

## ORIGINAL PAPER

Stefan Priebe · Iolanda Grappasonni · Massimo Mari · Michael Dewey · Fabio Petrelli · Ana Costa

**Posttraumatic stress disorder six months after an earthquake****Findings from a community sample in a rural region in Italy**

Received: 3 July 2007 / Revised: 15 September 2008 / Published online: 4 October 2008

■ **Abstract** *Background and aims* Various studies assessed rates of post-traumatic stress disorder (PTSD) following natural disasters including earthquakes. Yet, samples were often non-representative or small or both. This study aims to assess the prevalence of PTSD and predictors of PTSD 6 months after an earthquake in a rural region of Italy. *Methods* A questionnaire was handed out to a representative sample of approximate 3,000 people in the region of Molise in Italy 6 months after an earthquake in October/November 2002. The questionnaire assessed socio-demographic characteristics, aspects of the event, the experience of symptoms immediately after the earthquake, and symptoms of PTSD. *Results* Questionnaires of 2,148 people were returned, representing a response rate of 73.7%. The final analysis was based on 1,680 people. The screening tool provided a PTSD prevalence rate of 14.5%. Male gender, age under 55 years, and better school education predicted lower rates of PTSD. More variance was explained when psychological symptoms of immediately after the event were also included as predictors. *Conclusion* The findings on predictors are consistent

with the literature. Whilst personal characteristics explain only a small variance of PTSD six months after the event, early psychological distress allows a better prediction of who is likely to have PTSD 6 months later.

■ **Key words** earthquake – posttraumatic stress disorder – natural disaster – community sample

**Introduction**

Numerous studies established prevalence rates of post-traumatic stress disorder (PTSD) following natural disasters, and several of them assessed samples having experienced earthquakes [2, 3, 8, 13, 15, 18]. The prevalence of PTSD among victims of earthquakes ranged from 10.3 [13] to 30% [2]. However, studies used different assessment instruments to measure PTSD symptoms, and the time lag between the actual earthquake and the assessment of PTSD symptoms varied considerably, from 3 months [3] to 10 years [2]. Furthermore, many of the studies on victims of earthquakes were conducted in groups that were highly selective or small or both. Thus, it was difficult to test which characteristics of the affected people predicted PTSD across the whole population, and the statistical power for testing the predictive value of different variables in multivariate analyses was often limited.

Research findings on the role of gender and age in the prediction of PTSD symptoms following earthquakes are inconsistent. Some studies showed gender differences in the frequency of PTSD symptoms with women reporting more symptoms than men [1, 7, 10], whilst other studies found no such differences [9, 17]. With respect to age, Carr et al. [7], and Lewin et al. [14] identified higher levels of PTSD symptoms after an earthquake among middle-aged and older people, while Kato et al. [11] found that earthquake victims

---

Prof. S. Priebe, Dipl.-Psych., Dr. med. habil., FRCPsych (✉)  
Dr. M. Dewey · A. Costa  
Unit for Social and Community Psychiatry  
Barts & The London School of Medicine and Dentistry  
Queen Mary University of London  
Newham Centre for Mental Health  
London E13 8SP, UK  
Tel.: +44-020/7540-4210  
Fax: +44-020/7540-2976  
E-Mail: s.priebe@qmul.ac.uk

Dr. I. Grappasonni · Dr. F. Petrelli  
Dept. of Experimental Medicine and Public Health  
Faculty of Pharmacy  
University of Camerino  
Camerino (MC), Italy

Dr. M. Mari  
Dept. of Mental Health  
Jesi (AN), Italy

older than 60 years showed significant decreases in post-traumatic symptoms between the third and eight week after the earthquake, which did not occur in a younger group. It remains unclear to what extent the inconsistencies between studies reflect true differences between the samples studied or are due to the different methodologies used. In any case, more systematic data is required to understand the role of socio-demographic and other variables in the prediction of PTSD following earthquakes.

On October 31st and November 1st, 2002, two earthquakes struck the sparsely populated region of Molise in Southern Italy (see [24], for an analysis of the side effects of these earthquakes). The first one measured a strength of 5.4 on the Richter scale. This triggered a sequence of smaller earthquakes lasting for several days. In the events, 30 people were killed, 27 of whom were children trapped in the collapse of an elementary school, and up to 40% of buildings became temporarily or permanently uninhabitable. Particularly the death of the school children and the strong emotional response of the local population to that tragic event were widely reported in the national and international media at the time.

A team from another central Italian region, the Marche, was sent to the affected area to support mental health care in the aftermath of the event. As part of their activities, the team organised a survey of post-traumatic stress symptoms 6 months after the earthquake.

The aim of the present study is to investigate PTSD in a large and non-selective community sample in the rural region of Molise, Italy, six months after the earthquake. In particular, the study aims to (a) screen the prevalence of PTSD 6 months after the earthquake, and (b) examine socio-demographic, event-related, and post-event variables predictive of PTSD caseness.

## Methods

The population register of the five most affected villages (i.e. Larino, Colletorto, San Giuliano di Puglia, Santa Croce di Magliano, and Casacalenda) contained 20,416 names. The mental health team from the Marche selected every seventh name, which provided a sample of 2,916 individuals, and administered two self-report measures to all those individuals: one measured assessed socio-demographic variables, aspects of the event, experience of symptoms, and medication taken immediately after the earthquake, and the other measure was the Breslau short screening scale for PTSD [6]. The Breslau scale assesses seven symptoms of PTSD according to DSM-IV, and has been validated as a screening instrument against a structured diagnostic interview. The Breslau scale was presented in Italian and used as a measure for positive caseness of PTSD. Higher scores indicate a higher likelihood to have PTSD, and a cut off point of 4 symptoms has been found to be the best estimate for PTSD [6].

## Analysis

Positive screening for PTSD was the outcome variable. Following recommendations on the original validation study [6], a score of 4 was used as a cut-off point to identify individuals with and without PTSD.

As potential predictor variables we assessed: gender; age coded into three categories (15–19 years, 20–54 years, 55 years and over; the categorisation was based on the assumption that younger and older people might be more at risk than the middle aged group between 20 and 54 years of age); education coded into 5 categories (without qualification, primary school, lower secondary school, higher secondary school, university degree); damage to residence coded into 4 categories (no damage, habitable, partly habitable, and uninhabitable); how many of the shocks were experienced (some, only the strongest, most, or all); whether the individual was alone at the time of the earthquake or with someone else (dichotomous); whether the individual took medication immediately after the earthquake or not (dichotomous); and five short scales formed a priori from a list assessing symptoms of health problems experienced immediately after the earthquake (dissociation, hyper arousal, somatic symptoms, helplessness, and physical injury; mean scores for scale).

Respondents aged <15 and those who reported they had not experienced the earthquakes were excluded from the analysis.

Logistic regression was used to test three models. In model 1, only socio-demographic data (gender, age group, school education) were included as potential predictors. In model 2, event-related variables (damage to residence, frequency of shocks experienced, alone at the time of the earthquake) were added. Finally, in model 3, post-event variables (medication after earthquake, symptom levels of five health problems) were also included. We present odds ratios with 95% confidence intervals.

We fitted the models using R [21] using a function named `polr` from the MASS package for the proportional odds models.

## Results

The original sample contained 2,148 individuals, representing a response rate of 73.7%. After removing 66 individuals who reported they had not experienced any earthquakes and a further 198 aged less than 15 years, data of 1,879 individuals remained. For 359 individuals data on the educational qualification were missing. Missing data were replaced with estimates based on the age and professional qualification of participants. The models tested included two variables with some missing data: being alone (39 missing) and whether medication was taken immediately after the earthquake (161 missing of whom 10 were also missing being alone). The final models were thus tested among 1,680 individuals.

The distribution of scores of PTSD, as measured by the seven-symptom Breslau screening scale, was: 0:  $N = 512$ ; 1:  $N = 524$ ; 2:  $N = 364$ ; 3:  $N = 227$ ; 4:  $N = 148$ ; 5:  $N = 64$ ; 6:  $N = 25$ ; and 7:  $N = 6$ . Thus, 243 individuals representing 14.5% of the total sample screened positive for PTSD. The frequency of distribution of the categorical predictors is shown in Table 1, along with the results of the three logistic predictor models.

Chi squares at a significance level of 0.001 or beyond were found in all three models for gender (model 1:50.2, model 2:50.3, model 3: 16.7), and in model 3 for dissociation (75.1), hyper-arousal (56.7), and helplessness (17.0).

In interpreting the results, one should take into account that some of the categorisations represent simplifications of the categories available to respon-

**Table 1** Distribution of predictor variables and results of the three predictor models (for categorical predictor variables, the reference group is indicated)

Effect	N	Model 1		Model 2		Model 3	
		OR	95% CI	OR	95% CI	OR	95% CI
Gender							
Men	754	Reference		Reference		Reference	
Women	926	3.13	2.25–4.42	3.14	2.26–4.45	2.16	1.49–3.19
Age group							
15–19	244	1.41	0.90–2.20	1.42	0.90–2.23	0.88	0.52–1.47
20–54	899	Reference		Reference		Reference	
55 and over	537	1.57	1.05–2.37	1.53	1.01–2.32	0.97	0.60–1.56
Education							
Lower	90	1.34	0.72–2.41	1.37	0.73–2.52	1.00	0.48–2.04
Elementare-V	267	0.87	0.55–1.36	0.85	0.53–1.35	0.65	0.37–1.13
Licenza media	809	Reference		Reference		Reference	
Further	432	0.66	0.43–1.01	0.66	0.42–1.01	0.61	0.38–0.97
Degree	82	0.73	0.29–1.58	0.71	0.28–1.54	1.05	0.37–2.57
Residence							
Habitable	1,212			Reference		Reference	
Partly habitable	106	–	–	0.58	0.26–1.13	0.63	0.27–1.32
Uninhabitable	133	–	–	1.50	0.90–2.43	0.99	0.53–1.77
No residence	229	–	–	0.92	0.58–1.42	0.75	0.44–1.25
Shocks experienced							
Some	119			Reference		Reference	
Strongest	498	–	–	1.03	0.54–2.12	0.71	0.35–1.55
Most	750	–	–	1.25	0.68–2.51	0.71	0.36–1.51
All	313	–	–	1.53	0.79–3.17	0.70	0.33–1.55
Alone							
No	1,353			Reference		Reference	
Yes	327	–	–	0.90	0.60–1.32	1.04	0.66–1.62
Medication							
No	1,507					Reference	
Yes	327	–	–	–	–	1.27	0.77–2.06
Dissociation		–	–	–	–	2.26	1.87–2.74
Hyper-arousal		–	–	–	–	1.90	1.60–2.26
Somatic sympt.		–	–	–	–	0.90	0.62–1.30
Helplessness		–	–	–	–	1.76	1.34–2.29
Physical injury		–	–	–	–	0.83	0.39–1.57

Note: OR = Odd Ratios; CI = Confidence Intervals

dents. Specifically, age group was recorded when it became clear that the differences were towards the end of the age range. Damage to residence had an additional category, i.e. totally demolished, which we merged with uninhabitable. Education was re-coded to remove some low frequency categories. The predictive models shown in Table 1 are the results of the logistic regression for predicting PTSD on the Breslau scale.

In model 1, being female and being older than 55 years increased the likelihood of having PTSD after 6 months.

The predictive power of these variables was also found in model 2. However, the addition of event-related variables such as the damage caused to the own house did not increase the likelihood of positive estimates of PTSD (shown in Table 1).

In model 3, female gender, and having more symptoms of dissociation, hyper-arousal, and helplessness were all independent predictors of a higher likelihood of positive cases of PTSD after 6 months. Also, the tendency of people with higher school education to have lower rates of PTSD, that was already apparent in models 1 and 2, reached statistical significance in model 3.

The values of Nagelkerke's pseudo  $r^2$  for the three models in Table 1 are 0.037 for models 1, 0.042 for model 2, and 0.190 for model 3. Thus, the inclusion of symptoms of health problems experienced immediately after the earthquake yielded the model that explained the highest amount of variance of positive PTSD caseness.

## Discussion

The screening scale used in the current study estimated a prevalence of PTSD of 14.3% 6 months after the earthquakes. This finding is in line with some previous studies reported in the literature. Lai et al. [13] found prevalence rates of PTSD of 10.3% ten months after the earthquake, while in Onder et al.'s study [18], 11.7% of the affected community presented PTSD, 3 years after the earthquake. A few studies reported higher prevalence rates [2, 3]. These studies, however, assessed individuals after shorter periods of time following the earthquake [3], or used different methods of assessment [2]. For instance, in

Bland et al.'s study [2], criteria for PTSD were based on an affirmative answer to one of only two questions.

The analysis of socio-demographic variables yielded results consistent with the literature [7, 9, 12, 14, 23]. Female gender and age more than 55 were associated with a higher probability to screen positive for PTSD. According to Anderson and Manuel [1], one potential explanation for the higher PTSD rate in women is their greater tendency to express and report emotions, in particular feelings of fear. The finding that individuals above 55 years of age were at greater risk of PTSD may be seen in the light of previous studies showing that older people are more vulnerable to psychological symptoms after trauma, possibly because they might have fewer social and economic resources to cope with adverse events than younger people or have a reduced flexibility to adjust to a changed situation following a traumatic event [20]. Like younger people, those with higher school education may have more potential to cope with traumatic events resulting in lower PTSD rates. The association between high education and lower risk for PTSD has been found in previous studies [5].

When event-related variables were added (Model 2), none of the additionally considered predictors (damage to residence, frequency of shocks, and being alone at the time of the earthquake) increased the likelihood of PTSD after 6 months. Therefore, the addition of objective aspects of the experience of an earthquake did not increase the power of the model. However, the explained variance in PTSD increased when symptoms experienced after the earthquake were also considered in the model (Model 3). Symptoms of dissociation, hyper-arousal and helplessness, experienced immediately after the earthquake statistically contributed to the prediction of PTSD symptoms six months later. That initial psychological symptoms increase the likelihood of having PTSD later has been previously established in the literature [3, 4, 16]. In our study, the finding may suggest that such initial symptoms have a tendency to persist over time. The association of initial symptoms and positive PTSD caseness may however also be influenced by a memory bias: people with symptoms after 6 months might be more likely to remember and report symptoms in the past than those who feel symptom free at the time of the interview.

The current study has several limitations. Firstly, although the response rate of 70% is high for this type of research, there remains a non-response rate of 30% and a response bias may have influenced the findings. Secondly, we used only a screening scale to establish positive PTSD caseness, and such a scale captures PTSD symptoms irrespective of whether they are due to experiences during the earthquake or other traumatic events. Thus, it is impossible to distinguish the prevalence of PTSD specifically due to the experience of the earthquake or other traumatic events experienced. Thirdly, we assessed only a small number of

potential predictor variables. Specific strengths of the study are the large sample size and the substantial statistical power facilitating the interpretation of negative results, the relatively high response rate, and the strict application of a random sampling methodology.

Whether the PTSD prevalence rate of 14.3% is seen as high or low depends on the comparison and expectation. As compared with other studies following earthquakes, it is rather at the lower end of the spectrum. One might speculate that the earthquake was too weak to have a larger impact on the mental health of the affected population and/or that the social cohesion and community support in that central and rural region of Italy prevented higher rates of lasting mental distress [19]. At the same time, the number of people with PTSD symptoms still presents a public health problem and may justify considering specific health care interventions [22]. The risk factors identified in the present study, in particular female gender and immediate symptoms of psychological distress, could potentially be useful for screening exposed individuals for appropriate treatments.

---

## Conclusion

The prevalence of PTSD in a representative sample of individuals having experienced earthquakes in a rural Italian region was 14.3%. Among men, people aged under 55 years of age, and those with higher school education this prevalence was lower. The amount of variance explained by these variables (gender, age, and education) was relatively low, but the consideration of symptoms experienced immediately after the event enabled a better understanding of the risk factors likely to increase PTSD 6 months later. In particular, symptoms of psychological distress were found to identify people at higher risk and, thus, may be a reason for health care interventions.

---

## References

1. Anderson KM, Manuel G (1994) Gender differences in reported stress response to the Loma Prieta earthquake. *Sex Roles* 30:725–733
2. Bland S, Valoroso L, Stranges S, Strazzullo P, Farinano E, Trevisan M (2005) Long-term follow-up of psychological distress following earthquake experiences among working Italian males: a cross-sectional analysis. *J Nerv Ment Dis* 193(6):420–423
3. Bödvarsdóttir I, Elklit A (2004) Psychological reactions in Icelandic earthquake survivors. *Scand J Psychol* 45(1):3–13
4. Bremner JD, Southwick S, Brett E, Fontana A, Rosenheck R, Charney DS (1992) Dissociation and posttraumatic stress disorder in Vietnam combat veterans. *Am J Psychiatry* 149:328–332
5. Breslau N, Davis GC, Andreski P (1996) Risk factors for PTSD-related traumatic events: a prospective analysis. *Am J Psychiatry* 152:529–535

6. Breslau N, Peterson EL, Kessler RC, Schultz LR (1999) Short screening scale for DSM-IV posttraumatic stress disorder. *Am J Psychiatry* 156(6):908–911
7. Carr VJ, Lewin TJ, Webster RA, Kenardy JA, Hazell PL, Carter GL (1997) Psychosocial sequelae of the 1989 Newcastle earthquake, II: exposure and morbidity profiles during the first 2 years post-disaster. *Psychol Med* 27:167–178
8. Chang CM, Connor KM, Lai TJ, Lee LC, Davidson JR (2005) Predictors of posttraumatic outcomes following the 1999 Taiwan earthquake. *J Nerv Ment Dis* 193(1):40–46
9. Goenjan AK, Najarian LM, Pynoos RS, Steinberg AM, Manoukian G, Tavosian A, Fairbank LA (1994) Posttraumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia. *Am J Psychiatry* 151:895–901
10. Karanci AN, Rustemli A (1995) Psychological consequences of the 1992 Erzican (Turkey) earthquake. *Disasters* 19:8–18
11. Kato H, Asukai N, Miyake Y, Minakawa K, Nishiyama A (1996) Post-traumatic symptoms among younger and elderly evacuees in the early stages following the 1995 Hanhin-Awaji earthquake in Japan. *Acta Psychiatr Scand* 93:477–481
12. Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB (1995) Posttraumatic stress disorder in the national co-morbidity survey. *Arch Gen Psychiatry* 52:1048–1060
13. Lai TJ, Chang CM, Connor KM, Lee LC, Davidson JR (2004) Full and partial PTSD among earthquake survivors in rural Taiwan. *J Psychiatr Res* 38(3):313–322
14. Lewin TJ, Carr VJ, Webster RA (1998) Recovery from post-earthquake psychological morbidity: who suffers and who recovers? *Aust NZ J Psychiatry* 32(1):15–20
15. Montazeri A, Baradaran H, Omidvari S, Azin SA, Ebadi M, Garmaroudi G, Harirchi AM, Shariati M (2005) Psychological distress among Bam earthquake survivors in Iran: a population-based study. *BMC Public Health* 11(5):4
16. Murray J, Ehlers A, Mayon RA (2002) Dissociation and post-traumatic stress disorder: two prospective studies of road traffic accident survivors. *Br J Psychiatry* 180:363–368
17. Nolen-Hoeksema S, Morrow J (1991) A prospective study of depression and post-traumatic stress symptoms after a natural disaster: the 1989 Loma Prieta earthquake. *J Pers Soc Psychol* 6:115–121
18. Önder E, Tural Ü, Aker T, Kiliç C, Erdoğan S (2006) Prevalence of psychiatric disorders three years after the 1999 earthquake in Turkey: Marmara earthquake survey (MES). *Soc Psychiatry Psychiatr Epidemiol* 41:868–874
19. Peen J, Dekker J, Schoevers RA, ten Have M, Graaf R, Beekman AT (2007) Is the prevalence of psychiatric disorders associated with urbanization? *Soc Psychiatry Psychiatr Epidemiol* 42:984–989
20. Phifer JF (1990) Psychological distress and somatic symptoms after natural disaster: differential vulnerability among older adults. *Psychol Aging* 5:412–420
21. R Development Core Team. R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria, 2005. URL <http://www.r-project.org>. ISBN 3-900051-07-0
22. Silove D, Steel Z, Bauman A, Chey T, McFarlane A (2007) Trauma, PTSD and the longer-term mental health burden amongst Vietnamese refugees. *Soc Psychiatry Psychiatr Epidemiol* 42:467–476
23. Solomon SD, Davidson JRT (1997) Trauma: prevalence, impairment, service use and cost. *J Clin Psychiatry* 58(Suppl 9):5–11
24. Strollo A, Richwalski SM, Parolai S, Gallipoli MR, Mucciarelli M, Caputo R (2007) Site effects of the 2002 Molise earthquake, Italy: analysis of strong motion, ambient noise, and synthetic data from 2D modelling in San Giuliano di Puglia. *Bull Earthquake Eng* 5:347–362