalence of resource loss amongst the volunteers, indicating that resource loss was always related to higher value of PTSD symptoms, significantly in 5 out of 6 times. The same could be said for subjective health complaints although it only was significant in 3 out of 6 questions. In addition to resource loss, 49% of the volunteers reported having had damage to their home and 33% needed to relocate as their house was structurally unsafe, 5% were physically injured in the quake, 24% had family members physically injured and 25% had family members or someone close to them buried under rubble. Furthermore, 47% of the volunteers reported uncertainty about the welfare of their loved ones. Exposure to dead bodies or body parts was reported by 58% of the volunteers and

Table 2
Volunteers loss of resources as a result of the earthquake.

	N (277)	%	PTSD symptoms <i>M</i>	Subjective health complaints <i>M</i>
In the days following the earthquake did you have to spend the night somewhere else than in your home?	Yes	62.2	24.0	20.2
	No		20.9	19.4
Did you need food and water aid after the earthquake?	Yes	48.5	25.7***	21.3
	No		20.2	18.5
Did you need clothes aid after the earthquake?	Yes	22.2	27.6**	24.1**
	No		21.5	18.7
Did you need shelter after the earthquake?	Yes	28.6	26.0**	21.3
	No		21.6	19.2
Did you suffer financial difficulties because of the earthquake?	Yes	46.0	26.3***	22.3**
	No		19.9	17.8
Did you need financial assistance from others because of hardships caused by the earthquake?	Yes	39.3	26.1***	22.1*
	No		21.0	18.5

Note: Loss of resources was measured at T3.

* $p < .05$ between the Yes/No categories.

** $p < .01$ between the Yes/No categories.

*** $p < .001$ between the Yes/No categories.

34% heard cries of trapped people. The above types of exposure fit criterion A1 of PTSD symptoms (DSM-V).

At 6 months post-earthquake, 28% of the volunteers reported a high level (above cut off score of 33) of PTSD symptom severity and 20.5% at 18 months. At 18 months the subjective health complaints were 19.78 (SD = 13.72). The subscales had the following results: Flu 2.03 (1.51); Musculoskeletal 7.47 (5.02); Pseudo Neurological 5.69 (4.45); Gastro intestinal 3.71 (3.94).

3.2. Prediction of PTSD symptoms and subjective health complaints

Multiple regression was performed with the variables gender, peri-traumatic distress, quality of sleep, hours of sleep and loss of resources as predictors of the long term (18 months) outcomes for PTSD symptoms and subjective health complaints, while controlling for symptoms at 6 months. An ANOVA analysis was carried out to compare differences in PTSD symptoms and subjective health symptoms depending on levels of the volunteers' affectedness.

3.2.1. PTSD symptoms

Gender, hours of sleep and peri-traumatic distress were not related to PTSD symptoms when controlling for symptoms of PTSD at 6 months (see Table 3). In total 27% of the variance in PTSD symptoms was explained (R^2 of .27, $F(4,220) = 13.01$, $p < .001$), with as significant predictors sleep quality (adding 2% of explained variance) and loss of resources, explaining another 3%. To further

Table 3
Multiple linear regression of prognostic indicators at 6 months of PTSD symptoms at 18 months.

	N	Step 1 β	Step 2 β	Step 3 β	Step 4 β	Step 5 β	Step 6 β
Gender	472	-.00	-.03	-.03	-.03	-.03	-.02
PTSD 6 months	471		.47***	.47***	.41***	.41***	.39***
Peri-traumatic distress	470			.01	-.01	-.01	-.01
Sleep quality	401				-.16*	-.16*	-.13*
Hours of sleep	456					.02	.02
Loss of resources	277						.16**
R^2		.00	.22	.22	.24	.24	.27
F		0.00	31.14***	20.67***	17.24***	13.75***	13.01***
ΔR^2			.22	.00	.02	.00	.03
ΔF			62.30***	0.01	5.62*	0.07	7.32**

Note: Gender: Male = 1; Female = 2.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

explore the relationship we tested whether resource loss could be a mediator between peri-traumatic distress and PTSD symptoms. Although significant correlations between all variables were present, resource loss was not a significant mediator between PDI and PTSD symptoms, $F = 10.04$, $p = .226$.

Post hoc testing showed that even when excluding the sleep related items from the IES-R (items 2, 15 and 22) the correlation between low sleep quality in the aftermath of the disaster and high symptoms of PTSD symptoms at 18 months remained significant, $r = .28$, $p < .01$. The presence of the three questions on sleep in IES-R, therefore, does not seem to explain the significant effects of sleep quality on PTSD symptoms. The ANOVA showed no differences in PTSD symptoms between external volunteers (coming from outside the area) ($N = 98$), those indirectly affected ($N = 110$) and the volunteers who were directly affected by the disaster ($N = 123$), $F(2,213) = .333$; $p = .717$.

3.2.2. Subjective health complaints

Gender was significantly related to subjective health complaints at 18 months, R^2 of .03, $F(1,211) = 6.24$, $p < .01$, with females reporting more complaints (see Table 4). Sleep showed the same relation to subjective health as to PTSD symptoms where only the quality of sleep had a significant effect on subjective health complaints, explaining 3% of the variance but hours of sleep, again had no effect. The total model explained R^2 of .31, $F(4,211) = 23.34$, $p < .01$.

In the last step, loss of resources did not add significantly to the explanation of variance for subjective health complaints resulting

Table 4
Multiple linear regression of prognostic indicators at 6 months of subjective health complaints at 18 months.

	N	Step 1 β	Step 2 β	Step 3 β	Step 4 β	Step 5 β	Step 6 β
Gender	472	.17*	.11	.11	.11*	.11*	.11*
Subjective health 6 months	453		.50***	.49***	.41***	.41***	.41***
Peri-traumatic distress	470			.04	.02	.02	.01
Sleep quality	401				-.20**	-.20**	-.19**
Hours of sleep	456					-.02	-.01
Loss of resources	277						.06
R^2		.03	.28	.28	.31	.31	.32
F		6.24*	40.13***	26.75***	23.34***	18.60***	15.63***
ΔR^2			.25	.00	.03	.00	.00
ΔF			71.91***	0.29	9.73**	0.06	0.85

Note: Gender: Male = 1, Female = 2.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

in the total model accounting for 31% of the variance. The ANOVA showed no differences with regard to subjective health complaints between external volunteers, those indirectly affected and those volunteers directly affected by the disaster, $F(2,202) = .030$; $p = .970$.

4. Discussion

This is the first longitudinal study of disaster volunteers which explores PTSD symptoms and subjective health complaints and predictors of these outcomes. It is also the first study that allows for comparison in symptoms between volunteers who are directly affected by the disaster and those who came from outside the area to volunteer in the operation thereby providing an insight of how much of the psychopathology may be attributed to the work itself and how much may come from the level of personal affectedness.

As shown in this study, the long-term levels of PTSD symptoms in volunteer disaster workers were found to be considerably higher compared to samples of professional workers (Chan & Huak, 2004; Chang et al., 2003; North et al., 2002), although due to differences in methodologies, that conclusion cannot be rigorously supported. PTSD symptoms were in the same range (Altindag, Ozen, & Sir, 2005; Carr et al., 1995; Kuo et al., 2003) or somewhat lower (Lai, Chang, Connor, Lee, & Davidson, 2004), than those found for community members affected by earthquakes. Interestingly, we were able to show that working as a volunteer in a disaster area may be an independent contributor to symptoms of PTSD and subjective health complaints as there was no difference in symptoms between those personally affected by the disaster and those who came from outside to volunteer.

Differences have previously been found between different types of emergency workers when Perrin et al. (2007) studied rescue workers at the World Trade Centre and found that PTSD diagnostic levels were much lower for police workers (6.2%) than for unaffiliated volunteers (21.2%). Advanced levels of training and organizational support may be protective factors for professional workers (North et al., 2002; Perrin et al., 2007) while many of the volunteers will have volunteered as a response to the disaster, often without training or preparation.

Subjective health complaints in this sample are relatively high especially when compared to a non-disaster Asian sample using the same instrument (Eriksen, Hellesnes, Staff, & Ursin, 2004). The high levels of subjective complaints may partly be explained by the long period of physical work, e.g. handling the deceased (Ursano, Fullerton, Kao, & Bhartiya, 1995), months of clearing out debris as well as many having to sleep on the street during their work. Several volunteers reported having worked for more than 24 h non-stop on some days during the first week or month after the earthquake.

Our hypothesis regarding the predictive value of disturbed sleep on adverse long term outcome was confirmed with reduced

sleep quality being strongly related to both PTSD symptoms and subjective health complaints as has been found in other samples (Ford & Kamerow, 1989; Germain, 2013; Lee & Hsu, 2012; Neylan et al., 2002; Van Liempt et al., 2007, 2011). The relation between traumatic event exposure and sleep problems is particularly pronounced among persons who do not recover from initial symptoms, but go on to develop trauma related psychopathologies even 18 months post disaster. Recent research has provided some clarity regarding the nature of sleep disturbances in PTSD where those with PTSD were found to have lighter sleep and elevated Rapid Eye Movement density compared to controls (Kobayashi, Boarts, & Delahanty, 2007). In fact, it is likely that intact sleep is important for emotional recovery from trauma (Pace-Schott et al., 2009) and sleep disturbances in PTSD might contribute to the development and maintenance of the disorder (Babson & Feldner, 2010). In all, the difficult circumstances in which volunteers work in the aftermath of the disaster are likely to interfere with sleep quality and, therefore, interfere even further with emotional recovery from the traumatic events. While a third of the volunteers slept less than 4h per night over a period of 6 months, no relation between hours of sleep and the outcomes could be established. To date, volunteer management has focused on hours of rest but not on the quality of rest, e.g. the type of rest facilities volunteers return to at the end of their shift. To make it worse, due to an imposed curfew to prevent looting in the area, the volunteers were sometimes not able to return home and thus had to endure adverse temporary living conditions, e.g. sleeping at the local branch office or amongst humanitarian aid supplies.

The fact that peri-traumatic distress did not predict PTSD symptoms independently or through the mediation of resource loss is in line with the revisions in DSM-V where Criterion A2 (requiring fear, helplessness, or horror to happen right after the trauma) was removed in DSM-5 as research suggests that Criterion A2 did not improve diagnostic accuracy (Friedman et al., 2011).

Ultimately, even though loss of resources contributed to PTSD symptoms at 18 months it did not predict subjective health complaints as in other samples (Hobfoll et al., 2012). The finding of resource loss being a contributor to long-term PTSD symptoms is in line with studies of samples of community members affected by disasters (Benight et al., 1999; Brunet, Boyer, et al., 2001; Hobfoll, 1991; Hobfoll et al., 2006), but this is the first study to be conducted on community volunteers. These findings support the COR theory of Hobfoll where he states that resource loss is a major factor in predicting long-term psychological impact of stressful events. He highlights the concern that those who have the fewest resources are most affected in the crisis stage, have fewer resources for recovery, and continue to be vulnerable to the further demands that follow in the aftermath of disaster (Hobfoll et al., 2006).

Gender was not related to PTSD in this study although a well-known predictor of peri- and PTSD symptoms in community samples (Burke, Richardsen, & Martinussen, 2006; Lilly, Pole, Best, Metzler, & Marmar, 2009; Olf, Langeland, Draijer, & Gersons, 2007). In spite of that it is not always replicated in female professional workers (Burke et al., 2006; Lilly et al., 2009; Olf et al., 2007). Our findings might indicate that the study included more resilient females or that there could be a cultural factor in how symptoms are expressed. It has been suggested that Asian cultures might use somatization as an alternative expression of psychological distress following exposure to traumatic events (Kokai, Fujii, Shinfuku, & Edwards, 2004) and the females have significantly higher subjective health complaints in the current study.

The main limitation of this study is the lack of data from adequate control groups, which makes it difficult to rigorously attribute the symptoms to the volunteer work. However, the ability to compare between external volunteers and those directly affected by the disaster gives us an opportunity to distinguish between volunteers that were personally affected (thus victims) and those that were not. This provides good reason to assume that the work itself contributed to the long-term symptoms. A comparison with published studies using the same assessment instruments supports our findings that PTSD and subjective health complaints are higher in volunteers than among professional workers (Chan & Huak, 2004; Chang et al., 2003; Eriksen et al., 2004; North et al., 2002).

Strengths of this study include the longitudinal design, thorough development of the questionnaire and the high response rate of a unique sample of disaster volunteers due to the good registration and management within the Indonesian Red Cross. Although 22% were lost at follow-up, they were not different from those that completed the 6-month assessment. Disaster volunteers can be a difficult population to study as they are often a part of the affected community, and recruitment later in time can thus be a challenge due to relocation. Others have come from far away to assist in the crisis but have left for their home areas by the time the research takes place. Furthermore, especially in Indonesia where the unemployment rate can be as high as 7% in some areas (BPS, 2013) and more in disaster hit areas, it may be hard for the volunteers to get time off work to participate in a research project.

In conclusion, this is the first study in volunteers showing the possible effect of disaster work alone. Furthermore, it is also the first study to show that reduced sleep quality is strongly related to long term PTSD symptoms and subjective health complaints, over and above 6 month symptom levels. Volunteers might be more vulnerable than professional rescue workers, but they may be a more resilient group compared to community survivors, especially the females. This might be the reason for them to volunteer to begin with, or volunteering may help them remain more active and in control and thereby protecting them from adverse mental health outcomes. Future research should focus on understanding what aspects of volunteering makes the volunteer vulnerable to complaints, e.g. the preparation and training, the tasks carried out or the quality of supervision. Furthermore, differences between community survivors and volunteers and the aspect that may make the volunteers more resilient than their fellow community members also deserve further exploration.

These findings may need to be considered within future revisions of the Inter Agency Standing Committee (IASC) Guidelines on the mental health of volunteer and professional disaster workers (IASC, 2007). This study shows opportunities for intervention for organizations active in disaster work, for instance, by providing screening and supporting volunteers' basic needs, especially those that have lost or lost access to many personal resources, such as proper sleeping facilities. Disaster preparedness is vitally important and relies significantly on volunteer capacity, particularly in developing countries where statutory services are less developed.

Attention to good volunteer mental and physical health is thus critical for humanitarian agencies.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

This study was supported by a grant from the International Federation of Red Cross/Red Crescent Societies, The Netherlands Red Cross, The Royal Netherlands Academy of Arts and Sciences, The Icelandic International Development Agency (ICEDA), The Austrian Red Cross, and The French Red Cross. We are indebted to the staff of the Indonesian Red Cross for their support, interest and precise activity in facilitating the collection of the data.

References

- Altindag, A., Ozen, S., & Sir, A. (2005). One-year follow up study of post-traumatic stress disorder among earthquake survivors in Turkey. *Comprehensive Psychiatry*, 46(5), 328–333. <http://dx.doi.org/10.1016/j.comppsy.2005.01.005>
- Babson, K. A., & Feldner, M. T. (2010). Temporal relations between sleep problems and both traumatic event exposure and PTSD: a critical review of the empirical literature. *Journal of Anxiety Disorders*, 24, 1–15.
- Benight, C. C., Ironson, G., Klebe, K., Carver, C. S., Wrynings, C., Burnett, K., et al. (1999). Conservation of resources and coping self-efficacy predicting distress following a natural disaster: a causal model analysis where the environment meets the mind. *Anxiety, Stress and Coping*, 12, 107–126. <http://dx.doi.org/10.1080/10615809908248325>
- Bonicatto, S., Dew, M. A., Soria, J. J., & Seghezze, M. E. (1997). Validity and reliability of Symptom Checklist 90 (SCL90) in an Argentine population sample. *Social Psychiatry and Psychiatric Epidemiology*, 32(6), 332–338.
- Basan Pusat Statistik[Inl]|Statistics Indonesia. Available from: <http://www.bps.go.id> Accessed 23.04.13.
- Breslau, N., Roth, T., Rosenthal, L., & Andreski, P. (1996). Sleep disturbance and psychiatric disorders: a longitudinal epidemiological study of young adults. *Biological Psychiatry*, 39, 411–418.
- Brunet, A., Boyer, R., Weiss, D. S., & Marmar, C. R. (2001). The effects of initial trauma exposure on the symptomatic response to a subsequent trauma. *Canadian Journal of Behavioral Science*, 33(2), 97–102. <http://dx.doi.org/10.1037/h0087132>
- Brunet, A., Weiss, D. S., Metzler, T. J., Best, S. R., Neylan, T. C., Rogers, C., et al. (2001). The peritraumatic distress inventory: a proposed measure of PTSD criterion A2. *American Journal of Psychiatry*, 158(9), 1480–1485. <http://dx.doi.org/10.1176/appi.ajp.158.9.1480>
- Burke, R. J., Richardsen, A. M., & Martinussen, M. (2006). Gender differences in policing: reasons for optimism? *Policing: An International Journal of Policy Strategies and Management*, 29, 513–523. <http://dx.doi.org/10.1108/13639510610684737>
- Cardozo, B. L., Crawford, C. G., Eriksson, C., Zhu, J., Sabin, M., Ager, A., et al. (2012). Psychological distress, depression, anxiety, and burnout among international humanitarian aid workers: a longitudinal study. *PLoS ONE*, 7(9), e44948. <http://dx.doi.org/10.1371/journal.pone.0044948> (Epub 12.09.12)
- Carr, V. J., Lewin, T. J., Webster, R. A., Hazell, P. L., Kenardy, J. A., & Carter, G. L. (1995). Psychosocial sequelae of the 1989 Newcastle earthquake: community disaster experiences and psychological morbidity 6 months post-disaster. *Psychological Medicine*, 25(3), 539–555. <http://dx.doi.org/10.1017/S0033291700033468>
- Chan, A. O. M., & Huak, C. Y. (2004). Emotional impact of 2004 Asian Tsunami on Singapore medical relief workers. *International Journal of Disaster Medicine*, 19(6), 152–156. <http://dx.doi.org/10.1080/15031430510034695>
- Chang, P. P., Ford, D. E., Mead, L. A., Cooper-Patrick, L., & Klag, M. J. (1997). *Insomnia in young men and subsequent depression. The Johns Hopkins Precursors Study. American Journal of Epidemiology*, 146, 105–114.
- Chang, C. M., Lee, L. C., Connor, K. M., Davidson, J. R., Jeffries, K., & Lai, T. J. (2003). Posttraumatic distress and coping strategies among rescue workers after an earthquake. *Journal of Nervous and Mental Disease*, 191(6), 391–398. DOI: 0022-3018/03/1916-391.
- Creamer, M., Bell, R., & Failla, S. (2003). Psychometric properties of the impact of event scale – revised. *Behaviour Research and Therapy*, 41(12), 1489–1496. <http://dx.doi.org/10.1016/j.brat.2003.07.010>
- Derogatis, L. (1977). *SCL-90R manual*. Baltimore: John Hopkins University.
- Elal, G., & Slade, P. (2005). Traumatic Exposure Severity Scale (TESS): a measure of exposure to major disasters. *Journal of Traumatic Stress*, 18(3), 213–220. <http://dx.doi.org/10.1002/jts.20030>
- Eriksen, H. R., Ihlebaek, C., & Ursin, H. (1999). A scoring system for subjective health complaints (SHC). *Scandinavian Journal of Public Health*, 27(1), 63–72. <http://dx.doi.org/10.1177/14034948990270010401>
- Eriksen, H. R., Hellesnes, B., Staff, P., & Ursin, H. (2004). Are subjective health complaints a result of modern civilization? *International Journal of Behavioral Medicine*, 11, 122–125.

- FAO, Food and agriculture organization of the United Nations. (2007). *An assessment of peoples livelihoods in Yogyakarta and Central Java provinces pre and post disaster*. Rome: Italy.
- Ford, D. E., & Kamerow, D. B. (1989). Epidemiologic study of sleep disturbances and psychiatric disorders: an opportunity for prevention? *Journal of American Medical Association*, 262, 1479–1484.
- Friedman, M. J., Resick, P. A., Bryant, R. A., & Brewin, C. R. (2011). Considering PTSD for DSM-5. *Depression and Anxiety*, 28(9), 750–769.
- Fullerton, C. S., Ursano, R. J., & Wang, L. (2004). Acute stress disorder, posttraumatic stress disorder, and depression in disaster or rescue workers. *American Journal of Psychiatry*, 161(8), 1370–1376. <http://dx.doi.org/10.1176/appi.ajp.161.8.1370>
- Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of post-traumatic stress after disasters. *Epidemiology Reviews*, 27, 78–91.
- Germain, A. (2013). Sleep disturbances as the hallmark of PTSD: where are we now? *American Journal of Psychiatry*, 170(4), 372–382. <http://dx.doi.org/10.1176/appi.ajp.2012.12040432>
- Hjellset, V. T., Ihlebaek, C. M., Bjorge, B., Eriksen, H. R., & Hostmark, A. T. (2010). Health-related quality of life, subjective health complaints, psychological distress and coping in Pakistani immigrant women with and without the metabolic syndrome: the InnvaDiab-DEPLAN Study on Pakistani immigrant women living in Oslo, Norway. *Journal of Immigrant Minority Health*, 13(4), 732–741. <http://dx.doi.org/10.1007/s10903-010-9409-6>
- Hobfoll, S. E. (1991). Traumatic stress: a theory based on rapid loss of resources. *Anxiety Research*, 4, 187–197. <http://dx.doi.org/10.1080/08917779108248773>
- Hobfoll, S. E., Tracy, M., & Galea, S. (2006). The impact of resource loss and traumatic growth on probably PTSD and depression following terrorist attacks. *Journal of Traumatic Stress*, 19(6), 867–878. <http://dx.doi.org/10.1037/a0016545>
- Hobfoll, S. E., Hall, B. J., & Canetti, D. (2012). Political violence, psychological distress and perceived health: a longitudinal investigation in the Palestinian authority. *Psychological Trauma: Theory, Research, Practice and Policy*, 4(1), 9–21. <http://dx.doi.org/10.1037/a0018743>
- Inter-Agency Standing Committee (IASC). (2007). *Mental health and psychosocial support*. Geneva: IASC.
- International Federation of Red Cross and Red Crescent Societies. (2014). *Volunteering in emergencies*. Retrieved from [www.ifrc.org/volunteering in emergencies](http://www.ifrc.org/volunteering_in_emergencies)
- Ihlebaek, C., Brage, S., & Eriksen, H. R. (2007). Health complaints and sickness absence in Norway. *Occupational Medicine*, 57, 43–49. <http://dx.doi.org/10.1093/occmed/kq1107>
- King, D. W., King, L. A., Foy, D. W., Keane, T. M., & Fairbank, J. A. (1999). Posttraumatic stress disorder in a national sample of female and male Vietnam veterans: risk factors, war-zone stressors, and resilience-recovery variables. *Journal of Abnormal Psychology*, 108, 164–170. <http://dx.doi.org/10.1037/0021-843X.108.1.164>
- Kobayashi, I., Boarts, J. M., & Delahanty, D. L. (2007). Polysomnographically measured sleep abnormalities in PTSD: a meta-analytic review. *Psychophysiology*, 44, 660–669.
- Kokai, M., Fujii, S., Shinfuku, N., & Edwards, G. (2004). Natural disaster and mental-health in Asia. *Psychiatry and Clinical Neurosciences*, 58(2), 110–116. <http://dx.doi.org/10.1111/j.1440-1819.2003.01203.x>
- Kuo, C. J., Tang, H. S., Tsay, C. J., Lin, S. K., Hu, W. H., & Chen, C. C. (2003). Prevalence of psychiatric disorders among bereaved survivors of a disastrous earthquake in Taiwan. *Psychiatric Services*, 54(2), 249–251. <http://dx.doi.org/10.1176/appi.ps.54.2.249>
- Lai, T. J., Chang, C. M., Connor, K. M., Lee, L. C., & Davidson, J. R. (2004). Full and partial PTSD among earthquake survivors in rural Taiwan. *Journal of Psychiatric Research*, 38(3), 313–322. <http://dx.doi.org/10.1016/j.jpsychires.2003.08.005>
- Lee, S. Y., & Hsu, H. C. (2012). Stress and health related well-being among mothers with low birth weight infant: the role of sleep. *Social Science and Medicine*, 74(7), 958–965. <http://dx.doi.org/10.1016/j.socscimed.2011.12.030>
- Lilly, M. M., Pole, N., Best, S. R., Metzler, T., & Marmar, C. R. (2009). Gender and PTSD: what can we learn from female police officers? *Journal of Anxiety Disorders*, 23, 767–774. <http://dx.doi.org/10.1016/j.janxdis.2009.02.015>
- Lim, H. K., Woo, J. M., Kim, T. S., Kim, T. H., Choi, K. S., Chung, S. K., et al. (2009). Reliability and validity of the Korean version of the Impact of event scale – revised. *Comprehensive Psychiatry*, 50, 385–390. <http://dx.doi.org/10.1016/j.comppsy.2008.09.011>
- Marmar, C. R., McCaslin, S. E., Metzler, T. J., Best, S., Weiss, D. S., Fagan, J., et al. (2006). Predictors of posttraumatic stress in police and other first responders. *Annals of the New York Academy of Sciences*, 1071(1), 1–18. <http://dx.doi.org/10.1196/annals.1364.001>
- Morren, M., Yzermans, C. J., van Nispen, R. M., & Wevers, S. J. (2005). The health of volunteer firefighters three years after a technological disaster. *Journal of Occupational Health*, 47(6), 523–532. <http://dx.doi.org/10.1539/joh.47.523>
- Neylan, T. C., Metzler, T. J., Best, S. R., Weiss, D. S., Fagan, J. A., Liberman, A., et al. (2002). Critical incident exposure and sleep quality in police officers. *Psychosomatic Medicine*, 64, 345–352. DOI: 0033-3174/02/6402-0345.
- Nishi, D., Matsuoka, Y., Noguchi, H., Sakuma, K., Yonemoto, N., Yanagita, T., et al. (2009). Reliability and validity of the Japanese version of the peritraumatic distress inventory. *General Hospital Psychiatry*, 31, 75–79. <http://dx.doi.org/10.1016/j.genhosppsych.2008.09.002>
- Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the literature, 1981–2001. *Psychiatry*, 65, 207–239. <http://dx.doi.org/10.1521/psyc.65.3.207.20173>
- North, C. S., Tivis, L., McMillen, J. C., Pfefferbaum, B., Cox, J., Spitznagel, E. L., et al. (2002). Coping, functioning, and adjustment of rescue workers after the Oklahoma City bombing. *Journal of Traumatic Stress*, 15(3), 171–175. <http://dx.doi.org/10.1023/A:1015286909111>
- Olff, M., Langeland, W., Draijer, N., & Gersons, B. P. (2007). Gender differences in posttraumatic stress disorder. *Psychological Bulletin*, 133(2), 183–204. <http://dx.doi.org/10.1037/0033-2909.133.2.183>
- Pace-Schott, E. F., Milad, M. R., Orr, S. P., Rauch, S. L., Stickgold, R., & Pitman, R. K. (2009). Sleep promotes generalization of extinction of conditioned fear. *Sleep*, 32, 19–26.
- Perera-Diltz, D. M., Laux, J. M., Tiarniyu, M. F., Piazza, N. J., Ritchie, M. H., & Stead, G. B. (2009). Development of a screening instrument for post-traumatic symptoms: the Sinhala version of the impact of event scale. *Psychology and Developing Societies*, 21(2), 277–298. <http://dx.doi.org/10.1177/097133360902100206>
- Perrin, M. A., DiGrande, L., Wheeler, K., Thorpe, L., Farfel, M., & Brackbill, R. (2007). Differences in PTSD prevalence and associated risk factors among World Trade Center disaster rescue and recovery workers. *American Journal of Psychiatry*, 164, 1385–1394. <http://dx.doi.org/10.1176/appi.ajp.2007.06101645>
- Rao, U., Poland, R. E., & Ming-Lin, K. (2012). Comparison of symptoms in African-American, Asian-American, Mexican-American and non-Hispanic white patients with major depressive disorder. *Asian Journal of Psychiatry*, 5(1), 28–33.
- Thormar, S. B., Gersons, B. P., Juen, B., Marschang, A., Djakababa, M. N., & Olff, M. (2010). The mental-health impact of volunteering in a disaster setting: a review. *Journal of Nervous and Mental Disease*, 198(8), 529–538. <http://dx.doi.org/10.1097/NMD.0b013e3181ea1fa9>
- Tomioka, M., Shimura, M., Hidaka, M., & Kubo, C. (2008). The reliability and validity of a Japanese version of Symptom Checklist 90 Revised. *BioPsychoSocial Medicine*, 2(19), 1–8. <http://dx.doi.org/10.1186/1751-0759-2-19>
- Torsheim, T., Ravens-Sieberer, U., Hetland, J., Vålilmaa, R., Danielson, M., & Overpeck, M. (2006). Cross-national variation of gender differences in adolescent subjective health in Europe and North America. *Social Science and Medicine*, 62(4), 815–827.
- Ursano, R. J., Fullerton, C. S., Kao, T. C., & Bhartiya, V. R. (1995). Longitudinal assessment of posttraumatic stress disorder and depression after exposure to traumatic death. *Journal of Nervous and Mental Disease*, 183(1), 36–42.
- Van Liempt, S., Vermetten, E., de Groen, J. H., & Westenberg, H. G. (2007). Slaapafwijkingen bij posttraumatische stressstoornis: Overzicht van onderzoeksbevindingen. *Tijdschrift Psychiatrie*, 49, 629–638.
- Van Liempt, S., Westenberg, H. G. M., Arends, J., & Vermetten, E. (2011). Obstructive sleep apnea in combat-related posttraumatic stress disorder: a controlled polysomnography study. *European Journal of Psychotraumatology*, 2, 1–5. <http://dx.doi.org/10.3402/ejpt.v2i0.8451>
- Wang, X., Gao, L., Shinfuku, N., Zhang, H., Zhao, C., & Shen, Y. (2000). Longitudinal study of earthquake-related PTSD in a randomly selected community sample in north China. *American Journal of Psychiatry*, 157, 1260–1266.
- Weiss, D. (2007). Cross-cultural assessment of Psychological trauma and PTSD. *International and cultural Psychology*, 2, 219–238. http://dx.doi.org/10.1007/978-0-387-70990-1_10
- Weiss, D., & Marmar, C. (1997). The impact of event scale – revised. In: J. Wilson, & T. Keane (Eds.), *Assessing psychological trauma and PTSD: a practitioner's handbook* (pp. 399–411). New York: Guilford Press.
- Wilhelmsen, I., Mulindi, S., Sankok, D., Wilhelmsen, A., Eriksen, H., & Ursin, H. (2007). Subjective health complaints are more prevalent in Maasai than in Norwegians. *Nordic Journal of Psychiatry*, 61(4), 304–309. <http://dx.doi.org/10.1080/08039480701415319>
- Witteveen, A. B., Bramsen, I., Twisk, J. W., Huizink, A. C., Slottje, P., Smid, T., et al. (2007). Psychological distress of rescue workers eight and one-half years after professional involvement in the Amsterdam air disaster. *Journal of Nervous and Mental Disease*, 195(1), 31–40. <http://dx.doi.org/10.1097/01.nmd.0000252010.19753.19>