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Psychology, Health & Medicine

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713441652>

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Online publication date: 25 January 2010

To cite this Article Mason, Victoria, Andrews, Holly and Upton, Dominic(2010) 'The psychological impact of exposure to floods', Psychology, Health & Medicine, 15: 1, 61 – 73

To link to this Article: DOI: 10.1080/13548500903483478

URL: <http://dx.doi.org/10.1080/13548500903483478>

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The psychological impact of exposure to floods

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(Received 7 May 2009; final version received 30 July 2009)

A number of studies have shown a range of symptoms resulting from exposure to natural disasters such as flooding. Among these consequences, individuals may experience symptoms of post-traumatic stress disorder (PTSD), depression and anxiety. The aim of this study was to examine the psychological impact of flooding in the UK. A cross-sectional survey was used to investigate the psychological symptoms associated with the aftermath of the flood amongst adults living in the affected communities. A questionnaire battery including the Harvard Trauma Questionnaire (trauma and symptoms associated with PTSD), Hopkins Symptom Checklist (anxiety and depression), Coping Strategies Questionnaire and a range of questions addressing sociodemographic characteristics and factors relating to the flood was administered to households in flood-affected areas. Four hundred and forty four completed questionnaires were returned. 27.9% of participants met criteria for symptoms associated with PTSD, 24.5% for anxiety and 35.1% for depression. Females had higher mean scores on PTSD, anxiety and depression than males. Most frequently reported coping strategies were rational, detached and avoidant, with the least frequent being emotional coping. Having to vacate home following flood, previous experience of flooding and poor health were associated with greater psychological distress. Detached coping appeared to be related to less distress. Although it is not possible to determine whether the symptoms were a direct consequence of the flood, symptoms of distress are a significant issue amongst communities affected by environmental events warranting further attention to prevent chronic distress.

Keywords: floods; trauma; depression; anxiety; survey

Introduction

Several psychological sequelae have been consistently found following exposure to natural disaster events. The disorder most commonly found in people exposed to natural disasters is post-traumatic stress disorder (PTSD) (Breslau, Chase and Anthony, 2002; Norris, 2005). The symptoms include trauma re-experiencing, emotional numbing and/or avoidance and exaggerated arousal (American Psychiatric Association, 2000). Exposure alone however does not fully explain the onset of PTSD as many individuals do not develop such symptoms. Indeed, events are not inherently 'traumatic', but may be appraised as such.

Research suggests that the type of disaster (e.g. flood, earthquake, fire) is not crucial in determining the psychological outcomes in those exposed to these events

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(Briere & Elliott, 2000). Consequently, given the paucity of literature on flooding (Norris, 2005), findings from other non-flood events might be usefully applied to understanding the consequences of flooding. Despite consensus that PTSD is a common consequence of exposure to natural disasters, however, the estimates of prevalence vary widely. Galea, Nandi and Vlahov (2005) reviewed the literature on disaster-related PTSD and found that the prevalence rates varied from 5 to 60% in the first 1–2 years following disaster, although most studies report prevalence rates in the lower half of this range. Studies of flooding in the UK have also found considerable psychological trauma in this population (e.g. Reacher et al., 2004; Tapsell, Tunstall and Wilson, 2003; Tunstall, Tapsell, Green, Floyd, & George, 2006). There are a number of potential confounders that could explain such wide variation in prevalence rates. For example, determining who has been exposed to the disaster and the extent of the impact can be difficult. Proximity to the event is an important determinant of outcome (Neria, Nandi, & Galea, 2008). In a natural disaster, there is no easy way of identifying and accessing all those directly exposed to the event to ensure that members of the general population are excluded. Indeed, using geographical location as a selection criterion does not guarantee that all those directly affected will be included in the sample. Compounding this problem is the fact that many of the worst affected people have to be evacuated and may therefore be difficult to find.

The method of assessing PTSD could also affect prevalence rates. For example, Wang et al. (2000) found that the use of DSM-IV criteria led to lower prevalence estimates than DSM-III-R criteria. Self-report methodologies may also result in higher prevalence rates compared to clinical assessments. High levels of PTSD in people exposed to disasters cannot solely be attributed to the use of self-report methodologies however, for example, prevalence rates of 24.2% nine months after exposure to an earthquake have been found using clinical interviews to assess PTSD (Wang et al., 2000). Whilst this prevalence rate is not as high as that of some studies utilising self-report methodology (e.g. Goenjian et al., 2000), it still shows that the consequences of disasters represent a significant public health problem.

Although prevalence rates may be affected by sampling and methodological issues, the effects of selective participation appear to be minimal. For example, although several demographic variables were associated with the probability of participating in a study of psychological outcomes following a man-made disaster in the Netherlands, the biases were too small to affect prevalence estimates significantly (Grievink, van der Velden, Yzermans, Roorda, & Stellato, 2006).

Not surprisingly, there is also evidence to suggest that depression and anxiety are common sequelae of natural disasters. Norris (2005) found that depression was the second most commonly found disorder among people exposed to disaster after PTSD. Prevalence estimates for depression after disasters also vary widely. It is likely that the same sampling and methodological issues that affect prevalence rates for PTSD affect estimates of prevalence rates of depression. In a review of psychological sequelae following disasters, the third most common psychological consequence was anxiety (Norris, Friedman, & Watson, 2002). In particular, generalised anxiety disorder is diagnosed in higher than normal rates in people exposed to disasters, and self-report anxiety is higher than in controls (Norris, 2005).

PTSD, depression and anxiety do not necessarily occur in isolation, however, as there appears to be considerable co-morbidity (Goenjian et al., 2000). Furthermore, symptoms of one disorder may serve to exacerbate or prolong symptoms of another

(Goenjian et al., 2000), which highlights the complexity of these disorders if left untreated.

Whilst from an individual and public health perspective it is important to monitor the impact of environmental events on physical and mental health, by adopting a more critical perspective, some commentators have argued that caution should be exercised to avoid the pathologisation of a normal reaction to distressing circumstances in addition to recognising the potential for post-traumatic growth (e.g. Tedeschi & Calhoun, 2004). However, where reactions to events impact on the ability of people to perform everyday tasks and are generating unusually high levels of distress over a prolonged period, identification of cases is an important goal to ensure that appropriate intervention can be delivered to ameliorate or manage the problem.

Whilst this should be borne in mind, many of the research studies have attempted to examine risk factors associated with the development of psychological disorders following a disaster. In a review of the literature, Galea et al. (2005) found that a greater degree of exposure was related to a higher rate of PTSD, which points towards a possible 'dose-response' relationship between degree of trauma and distress. Similarly, in the UK, Tunstall et al. (2006) found that the degree of flooding was a predictor for psychological distress, although the amount of variance explained by this factor was small.

Several more specific factors have emerged. For example, property damage and relocation were significantly associated with distress and psychopathology (e.g. Bland, O'Leary, Farinero, Jossa & Trevisan, 1996; Briere & Elliott, 2000; Galea et al., 2005; Marshall, Schell, Elliott, Rayburn, & Jaycox, 2007; Najarian, Goejian, Pelcovitz, Mandel, & Najarian, 2001; Neria et al., 2008; Yzermans, et al., 2005). The fear of death and injury to oneself or loved ones emerged as a risk factor for the development of subsequent psychological difficulties following a disaster (e.g. Briere & Elliott, 2000; Verger, et al., 2003). Previous experience of disasters also appears to be associated with the likelihood of developing a psychological disorder following a disaster; however, there are inconclusive reports about the direction of this effect (e.g. Galea et al., 2005; Norris & Murrell, 1988; Norris et al., 2002). Exposure to post-disaster stressors also appears to impact upon the psychological health of people exposed to events, for example lack of water, sanitation, electricity, adversity in housing reconstruction, were associated with an increased risk of developing PTSD following hurricane Katrina (Galea, Tracy, Norris & Coffey, 2008; Tunstall et al., 2006).

In general, gender has been shown to be associated with the development of PTSD, with women being more susceptible than men (Lee & Young, 2001) and this trend has also been found in people exposed to disasters (Galea et al., 2005, 2008; Grievink et al., 2006; Norris et al., 2002; Tunstall et al., 2006). Age may also play a role in predicting psychological outcomes following disaster. Children and adolescents appear more at risk of developing psychological distress than adults. For adults, evidence relating to at-risk age groups is not entirely consistent.

Assessing the contribution of pre-morbid physical and psychological health is difficult because baseline data are not always available given the unpredictable nature of these events. Galea et al. (2005) found that neuroticism, obsessive traits and psychiatric co-morbidity were associated with disaster-related PTSD and Norris et al. (2002) found that pre-disaster psychiatric history was an individual determinant of psychological outcome following disasters. Other individual level

predictors have included income level and socioeconomic class (Norris et al., 2002; Verger et al., 2003), family structure (Lima et al., 1989; Norris et al., 2002), and level of social support available pre- and post-disaster (Acierno et al., 2007; Galea et al., 2008; Vernberg, La Greca, Silverman, & Prinstein, 1996; Wang et al., 2000).

Given that events are only traumatic if they are appraised as such, coping styles are seen as playing a significant part in the response to disasters (Korol, 1990; Rachman, 1980; Terr, 1989). Vernberg et al. (1996) investigated the impact of children's coping on emotional distress following hurricane Andrew. Following inclusion of exposure variables, individual characteristics and social support, coping variables accounted for an additional 21% of the variance in PTSD. Higher use of coping strategies was associated with increased likelihood of PTSD, regardless of the type of strategy employed. Disasters may initially elicit a variety of coping strategies, both positive and negative, which can actually have a detrimental effect on mental health. As these events are (usually) novel experiences, individuals may have to learn how to cope with them successfully. Although least frequently used, blame/anger appeared to be the coping strategy that had the most negative effect on psychological outcome, suggesting that some coping strategies are more helpful than others.

Common mental disorders and more severe and enduring mental illness may come about following natural disasters such as flooding, which account for over half of all natural disasters (Liu et al., 2006). Given that more homes are being built on natural floodplains, the risk of flooding may increase. The aim of this study was to assess the psychological impact of widespread flooding and to identify risk factors for the development of psychological sequelae in a large population of adults.

Method

Design

A cross-sectional postal survey of flood-affected individuals was employed.

Sample

Flood-affected households were sent letters through two local councils (bodies that govern particular regions) ($N = 1550$; $N = 1662$) who held the lists of flood-affected addresses within their community. In addition, a number of participants contacted the research team following media coverage to request participation (independent contacts) ($N = 30$; overall total $N = 3242$). All participants were aged 18 or over.

Procedure

Approximately 6 months following the flood, each household received a postal questionnaire pack (described below), a cover letter explaining the purpose of the study, a consent form and a pre-paid return envelope. All data were stored confidentially and securely. No reminders were sent.

Measures

The questionnaire pack included the following measures: demographic data (gender, age, occupation); information regarding health status (are you in good physical health?) and aspects of the flood (such as whether vacation of the property was

required and previous experience of flooding); location (urban, suburban, rural); Harvard Trauma Questionnaire Revised (part IV) (HTQ-R, 40 items); Hopkins Symptom Checklist (HSCL-25, 25 items); Coping Styles Questionnaire (CSQ, 60 items).

The PTSD scale of the HTQ-R (Mollica, et al., 1992) was derived from the Diagnostic and Statistical Manual (DSM-IV) criteria using the stipulated three sub-domains: re-experiencing traumatic events; avoidance and numbing and psychological arousal. One item from DSM-IV (arousal) was not included since it cannot be measured through self-report.

The HSCL (Parloff, Kelman, & Frank, 1954) is a screening instrument used to measure symptoms of anxiety and depression. It has two parts: part 1 contains 10 items addressing anxiety and part 2 contains 15 items addressing depression. Each question is answered on a four-category scale: not at all (1), a little (2), quite a bit (3) and extremely (4). Although it does not give a diagnosis of depression, the depression score is strongly associated with criteria for depression defined by DSM-IV. The 10 anxiety items, while consistent with the DSM-IV diagnosis of generalised anxiety, have not been tested for their diagnostic validity.

The CSQ (Roger, Jarvis & Najarian, 1993) was derived from a combination of clinical experience, literature on coping and other scales. The final 60-item instrument assesses four different coping strategies: rational coping; detached coping; emotional coping and avoidance coping. Detached and rational coping are seen as adaptive styles whereas emotional and avoidance as maladaptive. Each of the 60 items is phrased as a statement regarding how people typically react to stress and respondents are asked to circle always (A), often (O), sometimes (S) or never (N). The scale has been used in a number of studies (e.g. Elklit, 1996; Pilar Matud, 2004; Jones and Elklit, 2007).

Data analysis

All analyses were carried out using Statistical Package for the Social Sciences (SPSS) (version 14.0). Scale scores were calculated for the HTQ-R, HSCL-25 and the CSQ according to guidelines given in the manual. Cut-off scores were used to assess whether a participant could be classified as potentially meeting criteria for psychiatric disorder or not (case positive or case negative). For the CSQ, scale scores for rational coping, emotional coping, detached coping and avoidance coping were produced. To ensure the reliability and validity of scale scores, participants who had more than 20% of data missing were excluded from analyses for all scale scores calculated.

Sequential binary logistic regression analysis was utilised to predict the probability that a participant would be classified as meeting criteria for psychiatric disorder on each of the scale scores calculated for the HTQ-R and HSCL-25. The predictor variables were entered in two blocks. In the first block, whether the participants had to vacate their home was entered. This variable was predicted to causally precede other variables, as whether the home was vacated or not was deemed to be a proxy measure for flooding severity and hence exposure to trauma. The more severe the flood damage, the more traumatic the event was predicted to be. Gender, age, health status, whether the participant had been flooded before and each of the four coping scale scores were added to the model in the second block. These variables were identified in previous literature as impacting upon psychological

sequelae post-disaster. The enter method was utilised as there was no theoretical rationale for assuming an order of importance of the variables entered in Block 2.

Results

Overall, 444 (of 3242) completed questionnaires were returned (Council 1 ($N = 229$, 51.5%); Council 2 ($N = 198$, 44.5%); independent contacts ($N = 17$, 3.8%)). Data from two participants were deleted due to evidence of response sets. The respondent characteristics are shown in Table 1.

The Scale scores from the three questionnaires are shown in Table 2. Symptoms of anxiety were less frequently reported than symptoms of PTSD and symptoms of depression were the most commonly reported. Rational coping was the most

Table 1. Respondent characteristics.

Characteristic	Number or mean (%)
Female	262 (58.9%)
Age	56.87 (SD 14.87, range 22–92)
Occupational status	
Employed	206
Retired	149
Homemakers	15
Students	4
Unemployed	4
Number with dependents living in residence	191 (42.9%)
Number considering themselves in good physical health	358 (80.4%)
Number who received psychological support following the flood	29 (6.5%)
Number whose home was flooded	411 (92.4%)
Number who had to vacate their property following the flood	269 (60.4%)
Of these, number not yet returned to their home	158 (58.7%)
Number of individuals who had been flooded before	119 (26.7%, mean number of times 1.8, range 1–6)
Location	
Urban	75 (16.9%)
Suburban	89 (20%)
Rural	252 (56.6%)

Table 2. Mean and standard deviation for the HTQ, HSCL and CSQ scale scores for all participants and by gender.

Scale	Scale scores ^a	Mean (SD)	Male, mean (SD)	Female, mean (SD)
Harvard Trauma Questionnaire ^a	PTSD	1.69 (0.67)	1.57 (0.61)	1.76 (0.68)
Hopkins Symptoms Checklist ^a	Anxiety	1.52 (0.65)	1.39 (0.58)	1.60 (0.68)
	Depression	1.69 (0.71)	1.49 (0.59)	1.82 (0.75)
Coping Styles Questionnaire ^b	Rational coping	1.76 (0.59)	1.96 (0.57)	1.65 (0.57)
	Emotional coping	0.91 (0.49)	0.73 (0.45)	1.04 (0.48)
	Detached coping	1.35 (0.55)	1.49 (0.56)	1.26 (0.53)
	Avoidance coping	1.09 (0.44)	0.98 (0.44)	1.17 (0.41)

^aScales range from 1–4, where 1 is not at all and 4 is extremely.

^bScale ranges from 0–3, where 0 is never and 3 is always.

commonly reported coping style followed by detached, avoidance and emotional coping was used least frequently.

The prevalence of PTSD and anxiety and depression are presented in Table 3. Around one-third of individuals reported levels of symptoms associated with PTSD that would identify them as potentially meeting criteria for psychiatric disorder. The numbers of individuals identified as potentially meeting criteria for depression were higher than for anxiety.

Table 4 shows the results from the logistic regression for each of the predictors for the HTQ and Table 5 for the HSCL. For the results presented, those potentially meeting criteria for psychiatric disorder are described as a case.

HTQ PTSD scale scores

Data from 392 participants were available for analysis: 288 who were not a case and 104 who were a case. In block 1, a test of the model including whether the participants vacated their home or not *versus* a model with intercept only was statistically significant $\chi^2(1, N = 392) = 17.116, p < 0.001$. The model was able to correctly classify 100% of people who were not cases, and 0% of people who were cases, for an overall success rate of 73.5%. Nagelkerke $R^2 = 0.062$, suggesting that only 6.2% of the variance in caseness is explained by this model.

In block 2, the addition of demographic and coping variables made a significant improvement to the vacate-home only model $\chi^2(8, N = 392) = 103.934, p < 0.001$. A test of the full model *versus* the intercept-only model was also significant $\chi^2(9, N = 392) = 121.050, p < 0.001$. The model was able to correctly classify 93.4% of people who were not cases and 52.9% of people who were cases, giving an overall success rate of 82.7%. Nagelkerke $R^2 = 0.388$, suggesting that 38.8% of the variance in caseness is explained by this model.

Table 3. Prevalence of symptoms above recommended cut-offs for those meeting criteria for being a case.

Instrument (cut-off)	Scale	Frequency of positive cases (%)
Harvard Trauma Questionnaire (≥ 2)	PTSD	124 (27.9)
Hopkins Symptoms Checklist (≥ 1.75)	Anxiety	109 (24.5)
	Depression	156 (35.1)

Table 4. Statistics for block 1 and 2 predictor variables for the HTQ.

Scale score	Block	Predictor	B	SE	Wald χ^2	Odds ratio (95% CI)
HTQ PTSD	1	Vacate home	1.05	0.27	15.37***	2.86 (1.69–4.83)
		Constant	-1.74	0.23	56.46***	0.18
	2	Vacate home	0.71	0.31	5.20*	2.04 (1.11–3.75)
		Emotional coping	2.18	0.45	24.06***	8.86 (3.71–21.18)
		Avoidance coping	1.05	0.41	6.69**	2.86 (1.29–6.34)
		Constant	-4.48	1.27	12.53***	0.01

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 5. Statistics for block 1 and 2 predictor variables for the HSCL.

Scale score	Block	Predictor	B	SE	Wald χ^2	Odds ratio (95% CI)
HSCL anxiety	1	Vacate home	1.11	0.29	14.94***	3.04 (1.73–5.35)
		Constant	–1.97	0.25	61.27***	0.14
	2	Vacate home	0.78	0.34	5.39*	2.18 (1.13–4.20)
		Health	–1.44	0.37	15.59***	0.236 (0.116–0.484)
		Rational coping	1.007	0.434	5.389*	2.74 (1.17–6.40)
		Emotional coping	2.18	0.47	21.99***	8.87 (3.56–22.09)
		Detached coping	–1.07	0.50	4.60*	0.34 (0.13–0.91)
HSCL depression	1	Vacate home	1.16	0.24	22.52***	3.18 (1.97–5.13)
		Constant	–1.41	0.21	46.48***	0.24
	2	Vacate home	0.84	0.30	7.54**	2.30 (1.27–4.18)
		Health	–1.03	0.38	7.33**	0.36 (0.17–0.75)
		Emotional coping	3.16	0.50	40.61***	23.66 (8.94–62.60)
		Constant	–2.78	1.23	5.07*	0.06

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

Employing a 0.05 criterion of statistical significance, whether the participants vacated their home, health, rational coping, emotional coping and detached coping had significant partial effects and whether the participant had been flooded before approached significance. Whether the participants believed themselves to be in good health and whether they had been flooded before had partial effects that approached significance. All variables increased the likelihood of a participant being classified as a case.

Presence of symptoms of anxiety – HSCL anxiety scale scores

Data from 392 participants were available for analysis: 301 who were not a case and 91 who were a case. In block 1, a test of the model including whether the participant vacated their home or not *versus* a model with intercept only was statistically significant $\chi^2(1, N = 392) = 17.039, p < 0.001$. The model was able to correctly classify 100% of people who were not cases, and 0% of people who were cases, for an overall success rate of 76.8%. Nagelkerke $R^2 = 0.064$, suggesting that only 6.4% of the variance in caseness is explained by this model.

In block 2, the addition of demographic and coping variables made a significant improvement to the vacate-home only model $\chi^2(8, N = 392) = 103.276, p < 0.001$. A test of the full model *versus* the intercept only model was also significant $\chi^2(9, N = 392) = 120.315, p < 0.001$. The model was able to correctly classify 100% of people who were not cases and 0% of people who were cases, giving an overall success rate of 82.9%. Nagelkerke $R^2 = 0.399$, suggesting that 39.9% of the variance in caseness is explained by this model.

Employing a 0.05 criterion of statistical significance, whether the participants vacated their home, health, rational coping, emotional coping and detached coping had significant partial effects and the effect of whether the participant had been flooded before approached significance. All variables increased the likelihood of a

participant being classified as a case, except detached coping which was a protective factor.

Presence of depressive symptoms – HSCL depression scale scores

Data from 393 participants were available for analysis: 257 who were not a case and 136 who were a case. In block 1, a test of the model including whether the participant vacated their home or not *versus* a model with intercept-only was statistically significant $\chi^2(1, N = 393) = 24.798, p < 0.001$. The model was able to correctly classify 100% of people who were not cases, and 0% of people who were not cases, for an overall success rate of 65.4%. Nagelkerke $R^2 = .084$, suggesting that only 8.4% of the variance in caseness is explained by this model.

In block 2, the addition of demographic and coping variables made a significant improvement to the vacate-home only model $\chi^2(8, N = 393) = 154.425, p < 0.001$. A test of the full model *versus* the intercept-only model was also significant $\chi^2(9, N = 393) = 179.223, p < 0.001$. The model was able to correctly classify 9.3% of people who were not cases and 66.2% of people who were cases, giving an overall success rate of 81.9%. Nagelkerke $R^2 = 0.505$, suggesting that 50.5% of the variance in caseness is explained by this model. Employing a 0.05 criterion of statistical significance, whether the participants had to vacate their home, health, and emotional coping had significant partial effects. All variables increased the likelihood of a participant being classified as a case.

Discussion

This cross-sectional study investigated symptoms of distress following extensive flooding in the UK. Almost a third (27.9%) of participants scored over the threshold to be classified as potentially meeting criteria for PTSD. On the HSCL anxiety scale, a quarter (24.5%) of participants scored over the threshold to be classified as potentially meeting criteria for psychiatric disorder, and on the depression scale over a third (35.1%). Although these questionnaires do not provide a clinical diagnosis, individuals identified as potentially meeting criteria for psychiatric disorder were experiencing a level of symptoms that might warrant further investigation in a clinical setting. The prevalence levels found were broadly consistent with those found in other studies of the psychological sequelae of disasters (see Galea et al., 2005; Neria et al., 2008; Norris et al., 2002, 2005).

Given the relatively mild nature of the flooding, the high prevalence rates identified in the present study may be questioned. Indeed, it is possible that methodological issues impacted upon the rates found. For example, questionnaires were only sent to flood-affected households; therefore, we can assume that only those directly affected by the floods were assessed. We can expect these individuals to have higher prevalence rates than those found in the general population following a disaster (Neria et al., 2008; Reacher et al., 2004). In many previous studies, it is not possible to be sure whether only those directly affected were studied (Neria et al., 2008). Those directly affected in the present study may therefore be experiencing less negative psychological symptoms than direct victims of more severe disasters, but due to the inclusion of the general population in other surveys of psychological sequelae the overall prevalence rate appears lower. Furthermore, the use of self-report methodology may have resulted in larger prevalence estimates than if we had

used clinical assessment procedures. It is also possible that only those individuals who were most distressed and affected by the flood and its aftermath completed and returned the questionnaire. Despite these issues and in line with previous research on flooding in the UK (e.g. Reacher et al., 2004; Tapsell et al., 2003; Tunstall et al., 2006), it appears that following flooding, people in the UK can experience significant distress.

Exposure to flooding was associated with increased risk of psychological sequelae. Participants who experienced the most severe flooding and had to vacate their homes were approximately twice as likely to meet criteria for PTSD, anxiety and depression as participants who remained in their own home. It is not clear whether the increased likelihood of psychological symptoms is as a result of exposure to the disaster or relocation itself however. Previous research has found that both degree of exposure (e.g. Neria et al., 2008; Norris et al., 2002; Vernberg et al; 1996) and relocation (e.g. Acierno et al., 2007; Bland et al., 1996; Galea et al., 2005; Yzermans et al., 2005) are associated with an increased risk of poor psychological outcomes.

Previous experience of flooding emerged as a risk factor for increased symptoms of PTSD and anxiety. This finding supports previous literature that found a negative effect of previous experience on psychological outcome (e.g. Bland et al., 1996; Goenjian et al., 2000; Norris et al., 2002). It seems reasonable to assume that fear of reoccurrence increases following repeated exposure and may therefore increase anxiety.

In addition to previous experience, self-reported physical health emerged as a risk factor for symptoms of PTSD, anxiety and depression. Participants who reported being in poor health were between 2 and 4.2 times more likely to meet criteria for PTSD, anxiety and depression than participants who reported being in good health. This finding is in line with previous research that shows poor physical health is associated with poorer psychological outcomes post-disaster (Lima et al., 1989; Tunstall et al., 2006).

For all measures, at least one coping variable was significantly associated with the likelihood of reporting high levels of psychological symptoms. The direction of results was the same in all cases; reporting use of rational, emotional or avoidance coping was associated with increased risk of psychiatric disorder, whereas reporting use of detached coping was associated with reduced risk. This result partially supports the findings of Vernberg et al. (1996) who found the use of coping strategies was associated with an increase in PTSD in children exposed to hurricane Andrew. In the present study, one protective coping factor was found which may reflect the fact that detached coping was not assessed by Vernberg et al. (1996), or that use of coping styles has different effects on risk in adults and children. Engaging in emotional coping appeared to place participants at the greatest increased risk. The finding that rational coping was associated with greater distress is somewhat counterintuitive. It is possible however that adopting a very practical and problem-focused approach to the aftermath of the flood was counter-productive, given that in some circumstances, there was very little that could have been done due to the unpredictable nature of the floods, and that individuals had very little actual control over the events that followed. Thus, in the short-term, other strategies such as detached coping may be more adaptive. Indeed, that detached coping was associated with fewer symptoms could be explained by the fact that this enables individuals to distance themselves from the situation.

A number of methodological issues should be highlighted when interpreting the results of this investigation. First, we did not assess criteria that would give a diagnosis of any condition, but symptoms associated with the condition. Consequently, we cannot say for certain how many individuals scoring highly on this range of symptoms would have had PTSD, anxiety or depression, and therefore cannot directly compare our findings to some of those previously reported. Second, data were collected for a minimum of 5 months after the floods. The lack of consensus on the trajectory of psychological sequelae following disasters makes it impossible to predict whether initial symptom levels were higher and whether symptom levels will alter in the coming months and years. Longitudinal research should be conducted to establish this. Given the unpredictable nature of such events, it was not possible to collect baseline data and therefore it is not possible to say whether the experience of flooding itself was responsible for the distress assessed through this study. Third, it was not possible to reliably measure the extent of flooding and we were reliant on self-report to assess this. Fourth, although the response to the study was good, the overall response rate is modest, which limits the extent to which these findings apply outside of the study population. As with all studies of this nature, the instruments were carefully selected to assess trauma, anxiety, depression and coping and have been validated to measure this; however, it is possible that they were not sensitive enough to detect some of the more specific responses to the flood.

This study has a number of implications for the way that communities respond to environmental events such as flooding. Firstly, without pathologising a normal reaction to a traumatic experience, the study highlights the large number of people who are potentially in need of psychological attention following exposure to an event such as floods or other natural disasters. Appropriate community support and access to Primary Care services would be important in detecting distress following such events. The results of this study also highlight potential at-risk groups, such as those in poor health and those who have been relocated, who may benefit from targeted mental health services following a disaster. The results also suggest that people could be encouraged to engage in detached coping in the short-term at least. Health providers and government agencies may be able to benefit from information generated by this study and potentially use it to inform their immediate and long-term response to communities affected by natural disasters of this nature in the future.

Acknowledgements

The authors thank Dr. Allan Jones for his role in the development and initiation of the study. They also thank all the individuals affected by the floods who kindly participated in the study, the staff at Wychavon District and Tewkesbury Borough Councils and Stella Williamson for assisting with data entry.

References

- Acierno, R., Ruggiero, K.J., Galea, S., Resnick, H.S., Koenen, K., Roitzsch, J., et al. (2007). Psychological sequelae resulting from the 2004 Florida hurricanes: Implications for post disaster intervention. *American Journal of Public Health*, 97(S1), S103–S108.
- American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders, 4th ed text revision (DSM-IV-TR)*. Washington, DC: American Psychiatric Association.

- Benight, C.C., & Harper, M.L. (2002). Coping self efficacy perceptions as a mediator between acute stress response and long-term distress following natural disasters. *Journal of Traumatic Stress, 15*, 177–186.
- Bland, S.H., O'Leary, E.S., Farinano, E., Jossa, F., & Trevisan, M. (1996). Long-term psychological effects of natural disasters. *Psychosomatic Medicine, 58*, 18–24.
- Breslau, N., Chase, G.A., & Anthony, J.C. (2002). The uniqueness of the DSM definition of post-traumatic stress disorder: Implications for research. *Psychological Medicine, 32*, 573–576.
- Briere, J., & Elliott, D. (2000). Prevalence, characteristics, and long-term sequelae of natural disaster exposure in the general population. *Journal of Traumatic Stress, 13*(4), 661–679.
- Elklit, A. (1996). Coping Styles Questionnaire: A contribution to the validation of a scale for measuring coping strategies. *Personality and Individual Differences, 21*(5), 809–812.
- Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic Reviews, 27*, 78–91.
- Galea, S., Tracy, M., Norris, F., & Coffey, S.F. (2008). Financial and social circumstances and the incidence and course of PTSD in Mississippi during the first two years after hurricane Katrina. *Journal of Traumatic Stress, 21*(4), 357–368.
- Goenjian, A.K., Steinberg, A.M., Najarian, L.M., Fairbanks, L.A., Tashjian, M., & Pynoos, R.S. (2000). Prospective study of posttraumatic stress, anxiety, and depressive reactions after earthquake and political violence. *American Journal of Psychiatry, 157*, 911–916.
- Goldberg, D., & Williams, P. (1991). *A users guide to the General Health Questionnaire GHQ – 12*. London: NFER-Nelson.
- Grievink, L., van der Velden, P.G., Yzermans, C.J., Roorda, J., & Stellato, K. (2006). The importance of estimating selection bias on prevalence estimates shortly after a disaster. *Annals of Epidemiology, 16*(10), 782–788.
- Jones, A., & Elklit, A. (2007). The association between gender, coping style and whiplash related symptoms in sufferers of whiplash associated disorder. *Scandinavian Journal of Psychology, 48*(1), 75–80.
- Korol, M.S. (1990). *Children's psychological responses to a nuclear waste disaster in Fernald, Ohio*. Unpublished doctoral dissertation, University of Cincinnati, Ohio.
- Lee, D., & Young, K. (2001). Post traumatic stress disorder: Diagnostic issues and epidemiology in adult survivors of traumatic events. *International Review of Psychiatry, 13*, 150–158.
- Lima, B.R., Chavez, H., Samenjogo, N., Pompei, M.S., Pai, S., Santacruz, H., et al. (1989). Disaster severity and emotional disturbance: Implications for primary mental health care in developing countries. *Acta Psychiatrica Scandinavica, 79*(1), 74–82.
- Liu, A., Tan, H., Zhou, J., Li, S., Yang, T., Wang, J., et al. (2006). An epidemiological study of posttraumatic stress disorder in flood victims in Hunan China. *Canadian Journal of Psychiatry, 51*(6), 350–354.
- Marshall, G.N., Schell, T.L., Elliott, M.N., Rayburn, N.R., & Jaycox, L.H. (2007). Psychiatric disorders among adults seeking emergency disaster assistance after a wildland–urban interface fire. *Psychiatric Services, 58*(4), 509–514.
- Mollica, R.F., Caspi-Yavin, Y., Bollini, P., Truong, T., Tor, S., & Lavelle, J. (1992). The Harvard Trauma Questionnaire. Validating a cross cultural instrument for measuring torture, trauma and posttraumatic stress disorder in Indochinese refugees. *Journal of Nervous and Mental Disease, 184*, 111–116.
- Najarian, L.M., Goenjian, A.K., Pelcovitz, D., Mandel, F., & Najarian, B. (2001). The effect of relocation after a natural disaster. *Journal of Traumatic Stress, 14*(3), 511–526.
- Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: A systematic review. *Psychological Medicine, 38*(4), 467–480.
- Norris, F.H. (2005). *Range, magnitude and duration of the effects of disasters on mental health: Review update 2005*. Retrieved January 6, 2009 from http://www.redmh.org/research/general/REDMH_effects.pdf
- Norris, F.H., Friedman, M.J., & Watson, P.J. (2002). 60,000 disaster victims speak, Part II: Summary and implications of the disaster mental health research. *Psychiatry, 63*(3), 240–260.
- Norris, F.H., & Murrell, S.A. (1988). Prior experience as a moderator of disaster impact on anxiety symptoms in older adults. *American Journal of Community Psychology, 16*, 665–683.

- Parloff, M.B., Kelman, H.C., & Frank, J.D. (1954). Comfort, effectiveness, and self-awareness as criteria for improvement in psychotherapy. *American Journal of Psychiatry*, 3, 343–351.
- Pilar Matud, M. (2004). Gender differences in stress and coping styles. *Personality and Individual Differences*, 37(7), 1401–1415.
- Rachman, S. (1980). Emotional processing. *Behavior Research Therapy*, 18, 51–60.
- Reacher, M., McKenzie, K., Lane, C., Nichols, T., Iversen, A., Hepple, P., et al. (2004). Health impacts of flooding in Lewes: A comparison of reported gastrointestinal and other illness and mental health in flooded and non-flooded households. *Communicable Disease and Public Health*, 7(1), 1–8.
- Roger, D., Jarvis, G., & Najarian, B. (1993). Detachment and coping: The construction and validation of a new scale for measuring coping strategies. *Personality and Individual Differences*, 15, 619–629.
- Tapsell, S.M., Tunstall, S.M., & Wilson, T. (2003). *Banbury and Kidlington four years after the flood: An examination of the long-term health effects of flooding* (Report to the Environment Agency). Thames Region: Flood Hazard Research Centre, Middlesex University, Enfield.
- Tedeschi, R., & Calhoun, L. (2004). Posttraumatic growth: A new perspective on psychotraumatology [Electronic version]. *Psychiatric Times*, 21(4). Retrieved from <http://www.psychiatristimes.com/p040458.html>
- Terr, L.C. (1989). Treating psychic trauma in children: A preliminary discussion. *Journal of Traumatic Stress*, 2, 3–20.
- Tunstall, S., Tapsell, S., Green, C., Floyd, P., & George, C. (2006). The health effects of flooding: Social research results from England and Wales. *Journal of Water and Health*, 4(3), 365–380.
- Verger, P., Rotily, M., Hunault, C., Brenot, J., Baruffol, E., & Bard, D. (2003). Assessment of exposure to a flood disaster in a mental-health study. *Journal of Exposure Analysis and Environmental Epidemiology*, 13, 436–442.
- Vernberg, E.M., La Greca, A.M., Silverman, W.K., & Prinstein, M.J. (1996). Prediction of posttraumatic stress symptoms in children after hurricane Andrew. *Journal of Abnormal Psychology*, 105(2), 237–248.
- 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.
- Yzermans, C.J., Donker, G.A., Kerssens, J.J., Dirkzwager, A.J.E., Soeteman, J.H., & ten Veen, P.M.H. (2005). Health problems of victims before and after disaster: A longitudinal study in general practice. *International Journal of Epidemiology*, 34, 820–826.