

# Associations of pre-trauma attributes and trauma exposure with screening positive for PTSD: analysis of a community-based study of 2085 young adults

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## ABSTRACT

**Background.** While pre-trauma personality and mental health measures are risk factors for post-traumatic stress disorder (PTSD), such information is usually obtained following the trauma and can be influenced by post-trauma distress. We used data collected from a community-based survey of young adults before and after a major natural disaster to examine the extent to which participants' traumatic experiences, demographic and pre-trauma risk factors were associated with their screening positive for PTSD when re-interviewed.

**Method.** A representative selection of 2085 young adults from the Australian Capital Territory and environs, interviewed in 1999 as part of a longitudinal community-based survey, were re-interviewed 3–18 months after a major bushfire had occurred in the region. When re-interviewed, they were asked about their experiences of trauma threat, uncontrollable and controllable traumatic experiences and their reaction to the fire. They were also screened for symptoms of fire-related PTSD experienced in the week prior to interview.

**Results.** Four-fifths of participants were exposed to the trauma with around 50% reporting having experienced uncontrollable traumatic events. Reporting PTSD symptoms was associated with being female, having less education, poorer mental health and higher levels of neuroticism prior to the trauma. Particular fire experiences, including being evacuated and feeling very distressed during the disaster, were more strongly associated with PTSD symptoms compared with pre-trauma measures.

**Conclusions.** While demographic and pre-trauma mental health increased the likelihood of reporting PTSD symptoms, exposure to trauma threat and reaction to the trauma made greater contributions in explaining such symptoms as a result of this disaster.

## INTRODUCTION

Researchers have identified a range of risk factors associated with developing post-traumatic stress disorder (PTSD) following a trauma. One group of factors concerns the extent of the experience of trauma and the types of traumatic experience, for example, whether they result from an impersonal disaster affecting large

numbers of individuals or from interpersonal violence (Breslau *et al.* 1995; Weiss *et al.* 1995; Bramsen *et al.* 2000; Ozer *et al.* 2003; Shalev *et al.* 2004; Frans *et al.* 2005). Other factors found to increase the likelihood of PTSD concern individual attributes existing prior to the trauma including sex, education, pre-trauma psychopathology, prior exposure to trauma and social support after the event (Ozer *et al.* 2003; Cox *et al.* 2004; Shalev *et al.* 2004).

Since occurrence of trauma is unpredictable, information obtained by those who have experienced traumatic events is usually obtained

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only after the trauma has occurred. This recruitment process results in two key limitations of the research to date. The first, that comparable information is not obtained from those subjected to the trauma who did not develop PTSD, has been addressed by some researchers (Nolen-Hoeksema & Morrow, 1991; Bromet & Dew, 1995). The second limitation concerns measuring the impact of the trauma. Pre-trauma attributes of those subjected to trauma can generally only be assessed through self-report after the trauma has occurred. When collected in this way, individuals' assessments of their pre-trauma measures, for example mental and physical health, personality attributes, and life circumstances, are likely to be influenced by their current post-trauma distress (Reijneveld *et al.* 2003). Only a few studies, for example, that by Knezevic and colleagues (2005) have had access to data on mental health and personality attributes of civilian participants collected prior to their experiencing a trauma. Overall, there have been few epidemiological reports on the contribution of pre-trauma mental health and personality in explaining experiences of PTSD reported by civilians.

In this paper, we examine the extent to which demographic and pre-trauma risk factors, level of trauma exposure, and immediate reaction to the trauma contribute to symptoms of PTSD in a large sample of young adults who took part in two consecutive waves of a community-based epidemiological survey. The 2085 participants in this study were aged between 20 and 24 years when first interviewed for the PATH Through Life Project in 1999 and were re-interviewed 4 years later. In the intervening period, a major natural disaster, a large bushfire, occurred in the region from which participants had been drawn. Questions concerning their experiences of, and reactions to, this disaster were asked of participants as part of their second interview.

The conceptual basis for our analyses drew on meta-analyses of risk factors for PTSD reported by Brewin *et al.* (2000) and Ozer *et al.* (2003). Their research has indicated that probable risk factors can be grouped into demographic factors, including sex, education and socio-economic status; prior adjustment, including pre-trauma psychopathology, family history of psychopathology, childhood abuse and other childhood adversity; previous experiences of trauma; and

perceived post-trauma support. Different aspects of the trauma experience itself can also affect the likelihood of experiencing post-traumatic stress, including perceived level of life threat, peritraumatic emotions and dissociation (Brewin *et al.* 2000; Ozer *et al.* 2003). Risk factors for which there were measures available in our study included sex, education, pre-trauma estimates of mental health, neuroticism, social support and childhood adversity, and experience of trauma prior to the bushfires.

Information on exposure to the fire was obtained from participants' responses to questions covering their experience of threat of trauma, uncontrollable traumatic experiences, controllable traumatic experiences, and immediate reaction during the fire. Exposures to controllable and uncontrollable traumatic events were considered separately since it could be expected that experience of controllable events would be less distressing to the individual than events perceived to be uncontrollable (Bolstad & Zinbarg, 1997). When re-interviewed, participants were also given Brewin and colleagues' (2002) brief screening instrument to assess the extent to which they had experienced symptoms of PTSD in the week prior to their interview.

In this paper we report our findings concerning the extent to which demographic characteristics, pre-trauma psychopathology, prior trauma experiences, social support, trauma exposure and reaction to the trauma were associated with participants reporting PTSD symptoms when interviewed after the bushfire. We hypothesized that, when all predictor variables were taken into account, symptoms of PTSD would be positively associated with being female, having less education, reporting higher levels of pre-trauma psychopathology, less social support, and with being more distressed and upset during the disaster. We also hypothesized that after adjusting for pre-trauma risk factors, having more PTSD symptoms would be associated with reporting more uncontrollable traumatic events, but not with having experienced controllable traumatic events or threat of trauma.

## METHOD

### Disaster

In January 2003, bushfires began by lightning strikes in bushland surrounding Canberra, the

national capital of Australia with a population of around 300 000. On the afternoon of 18 January, a 10-km fire front reached Canberra's western suburbs, fuelled by dry tinder and scorching winds that reached gale force at times. On the afternoon and evening of 18 January, four people were killed, 440 presented to local hospitals with fire-related injuries, 488 houses were destroyed and over 5000 of Canberra's population were evacuated at short notice to emergency shelters (ACT Government, 2003).

### Sample

The PATH Through Life Project is following a random selection of three age groups of residents of the ACT and Queanbeyan, NSW, a smaller neighbouring town of around 37 000 people (Parslow *et al.* 2004). Participants in Wave 1 of the PATH Through Life Project were drawn from the corresponding electoral rolls for these centres. (Enrolment is compulsory for Australians aged  $\geq 18$  years.) Participants of interest in this study were aged from 20–24 years on 1 January 1999. Of the 4105 potential participants found and in the appropriate age group, 2404 (58.6%) agreed to participate in Wave 1. Wave 2 for this age group commenced in March 2003. Of Wave 1 participants, 190 (7.9%) refused to continue in the study, seven (0.3%) had died and 68 (2.8%) could not be contacted. This left 2139 (89.0% of the original cohort) who were re-interviewed.

Responses to all questions concerning the bushfire disaster and other measures used in the analyses for this study were provided by 2085 (97.5%) of these Wave 2 participants. A total of 52.6% of these participants were female, and their mean age was 26.7 years (s.d. = 1.49). Time between the bushfire and the date of Wave 2 interviews ranged from 12–82 weeks (mean 38.0 weeks, s.d. = 12.4) while the mean time between the Wave 1 interview and the fire was 3.4 years (s.d. = 0.27).

The study was approved by the Australian National University Research Ethics Committee.

### Measures

Study participants answered 11 questions concerning their exposure to the bushfires (Table 1). Five questions concerned uncontrollable events including fire-related injury or damage or

destruction of property, either their own or that of family or friends. Two questions covered controllable actions – being personally involved in fighting fires in their home or neighbourhood; and undertaking other work including fire-fighting elsewhere to assist with the effort. Three questions were assessed as representing trauma threats – having been put on alert or evacuated, or having had buildings in their suburb damaged or destroyed by fire. A final question concerned the individual's subjective response to the experience of the fires, whether they had felt very frightened or very upset during the fires.

Other pre-trauma measures obtained from participants at their first interview included measures of psychopathology – a summed score of depressive and anxiety symptoms using Goldberg's Depression and Anxiety Scores (Goldberg *et al.* 1988), and level of neuroticism from the short form of the Eysenck Personality Questionnaire – Revised (EPQ-R; Eysenck *et al.* 1985). Counts of adverse childhood experiences and child abuse experiences were also obtained from participants' answers to 20 questions concerning whether each parent was affectionate, depressed, or had an alcohol or drug problem, whether there was conflict or tension in the house or parents were separated or divorced; whether the participant suffered humiliation, ridicule or bullying, was neglected, was verbally, physically, or sexually abused, or witnessed such abuse (Rosenman & Rodgers, 2004). Summed measures of both negative and positive social support from family, friends, and partner (Schuster *et al.* 1990), obtained prior to the fire were taken as indications of social support at the time of fire. Finally, in their second interview, participants were asked questions concerning the experience of other trauma from a total of 10 possible types including: combat, life-threatening accident, natural disaster, witnessing injury or death, rape, sexual molestation, physically attacked or assaulted, threatened with a weapon or held captive, tortured, or other trauma experience (Rosenman, 2002). Those identifying as having experienced such trauma were asked to describe it briefly and identify whether it had occurred in the past 4 years, that is, since their first interview. A count of traumatic experiences occurring prior to the first interview was included as a measure of prior

Table 1. Proportions of male and female survey participants reporting uncontrollable and controllable bushfire trauma experiences

| Type of experience  | % reporting experience (n=2085) | Number (%) of men reporting experience (n=988)<br>n (%) | Number (%) of women reporting experience (n=1097)<br>n (%) | p <sup>a</sup> |
|---|---------------------------------|---|--|----------------|
| Threat of trauma  |                                 |   |  |                |
| Area in which lived or worked put on alert                                  | 62.7                            | 619 (62.7)  | 688 (62.7)   | 0.98           |
| Evacuated from home or work   | 23.1                            | 97 (9.8)  | 134 (12.2)   | 0.08           |
| Buildings in own suburb damaged or destroyed                                | 19.7                            | 202 (20.6)  | 207 (18.9)   | 0.31           |
| Any threat  | 64.7                            | 644 (65.2)  | 705 (64.2)   | 0.86           |
| Uncontrollable traumatic events   |                                 |   |  |                |
| Own home, possessions, workplace damaged/destroyed                          | 3.9                             | 42 (4.3)  | 40 (3.6)   | 0.48           |
| Friend's/relative's home, possessions or workplace damaged or destroyed     | 48.4                            | 478 (48.4)  | 532 (48.5)   | 0.96           |
| Suffered injury due to fires  | 1.9                             | 20 (2.0)  | 20 (1.8)   | 0.74           |
| Friend or relative died or injured due to fires                             | 4.8                             | 46 (4.7)  | 54 (4.9)   | 0.78           |
| Owned an animal which suffered due to fires                                 | 3.1                             | 24 (2.4)  | 40 (3.6)   | 0.11           |
| Any uncontrollable traumatic event  | 50.1                            | 488 (49.4)  | 556 (50.6)   | 0.81           |
| Controllable events   |                                 |   |  |                |
| Personally involved in fighting bushfires threatening home or neighbourhood | 13.8                            | 167 (16.0)  | 121 (11.0)   | <0.01          |
| Did other work involving bushfires and their effects                        | 18.8                            | 211 (21.4)  | 180 (16.4)   | <0.01          |
| Any controllable event  | 25.7                            | 288 (29.1)  | 248 (22.6)   | <0.01          |
| Reaction during the trauma – felt very frightened or very upset             | 48.0                            | 311 (31.5)  | 689 (62.8)   | <0.01          |

<sup>a</sup> Comparing the percentages of men and women reporting this experience.

exposure to trauma. Sex and years of education were included in the analyses as previously identified risk factors for PTSD (Brewin *et al.* 2000; Livanou *et al.* 2002; Gavranidou & Rosner, 2003; Ozer *et al.* 2003).

Participants were asked the 10 questions of the Trauma Screening Questionnaire (TSQ; Brewin *et al.* 2002) concerning whether they had experienced PTSD-related symptoms of re-experiencing and hyperalertness symptoms at least twice in the week prior to their interview. Testing of the TSQ indicated that answering positively to three or more re-experiencing questions or to three or more hyperalertness questions predicted a diagnosis of PTSD with positive predictive power of 0.73 or 0.62 respectively (Brewin *et al.* 2002). In the survey, these items were reworded to refer specifically to PTSD symptoms resulting from the Canberra bushfires; e.g. 'Upsetting dreams about the bushfires'.

## Statistical analysis

In our initial analyses, we examined the extent to which participants reported experiencing trauma threat, uncontrollable and controllable traumatic events, and whether they were very distressed during the fire. Our second analysis used one-way ANOVA and  $\chi^2$  tests to compare scores on individual predictor variables for those who met or did not meet screening criteria for PTSD. Predictor variables were then grouped into six blocks of risk factors covering: demographic factors, pre-trauma attributes and experiences, fire-related experiences of trauma threat, of uncontrollable traumatic events, of controllable traumatic events, and reaction during the fire. We assessed the contribution of these six groups of variables to explaining counts of PTSD symptoms, first by examining blocks individually and then by including all blocks in the model. Given the distribution of

PTSD symptoms was strongly skewed, we used negative binomial regression analyses to examine associations between this symptom count and predictor variables. The incidence rate ratios derived from these analyses can be interpreted in the same way as are odds ratios from a logistic regression; that is, the incidence rate ratio gives the expected change in the dependent variable for a one unit change in the predictor variable. These regression analyses were undertaken for blocks of predictor variables considered in isolation and then with all predictor variables entered simultaneously into the analyses. These analyses also adjusted for period of time between the fire and the date of participants' second interviews. Analyses were undertaken using SPSS 12.0 (SPSS Inc., Chicago, IL, USA) and STATA 9 (StataCorp, 2005).

## RESULTS

Of the 2085 participants in this study, 1652 (79.2%) reported at least one bushfire experience and over 60% lived in areas that were put on alert during the bushfires (Table 1). Just under half of respondents reported that the home, possessions or workplace of a friend or relative had been damaged or destroyed. Almost one-third of men and two-thirds of women reported that they had felt very frightened or very upset during the period of the fires. Men were more likely to report having experienced controllable events, either being personally involved in fighting fires threatening their own home or neighbourhood, or participating in other ways in the firefighting efforts. A total of 746 participants (36%) reported having experienced one or more PTSD re-experiencing or hyperarousal symptoms at least twice in the past week while the mean number of such experiences of PTSD symptoms was 0.8 (S.D. = 1.4). When PTSD screening criteria (Brewin *et al.* 2002) were applied, 104 participants (5.0% of all participants; 74.0% female) were assessed as screening positive for PTSD. Six per cent of those with direct experience of the fire screened positive.

Using one-way ANOVAs and  $\chi^2$  tests, we compared mean attributes of predictor variables for participants who screened positive for PTSD and those who did not meet the specified screening criteria. Being female, pre-trauma depressive and anxiety symptoms, level of

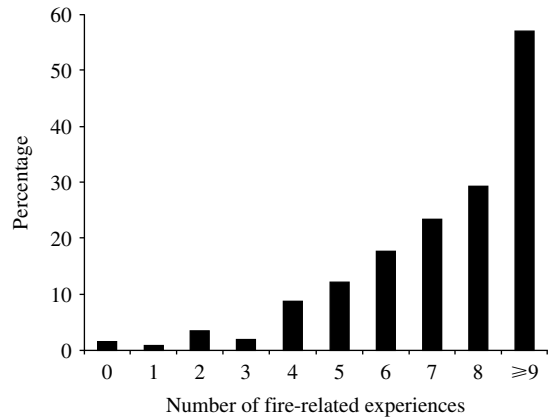


FIG. 1. Percentage screening positive for PTSD by number of fire-related experiences.

neuroticism and having prior experience of trauma were significantly associated with screening positive for PTSD after this disaster. Similarly, each of the 10 fire-related experiences and individuals' reactions to the fire were all highly significantly associated with screening positive for PTSD (Table 2). There was a strong association between level of exposure as measured by count of experiences and risk of screening positive for PTSD, as shown in Fig. 1.

We then examined associations between demographic and pre-trauma risk factors, fire exposure and fire reaction using negative binomial regression analyses. When considered separately, all six blocks of predictor variables contributed significantly to participants' levels of PTSD symptoms [Table 3, column (a)]. Blocks of factors that contributed most to explaining symptoms were having felt very frightened or very upset during the fires and having experienced threat of trauma or uncontrollable traumatic events. These findings also held when blocks of factors were entered sequentially into the model.

Our last analysis again used simultaneous negative binomial regression to identify individual predictor variables that contributed significantly to explaining PTSD symptoms [Table 3, column (b)]. When all risk factors were included in the analyses, six predictor variables remained strongly associated with PTSD symptoms: being female, having fewer years of education, pre-trauma depressive and anxiety

Table 2. *Characteristics and reported experiences of participants who screened/did not screen positive for PTSD*

| Characteristic  | Screened positive for PTSD                |   | <i>p</i> <sup>a</sup> |
|---|---|---|-----------------------|
|   | Yes % or mean (s.d.)<br>( <i>n</i> = 104) | No % or mean (s.d.)<br>( <i>n</i> = 1981) |                       |
| <b>Sociodemographic</b>   |   |   |                       |
| Female sex  | 74.03                                     | 51.49                                     | <0.01                 |
| Years of education  | 14.54 (1.55)                              | 14.68 (1.55)                              | 0.42                  |
| Time interval between fire and interview (weeks)                                | 37.17 (12.10)                             | 38.03 (12.39)                             | 0.45                  |
| <b>Pre-trauma attributes</b>  |   |   |                       |
| Goldberg depression and anxiety score   | 9.38 (4.74)                               | 6.57 (4.62)                               | <0.01                 |
| EPQ-R Neuroticism   | 6.55 (3.36)                               | 4.71 (3.36)                               | <0.01                 |
| Negative social support   | 7.30 (3.82)                               | 7.58 (3.56)                               | 0.40                  |
| Positive social support   | 7.65 (3.43)                               | 8.07 (3.19)                               | 0.19                  |
| Number of prior trauma experiences  | 0.67 (1.09)                               | 0.50 (0.88)                               | 0.06                  |
| Number of experiences of childhood adversity                                    | 1.93 (2.35)                               | 1.52 (2.10)                               | 0.06                  |
| <b>Threats of trauma</b>  |   |   |                       |
| Put on alert  | 86.54                                     | 61.43                                     | <0.01                 |
| Evacuated from home or work   | 40.38                                     | 9.54                                      | <0.01                 |
| Suburb damaged or destroyed   | 46.15                                     | 18.32                                     | <0.01                 |
| <b>Uncontrollable traumatic events</b>  |   |   |                       |
| Home/possessions, damaged/destroyed   | 21.16                                     | 3.02                                      | <0.01                 |
| Friend's/relative's home/possessions damaged/destroyed                          | 73.08                                     | 47.15                                     | <0.01                 |
| Suffered injury due to fires  | 11.54                                     | 1.41                                      | <0.01                 |
| Friend/relative died or injured due to fires (%)                                | 20.19                                     | 3.99                                      | <0.01                 |
| Owned animal that suffered due to fires (%)                                     | 19.23                                     | 2.22                                      | <0.01                 |
| <b>Controllable events</b>  |   |   |                       |
| Personally involved in fighting bushfires affecting own home, neighbourhood (%) | 44.23                                     | 12.22                                     | <0.01                 |
| Did other work involving bushfires and their effects (%)                        | 38.46                                     | 17.72                                     | <0.01                 |
| Felt very frightened, very upset during fires (%)                               | 83.66                                     | 46.08                                     | <0.01                 |
| Number of PTSD symptoms experienced at least twice in the week before interview | 5.21 (1.76)                               | 0.53 (0.89)                               | <0.01                 |

PTSD, Post-traumatic stress disorder; EPQ-R, Eysenck Personality Questionnaire – Revised.

<sup>a</sup> From one-way analyses of variance and  $\chi^2$  tests as appropriate.

symptoms score, being evacuated from home or work during the fires, having a friend or relative who died or was injured as a result of the fires and peritraumatic emotions.

## DISCUSSION

This study reports on our examination of the impact of a natural disaster on 2085 individuals drawn from the Canberra region who were re-interviewed for the PATH Through Life Project after a major natural disaster on 18 January 2003. Only around 20% of participants reported that they were not exposed to the bushfire in some way. For almost half of participants, this disaster had a significant impact resulting in the damage or destruction of the home, possessions or workplace of a friend or relative. When

interviewed at least 3 months after the fire, 5% of all survey participants reported sufficient symptoms of PTSD to indicate they could meet diagnostic criteria for this disorder. This compares with a prevalence level of 1.5% recently reported in an Australian-wide community study examining all types of trauma (Rosenman, 2002). This finding confirms that the mental health impact of such disasters on a local community can be substantial.

### Demographic and pre-trauma attributes and PTSD

In our study, being female and having less education were risk factors for reporting more PTSD symptoms after the disaster (Gavranidou & Rosner, 2003). These findings also confirm

Table 3. Contributions of predictor variables to explaining number of PTSD symptoms after trauma

| Predictor variables   | Association with PTSD symptoms, blocks assessed individually IRR (95% CI) (a) | Contribution of block alone to explaining symptoms ( $\chi^2$ ) | Additional contribution of block to explaining symptoms ( $\chi^2$ ) | Association with PTSD symptoms, blocks assessed simultaneously IRR (95% CI) (b) |
|---|---|---|--|---|
| <b>Sociodemographic</b>   |   |   |  |   |
| Being female  | 1.99 (1.69–2.34)***   |   |  | 1.40 (1.19–1.64)***   |
| Years of education  | 0.89 (0.84–0.93)***   | 86.26***  | 86.26***   | 0.90 (0.86–0.94)***   |
| Time since fire   | 0.99 (0.99–1.00)*   |   |  | 0.99 (0.99–1.00)  |
| <b>Pre-trauma attributes</b>  |   |   |  |   |
| Goldberg depression and anxiety score                                       | 1.05 (1.02–1.07)***   |   |  | 1.03 (1.01–1.05)**  |
| EPQ-R Neuroticism   | 1.05 (1.02–1.08)***   | 102.00***   | 62.36***   | 1.03 (1.00–1.06)*   |
| Negative social support   | 0.94 (0.79–1.12)  |   |  | 0.97 (0.83–1.14)  |
| Positive social support   | 1.07 (0.88–1.31)  |   |  | 1.05 (0.88–1.25)  |
| Number of prior trauma experiences  | 1.14 (1.07–1.22)***   |   |  | 1.02 (0.95–1.08)  |
| Number of experiences of childhood adversity                                | 1.01 (0.97–1.05)  |   |  | 1.02 (0.99–1.05)  |
| <b>Threat of trauma</b>   |   |   |  |   |
| Put on alert  | 1.53 (1.28–1.82)***   |   |  | 1.14 (0.97–1.36)  |
| Evacuated from home or work   | 1.93 (1.54–2.43)***   | 149.54***   | 142.62***  | 1.36 (1.11–1.68)**  |
| Suburb damaged or destroyed   | 1.68 (1.39–2.03)***   |   |  | 1.20 (0.99–1.46)  |
| <b>Uncontrollable traumatic events</b>                                      |   |   |  |   |
| Home/possessions, damaged/destroyed   | 2.09 (1.49–2.97)***   |   |  | 1.35 (0.99–1.86)  |
| Friend's/relative's home/possessions damaged/destroyed                      | 1.63 (1.39–1.90)***   | 166.65***   | 80.33***   | 1.21 (1.04–1.41)*   |
| Injured as result of fire   | 1.60 (0.97–2.62)  |   |  | 1.07 (0.70–1.65)  |
| Friend/relative died or injured due to fires                                | 1.87 (1.36–2.56)***   |   |  | 1.64 (1.25–2.16)***   |
| Owned animal that suffered due to fires                                     | 2.00 (1.36–2.95)***   |   |  | 1.37 (0.98–1.91)  |
| <b>Controllable events</b>  |   |   |  |   |
| Personally involved in fighting bushfires affecting own home, neighbourhood | 2.23 (1.80–2.76)***   | 102.65***   | 16.30***   | 1.33 (1.06–1.66)*   |
| Did other work involving bushfires and their effects                        | 1.48 (1.21–1.80)***   |   |  | 1.23 (1.03–1.47)*   |
| Felt very frightened, very upset during fires                               | 3.79 (3.24–4.44)***   | 260.24***   | 114.33***  | 2.43 (2.07–2.86)***   |

PTSD, Post-traumatic stress disorder; IRR, Incident rate ratio, EPQ-R, Eysenck Personality Questionnaire – Revised.

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

that this sex difference is not simply due to higher pre-trauma psychopathology, for example neuroticism or anxiety and depressive symptoms, since our analyses controlled for these measures. Time interval between the fire and being interviewed had no association with PTSD symptoms.

When all risk factors were included in the analyses, two pre-trauma measures, depressive and anxiety symptoms and level of neuroticism, were associated with experiencing PTSD symptoms after the event. Of interest, our study did not find that prior experience of trauma increased PTSD symptoms after the analysis controlled for all other risk factors. Similarly, other previously identified risk factors for PTSD, namely perceived social support and childhood adversity, did not contribute to explaining PTSD symptoms in this study.

### Experience of trauma and trauma threat, reaction to trauma and PTSD symptoms

As expected, participants who reported being very frightened and those who experienced uncontrollable traumatic experiences were more likely to have PTSD symptoms. These findings also held when pre-trauma measures were taken into account. We had hypothesized that experience of trauma threat would not contribute to PTSD when the pre-trauma risk factors were taken into account. However, when the analyses controlled for pre-trauma factors such as psychopathology, social support and prior trauma, experiencing threats continued to impact on individuals' post-traumatic stress. In particular, having been evacuated at short notice was strongly associated with experiencing PTSD symptoms. Government investigations of this

disaster and its impact, undertaken after the fires, have reported that this unplanned but compulsory evacuation was often done reluctantly, or evaded altogether, since it left individuals unsure of the safety of friends and other family members still in the area (McLeod, 2003). Such evacuation could also be perceived by those affected as the final loss of control over the safety of their home and family; such loss previously found to be a risk factor for PTSD (Weiss *et al.* 1995).

We had also hypothesized that choosing to undertake controllable actions by participating in the firefighting effort would not increase the risk of reporting symptoms of PTSD. While undertaking such actions impacted on the likelihood of reporting symptoms, this association was small relative to that found for other fire experiences, in particular, experiencing threat of trauma. Both controllable activities contributed independently to PTSD symptoms and also increased risk for PTSD when other categories of predictor variables were included in the model. Anecdotal evidence from subsequent official inquiries suggest that such action may have been initially perceived as controllable but became more difficult as water pressure dropped and random 'spot' fires begun by wind-blown burning branches could not be controlled.

Overall, exposure to the current trauma had a greater impact on individuals' symptoms compared with pre-trauma risk factors we had examined. Five of the 10 fire experiences were independently and significantly associated with reporting PTSD symptoms after all other risk factors were taken into account.

### Limitations and strengths

This study has some weaknesses. Some 11% of participants who were interviewed at Wave 1 were lost to the study by Wave 2, while an additional 2.2% did not fully answer questions on their bushfire experiences or other measures when re-interviewed. The period of time between the fire and second interview varied considerably. In our analyses, we have assumed that the association between this factor and participants' PTSD symptoms was linear. We recognize that this relationship may have been more complex; however, *post-hoc* analysis did not support there being a quadratic relationship between these factors. While we were able to

examine associations between a range of pre-trauma risk factors and PTSD symptoms, other previously identified risk factors were not available for our study, for example, measures of family psychopathology and peritraumatic dissociation (Ozer *et al.* 2003). One risk factor, prior experience of trauma, was only collected at the second interview, after the trauma had occurred. Responses to this question may have been influenced by the more recent experiences of the fire. Information concerning participants' trauma experiences relied on self-report.

A number of our measures of pre-trauma attributes are relatively weak since they were obtained from participants some time before the trauma. Nonetheless these limited measures of pre-trauma attributes also represent strengths of our study since they were collected from participants well before the disaster occurred. Most studies examining pre-trauma mental health have relied on self-recall of these pre-trauma measures as reported by individuals who have now experienced a traumatic event; with the strong likelihood that such recollection is influenced by their current state of mind (Reijneveld *et al.* 2003). The study by Knezevic and colleagues (2005) which did have access to pre-trauma personality factors was undertaken on a much smaller group of tertiary students. A second major strength of this study is that participants have not been selected because of their traumatic experience, or lack thereof, but were randomly selected from the community to participate in the PATH project well before the disaster occurred.

### CONCLUSION

This study found that 5.0% of a cohort of young adults screened positive for PTSD after experiencing a major bushfire disaster. While demographic and pre-trauma factors increased the likelihood of reporting PTSD symptoms, exposure to trauma threat and reaction to the trauma made greater contributions in explaining such symptoms.

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## DECLARATION OF INTEREST

None.

## REFERENCES

- ACT Government (2003). *Report of the Bushfire Recovery Taskforce Australian Capital Territory October 2003*. ACT Government: Canberra.
- Bolstad, B. R. & Zinbarg, R. E. (1997). Sexual victimization, generalized perception of control, and posttraumatic stress disorder symptoms severity. *Journal of Anxiety Disorders* **11**, 523–540.
- Bramsen, H., Dirkzwager, A. J. E. & van der Ploeg, H. M. (2000). Predeployment personality traits and exposure to trauma as predictors of posttraumatic stress symptoms: a prospective study of former peacekeepers. *American Journal of Psychiatry* **157**, 1115–1119.
- Breslau, N., Davis, G. & Andreski, P. (1995). Risk factors for PTSD-related traumatic events: A prospective analysis. *American Journal of Psychiatry* **152**, 529–535.
- 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**, 748–766.
- Brewin, C. R., Rose, S., Andrews, B., Green, J., Tata, P., McEvedy, C., Turner, C. & Foa, E. B. (2002). Brief screening instrument for post-traumatic stress disorder. *British Journal of Psychiatry* **181**, 158–162.
- Bromet, E. & Dew, M. A. (1995). Review of psychiatric epidemiologic research on disasters. *Epidemiologic Review* **17**, 113–119.
- Cox, B. J., MacPherson, P. S., Enns, M. W. & McWilliams, L. A. (2004). Neuroticism and self-criticism associated with post-traumatic stress disorder in a nationally representative sample. *Behavior Research and Therapy* **42**, 105–114.
- Eysenck, S. B. G., Eysenck, H. J. & Barrett, P. (1985). A revised version of the psychoticism scale. *Personality and Individual Differences* **6**, 21–29.
- Frans, O., Rimmo, P. A., Aberg, L. & Fredrikson, M. (2005). Trauma exposure and post-traumatic stress disorder in the general population. *Acta Psychiatrica Scandinavica* **111**, 291–299.
- Gavranidou, M. & Rosner, R. (2003). The weaker sex? Gender and post-traumatic stress disorder. *Depression and Anxiety* **7**, 130–139.
- Goldberg, D., Bridges, K., Duncan-Jones, P. & Grayson, D. (1988). Detecting anxiety and depression in general medical settings. *British Medical Journal* **297**, 897–899.
- Knezevic, G., Opacic, G., Savic, D. & Priere, S. (2005). Do personality traits predict post-traumatic stress? A prospective study in civilians experiencing air attacks. *Psychological Medicine* **35**, 659–663.
- Livanou, M., Basoglu, M., Salcioglu, E. & Kalendar, D. (2002). Traumatic stress responses in treatment-seeking earthquake survivors in Turkey. *Journal of Nervous and Mental Disease* **190**, 816–823.
- McLeod, R. (2003). *Inquiry into the Operational Response to the January 2003 Bushfires in the ACT*. ACT Government: Canberra.
- Nolen-Hoeksema, S. & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology* **61**, 115–121.
- Ozer, E. J., Best, S. R., Lipsey, T. L. & Weiss, D. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. *Psychological Bulletin* **129**, 52–73.
- Parslow, R. A., Jorm, A. F., Christensen, H. & Rodgers, B. (2004). Use of medical services after participation in a community-based epidemiological health survey. *Social Psychiatry and Psychiatric Epidemiology* **39**, 311–317.
- Reijneveld, S. A., Crone, M. R., Verhulst, F. C., Verhulst, S. & Verloove-Vanhorick, S. P. (2003). The effects of a severe disaster on the mental health of adolescents: a controlled study. *Lancet* **362**, 691–696.
- Rosenman, S. (2002). Trauma and posttraumatic stress disorder in Australia: findings in the population sample of the Australian National Survey of Mental Health and Well-being. *Australian and New Zealand Journal of Psychiatry* **36**, 515–520.
- Rosenman, S. & Rodgers, B. (2004). Childhood adversity in an Australian population. *Social Psychiatry and Psychiatric Epidemiology* **39**, 695–702.
- Schuster, T. L., Kessler, R. C. & Aseltine Jr., R. H. (1990). Supportive interactions, negative interactions, and depressed mood. *American Journal of Community Psychology* **18**, 423–438.
- Shalev, A. Y., Tuval-Mashiach, R. & Hadar, H. (2004). Posttraumatic stress disorder as a result of mass trauma. *Journal of Clinical Psychiatry* **65** (Suppl. 1), 4–10.
- StataCorp (2005). *Stata Statistical Software: Release 9.0*. Stata Corporation: College Station, TX.
- Weiss, D. S., Marmar, C. R., Metzler, T. J. & Ronfeldt, R. (1995). Predicting symptomatic distress in emergency services personnel. *Journal of Consulting and Clinical Psychology* **63**, 361–368.