Behaviourally-based interventions for children following volcanic eruptions: an evaluation of effectiveness

Kevin R. Ronan and David M. Johnston

The authors

Kevin R. Ronan is at the School of Psychology, Massey University, Palmerston North, New Zealand.

David M. Johnston is at the Institute of Geological and Nuclear Sciences, Wairekei, Taupo, New Zealand.

Keywords

Children, Counselling

Abstract

Represents the first systematic attempt to examine the effects of school-based interventions on children's self-reported PTSD-related distress and coping ability following a series of volcanic eruptions in a sample of 112 children. Pretreatment assessments carried out after the eruptions revealed that time was more of an ally for PTSD symptoms than for active coping ability. In terms of randomly assigned intervention conditions, both an exposure and a cognitive behavioural intervention were found to lead to significant improvement in both PTSD-related distress and coping ability. In terms of effect sizes (Cohen's *d*), the coping scores changed more following the one-hour intervention than they had during the entire two-month pretreatment interval; PTSD-related scores changed over half as much as during the two-month pretreatment interval. In addition, at four-month follow-up, either children continued to improve (PTSD-distress scores) or gains were maintained (coping scores). Treated children's PTSD and coping scores were significantly more adaptive than those of untreated children. Finally, multiple regression analyses did not reveal any significant, prospective predictors of treatment responsivity. Includes consideration of the value of self-report methodologies at the "early gates" of a multiple gating intervention model and the value of collaborations between scientists in the wake of a disaster.

Disaster Prevention and Management
Volume 8 · Number 3 · 1999 · pp. 169–176
 · ISSN 0965-3562

The past decade has seen a growing recognition of the effects of childhood exposure to traumatic events (Saylor, 1993). Witnessing instances of war, technology-related disasters (e.g. air crashes, road accidents, mass transport disasters) (Yule, 1994) and natural disasters including hurricanes, fires, earthquakes and volcanic eruptions (e.g. LaGreca *et al.,* 1996; Ronan, 1997) can lead children to developing transient fears (Long *et al.,* 1998). Some children may go on to develop a more severe range of anxiety-based conditions that includes symptoms of post-traumatic stress disorder (PTSD) (Lonigan *et al.*, 1994; Shannon *et al.*, 1994).

The growing recognition of the significant and negative impact of post-disaster PTSD symptoms in children has led funding agencies in places like the USA to set aside moneys available for quick access when disasters do strike (Saylor, 1993). In addition, progress has been made empirically in the assessment and prediction of children's PTSD reactions. A general finding is that most studies have found symptoms of post-traumatic stress disorder (PTSD) to be relatively common following a range of disasters (Long *et al.*, 1998). More recent studies have found that time appears to be an ally in the reduction of PTSD symptoms for some, but not other, children (LaGreca *et al.*, 1996). Thus, while some children appear to recover with time, some continue to suffer ill-effects.

Two prominent factors identified by LaGreca *et al.* (see also Ronan and Wilson-Grey, 1999) as predicting PTSD symptoms over time were social support and coping factors. Indeed, the presence of these factors (e.g. effective problem solving, feeling supported by others) predicted reductions in PTSD symptoms over time (LaGreca *et al.,* 1996). Thus, interventions that incorporate these features are warranted (Long *et al.,* 1998; Ronan and Deane, 1998). Other factors suggested to be effective include exposure combined with relevant information designed to enhance children's sense of

This research was partially supported by a grant from Massey University (1-0575-67214A) awarded to the author. The authors would like to thank the following schools and their students: Ohakune Primary School (Ellen Gould), Waiouru Primary School (Tauri Morgan), and Raetihi Primary School (Grant Fountain). The authors would also like to thank the following people for their advice concerning effect size calculations: Nik Kazantzsis, John Podd and Craig Whittington.

Disaster Prevention and Management
Volume 8 · Number 3 · 1999 · 169–176

control, reductions in their distress, and increased feelings of overall safety (Long *et al.,* 1998). For example, information and coping skills assistance provided to children in school settings may have a beneficial effect, is widely recommended, and is often provided but no such efforts have been subjected even to preliminary investigation (see also LaGreca *et al.,* 1996; Saylor, 1993).

The current study was designed to move this area forward from purely assessment-based research into a preliminary examination of both the effects of time and a comparison of brief and "early gate" (Johnston and Ronan, 1998) school-based interventions following a natural disaster. In a multiple gating model, early identification and intervention is designed to address the needs of communities and large groups through efficient use of resources and in a parsimonious timeframe. In the current research, it was also the case that there were necessary and self-imposed limitations placed on the research as a function of the needs of schools (e.g. limited access to participants) based on the post-disaster environment (e.g. Saylor, 1993). Consequently, it was simply not possible to provide the methodological control necessary to carry out a controlled, clinical trial. On the other hand, as a preliminary investigation, the purpose was first to replicate previous self-report based assessment research and extend it into the area of reactions to volcanic eruptions. The second purpose was to begin to move beyond solely assessment based research and begin looking at the effectiveness of brief programmes in schools following disasters while providing some level of control over threats to internal validity. Thus, we were able to use a mixed factorial design to assess both the effects of time and the effects of two randomly assigned interventions – those type of interventions that have been reported to occur in schools following a natural disaster but have never been subjected to empirical scrutiny (LaGreca *et al.,* 1996; Long *et al.,* 1998). Consequently, a major question of the research was aimed at answering the question of: does a one-hour, school-based intervention assist children to report decreased distress and increased coping ability? If so, how does intervention compare to the elapse of time (i.e. two-month within-subject interval)? Second, if the more comprehensive intervention of the two is shown to produce some beneficial effects, do they maintain over time for a subsample of participants (i.e. at four-month follow-up)? Finally, how do distress and coping scores of treated children compare to those of an untreated group at follow-up?

Method

Overview of design

The design was mixed factorial and involved four separate assessments over a seven-month period. From pre- to post-treatment, it included three separate assessments over a two-month interval. The first assessment (PRE1) was administered one month after the eruptions based on the rationale that PTSD symptoms are to be considered one month following a traumatic event (American Psychiatric Association, 1994). The second assessment (PRE2) was administered two months later (three months following eruptions) to assess the effects of elapsed time on PTSD symptoms and coping ability. This interval served as a within-subject control period. The third assessment (POST) assessed the effects of one of two randomly assigned intervention conditions: an exposure condition versus a cognitive-behavioral condition (see below for description). A fourth assessment (FU) was included four months later to assess maintenance of any change and to compare treated children with a separate, smaller sample of untreated children. The dependent variables were PTSD symptoms and coping ability. In addition to these constructs, an array of additional variables (exposure variables, demographic variables), home-based (family and parent) factors, and other factors related to negative and positive emotionality (anxiety, depression, and self-talk including perceptions of social support) were assessed at PRE1 to assess factors that predicted later intervention response.

Participants

Participants in the school based intervention were 113 children (52 males, 61 females) aged between seven and 13 years of age (M = 10.50, SD = 1.54). Ethnic composition of the sample was as follows: 70 Caucasian (European descent), 12 Maori, six Asian, 21 Maori/European, two Asian/Maori/Pacific Islander, and one Asian/Pacific Islander. Informed consent was necessary for participation (both parent and separately for the child). These children came from three primary schools all within an 11km radius of the base of Mount Ruapehu.

Disaster Prevention and Management
Volume 8 · Number 3 · 1999 · 169–176

Measures

Dependent variables

These measures were assessed at pretreatment (the one month (PRE1), and three month (PRE2) post-eruption intervals), post-treatment (POST), and at the seven-month interval (i.e. four-month follow-up (FU)).

Self-reported symptoms of PTSD

The Reaction Index (RI) is a 20-item measure of PTSD symptoms assessed on a 5-point frequency based scale (ranging from "none of the time" to "most of the time"). The advantage of the RI scale is that it is specifically designed to be tailored to a specific traumatic event. Reliability and validity data have been reported (e.g. Frederick *et al.,* 1992; LaGreca *et al.*, 1996; Vernberg *et al.*, 1996). In addition, findings have indicated that as total scales on the RI increase, so too does exposure to the traumatic event (e.g. Lonigan *et al.*, 1994). Correlations between the RI scale and actual PTSD cases has been quite high (0.91) (Frederick, 1985). Using the current sample, alpha reliability was found to be acceptable (0.81) (Ronan, 1997).

Coping Questionnaire (CQ)

The coping questionnaire is a three-item measure that was developed to assess changes in children's self-reported ability to cope with anxiety arousing situations (Kendall *et al.*, 1992). Like the RI, it is designed to be situation specific. Reliability data have been provided and the CQ has been shown to be sensitive to treatment (e.g. Kendall *et al.*, 1992; Kendall, 1994). In the current study, children rated their ability to cope with stimuli related to the eruptions (e.g. distressing thoughts) on a
7-point scale (from "not able to help myself" to "completely able to help myself feel comfortable"). Using the current sample, the CQ reliability was 0.71 (Ronan, 1997).

Predictor variables

All measures here were assessed at the one month post-eruption interval (PRE1). Of course, PRE1 RI and CQ scores were included as predictor variables.

Exposure and perception of life threat

Children in this study were directly exposed to the eruptions (e.g. second series of eruptions happened on a school day) and thus it was not necessary to code direct exposure. However, perception of life threat was assessed by children's rating of the item "I thought my world was coming to an end" on a 5-point scale. Additionally, location of residency in relation to the eruption was also coded (e.g. windward versus leeward side of the volcano).

Demographic variables

Sex, age, and ethnic background were included here (see also Vernberg *et al.,* 1996).

Home factors

Two items assessed one aspect of social support. These home-related factors were rated on a 5-point scale (from "none of the time" to "most of the time"): (a) "How much have your parents been upset by the volcano?" and (b) "When you hear talk about the volcano at home, do you feel scared, afraid, or upset?"

Emotional and cognitive features including perceptions of social support

The Children's Depression Inventory (Kovacs, 1981), the State-Trait Anxiety Inventory for Children (Spielberger, 1973), and the Negative Affect Self-Statement Questionnaire (Ronan *et al.*, 1994) were used to assess features of anxiety, depression, and affectively-oriented self-talk. All of these measures have demonstrated reliability, validity, and have been shown to be sensitive to the effects of intervention (Ronan, 1996). In addition to examining the overall impact of emotional factors and self-talk on treatment responsivity, four specific items from the NASSQ and CDI reflect symptoms and self-talk related to children's perceptions of social support. These specific items have been looked at more closely in previous studies and have shown relationships to prediction of PTSD symptoms and coping both initially and over time (e.g. Ronan and Wilson-Grey, 1998).

Interventions

Exposure and normalizing condition

Video-based exposure and information from a volcanologist about volcanic eruptions included watching a 20-minute video of the eruptions and discussions about the physical science of volcanoes. This necessarily included discussions about general physical safety in relation to the physical science. A child clinical psychologist also presented information intended to normalize fears as well as talking about other facets of the physical science (e.g. layperson reactions). Intended to normalize, this discussion also was included as a control for the amount of

Disaster Prevention and Management
Volume 8 · Number 3 · 1999 · 169–176

time spent presenting in the cognitive-behavioral condition.

Cognitive-behavioral condition
This condition included exposure, physical science information, and normalizing of fears supplemented by other cognitive-behavioural factors. A coping modelling approach (e.g. Ronan and Kendall, 1991) was used to demonstrate coping with both normal and adverse effects of exposure to the eruptions. This included modelling of negative self-talk and subsequent modification of that self-talk. Encouragement to access information and social support was provided in the form of modelling and direct suggestion. For example, the modelling of a cognitive restructuring sequence was designed to help those children whose distress and safety concerns were attributable to cognitive distortions based on a lack of information (e.g. how to problem-solve/seek information to dispel the false idea held by some children that water supplies were poisoned). Finally, the modelling of self-reinforcement for problem-solving attempts was emphasized. The basis for this intervention is a cognitive-behavioural intervention that has demonstrated efficacy with anxiety-disordered children (e.g. Kendall *et al.*, 1992; Kendall, 1994; Ronan and Deane, 1998; see also Johnston and Ronan, in press; Long *et al.*, 1998). More information is available from the first author.

Procedure
At the PRE1 assessment, children were administered the full battery of measures by a trained, graduate level child researcher. Instructions and items on each measure were read aloud. At the second assessment (PRE2) two months later, the children were administered the RI and the CQ followed by the one hour intervention in group settings that consisted of approximately 20 to 30 participants. Following the intervention, the children were administered the RI and CQ (POST assessment). Four months later, follow-up assessment was carried out using the RI and CQ. Children were randomly assigned to intervention condition based on school. Owing to the nature of the intervention and limitations imposed by schools, individual assignment to condition was not possible. However, in early intervention protocols, random assignment by school is not uncommon (e.g. Dadds *et al.*, 1997). A total of 69 children were assigned to the cognitive behavioural condition; 43 were assigned to the exposure condition. For treatment comparisons, data were analysed for the whole sample (n = 112) as well as separately for those children identified as symptomatic (n = 69) based on RI scores (i.e. 11 or above, see Frederick *et al.*, 1985). The rationale for analysing scores for the whole sample was to assess whether such interventions have value in general as well as to confirm that such an intervention did not negatively sensitize children who were not distressed.

Based on an agreement with the schools, the children in the exposure condition were offered the cognitive-behavioural components following the post-intervention assessment (i.e. during a debriefing phase). Thus, for children in this condition, the gathering of follow-up data was not warranted. Given that the cognitive-behavioural components were presented during debriefing without the time necessary for systematic assessment of this additional intervention, follow-up data if gathered on this group would have been of questionable utility[1]. Consequently, at four-month follow-up, only those who were involved in the cognitive-behavioural condition were administered follow-up assessments. In addition, another sample of untreated children (n = 11) were included for comparison. This group was administered the measures at the follow-up interval.

Results

Group comparability
No initial differences were noted between treatment groups on the dependent variables for either the whole sample or the symptomatic group (all ps > 0.10).

Treatment outcome analyses
A 2 (treatment groups) × 3 (assessment periods) multivariative analysis of variance (MANOVA) assessed for overall effects of time and condition. For the whole sample, the trials effect was highly significant ($F(4, 346) = 20.94$, $p < 0.001$). The interaction effect was non-significant ($F(4, 346) = 2.13$, $p > 0.05$). Univariate testing confirmed significant trials effects for both the RI ($F(2, 174) = 46.94$, $p < 0.001$) and the CQ ($F(2, 174) = 3.38$, $p < 0.05$). Owing to this pattern, further univariate testing was done to assess the relative effects of the two-month interval as well as the one-hour intervention for both RI and CQ scores (see below).

Disaster Prevention and Management
Volume 8 · Number 3 · 1999 · 169–176

For the symptomatic sample, a 2 × 3 MANOVA indicated a significant interaction ($F(4, 218) = 4.07$, $p < 0.01$) and significant trials effect ($F(4, 218) = 21.27$, $p < 0.001$). For the interactions, univariate F tests indicated that the source of the significance was a function of CQ scores ($F(2, 110) = 7.67$, $p < 0.001$) but not RI scores ($F(2, 110) = 1.20$, $p > 0.10$). Consequently, further 2 × 2 mixed factorial ANOVAs were carried out on CQ, but not RI, scores (see below for those analyses). For the RI, a univariate F test did confirm a significant trials effect for RI scores ($F(2, 110) = 48.26$, $p < 0.001$). Thus, for RI scores in the symptomatic sample, univariate tests assessed the relative effects of the two-month interval versus the one-hour intervention (see next section).

PTSD symptoms

For the whole sample, children improved over time ($t(107) = 7.17$, $p < 0.001$) as well as following treatment ($t(98) = 2.95$, $p < 0.005$). For those children who scored in the symptomatic range, a similar pattern was indicated, children improved both over time ($t(66) = 7.13$, $p < 0.001$) and following treatment ($t(58) = 2.60$, $p = 0.01$). Means and standard deviations are presented in Table I for those children who were symptomatic at PRE1. Effect sizes (Cohen's d; Borenstein *et al.*, 1997) were calculated for the initially symptomatic sample's RI scores ($n = 69$). Time accounted for change that was 0.80 (95 per cent confidence interval (CI), 0.43-1.17) of the pooled standard deviation (the pooled SD for this effect size calculation takes into account the correlation between measures, Borenstein *et al.*, 1997); the intervention accounted for an effect size of 0.52 (95 per cent CI, 0.15-0.89). The one-hour intervention, in terms of Cohen's d, accounted for a little over half of the change that occurred during the preceeding two-month interval though the overlap between confidence intervals is noted. Finally, for those children who continued to be symptomatic at PRE2, a 2 × 2 ANOVA indicated a nonsignificant condition by trials interaction and a significant trials effect ($F(1, 32) = 4.16$, $p < 0.05$). Thus, children in both conditions improved significantly.

Coping ability

For the whole sample, children improved both over time ($t(110) = 2.01$, $p < 0.05$) and following treatment ($t(108) = 2.70$, $p < 0.008$). For the symptomatic sample, further examination of the significant MANOVA interaction was carried out with mixed factorial ANOVA. For the PRE1 to PRE2 interval, a 2 × 2 ANOVA indicated a significant interaction ($F(1, 66) = 9.75$, $p < 0.01$) and a non-significant trials effect ($F(1, 66) = 2.75$, $p > 0.10$). The source for the interaction was found to be significant improvement for the CBT group over the two-month pretreatment interval ($t(36) = 3.68$, $p < 0.001$) and non-significant deterioration in CQ scores for the Exposure group ($t(42) = 0.20$, $p > 0.10$). Means and standard deviations are presented in Table I for those children who were symptomatic at PRE1. In terms of the PRE2 to Post-treatment interval, a 2 × 2 ANOVA indicated a non-significant interaction ($F(1, 65) < 1$) and a significant trials effect ($F(1, 65) = 6.87$, $p < 0.01$). Given no differences between treatments (i.e. the interaction occurred as a function of the pretreatment interval), the groups were collapsed to assess effect sizes. As with RI scores, effect sizes were calculated for the initially symptomatic sample. Time accounted for change that was 0.22 (95 per cent CI, -0.12 - 0.56) of the pooled standard deviation; the one-hour intervention accounted for an effect size of 0.31 (95 per cent CI, -0.03 - 0.65). In terms of the effect size, the intervention accounted for more change than that which occurred during the preceeding two-month interval, though it must be also noted that there was substantial overlap between confidence intervals. Finally, for those children who remained symptomatic at PRE2, a 2 × 2 ANOVA indicated a non-significant condition by trials interaction and a significant trials effect ($F(2, 32) = 3.23$, $p < 0.05$). Thus, as with RI scores, children in both treatment conditions improved significantly[2].

Table I RI and CQ scores for symptomatic children one month (PRE1) and three months (PRE2) following eruptions, and following intervention (POST)

	PRE1	PRE2	POST
RI scores			
Combined samples	23.25 (11.9)	15.8 (14.4)	12.5 (13.4)
CBT	23.50 (12.7)	14.6 (13.6)	11.9 (11.4)
EXP	22.94 (11.0)	17.6 (15.5)	13.4 (15.9)
CQ scores			
Combined samples	17.1 (4.1)	17.9 (3.9)	18.6 (3.5)
CBT	16.7 (3.9)	18.7 (3.2)	19.5 (2.7)
EXP	17.5 (4.1)	16.9 (4.5)	17.5 (4.1)

Notes: RI = Reaction index; CQ = Coping questionnaire; CBT = Cognitive behavioural condition; EXP = Exposure condition

Disaster Prevention and Management
Volume 8 · Number 3 · 1999 · 169–176

Follow-up

Four months following the intervention, 41 children who had taken part in the intervention were available for follow-up assessment. The remaining 28 children were not available owing to various reasons (e.g. moved to other schools, away at school camp). A separate group of 11 untreated children were included for comparison.

First, changes following intervention were maintained at four-month follow-up. For PTSD scores, additional, significant change occurred from post-treatment (M = 11.11, SD = 11.51) to follow-up (M = 7.51, SD = 8.32) ($t(36) = 2.54$, $p < 0.05$). For CQ scores, changes were maintained from post-treatment (M = 19.74, SD = 2.35) to follow-up (M = 19.92, SD = 2.22) ($t(38) = 0.56$, $p > 0.10$).

A *t*-test comparing means between the treatment group (TX Group) and the follow-up only group (FU-Only) was significant for RI scores (TX Group, M = 7.71, SD = 8.30; FU-Only, M = 13.55, SD = 7.87) ($t(47) = 2.08$, $p < 0.05$) and CQ scores (TX Group, M = 19.90, SD = 2.20; FU-Only, M = 17.73, SD = 4.24) ($t(50) = 2.34$, $p < 0.05$) indicating that the treatment group reported significantly reduced distress and increased coping ability compared to the FU-Only group. In addition, the FU-Only Group's RI score was still in the symptomatic range whereas the TX Group's was not.

Prediction of treatment responsivity

Multiple regression analyses addressed the ability of an array of variables (demographic factors (sex, gender, ethnicity), location, PRE1 scores on the following: perception of life threat, STAIC-State and Trait scales, CDI, NASSQ, CQ, RI and the two Home Factors) to predict treatment-related change scores. Given the equivalance of the treatment conditions, separate, standard regression analyses were carried out for RI and CQ change scores collapsed across treatment conditions. In the regression analyses, both regression equations were non-significant (RI, $F(13, 66) = 1.03$, $p > 0.10$; CQ, $(13, 73) = 1.26$, $p > 0.10$).

Discussion

Current findings provide support for the effectiveness of brief behaviourally-based intervention programmes for children of varying ethnic backgrounds, ages, and gender following a natural hazard. Both intervention conditions led to significant reductions in self-reported PTSD symptoms. The one-hour interventions accounted for a little over half the change (effect size of 0.52) that was accounted for by the preceeding two-month pretreatment interval (effect size of 0.80). In terms of coping ability, both conditions were found also to lead to significant improvement. Here, the one-hour intervention accounted for slightly more benefit (effect size of 0.31) than that which had occurred during the preceeding two-month pretreatment interval (effect size of 0.22). Initial changes either continued to improve (PTSD) or were maintained (coping) at four-month follow-up. In addition, significant differences between treated and non-treated children's PTSD symptoms and coping scores seven months after the eruptions (four months following intervention) further demonstrated the superiority of intervention over the effects of time alone. These results support the speculation and anecdotal reports that behaviourally-based, brief interventions in school settings following natural disasters can assist young people to reduce distress and increase active coping ability (e.g. LaGreca *et al.*, 1996; Long *et al.*, in press; Saylor, 1993; Vernberg *et al.*, 1996).

Time was found to have a more beneficial impact on PTSD symptoms than on coping ability. In particular, the change that occurred during the two-month pretreatment interval was much greater for the RI scores (0.80 of a standard deviation) than for coping scores (0.22 of a standard deviation). In addition, at the follow-up assessment, scores on the PTSD measure continued to improve with time whereas CQ benefits were maintained (i.e. CQ scores did not change over this four-month interval). At least two reasons may account for these differential effects. First, based on meetings with teachers and principals at all three schools, active efforts were being made at schools to assist children, particularly in the area of reducing PTSD-related distress. Thus, these efforts may have accounted for distress-related change during the two-month pretreatment interval. Second, the possibility exists that distress may be more likely to reduce naturally with the effects of time (i.e. "time heals"). On the other hand, it might be more difficult for children to increase coping ability without more direct or active assistance. This latter possibility is

supported by the finding that a subset of symptomatic children actually showed a non-significant decrement in coping scores in the two-month pretreatment interval. Additionally, there was also no change in CQ scores during the follow-up interval whereas the RI scores continued to improve. Of course, more research is needed to assess the relative effects of time and intervention on diverse areas of emotional and behavioural functioning. One area that certainly needs addressing is assessing the effectiveness of the various forms of "informal" assistance that are often provided by schools in the aftermath of a disaster (e.g. LaGreca *et al.,* 1996; Saylor, 1993). However, the finding that a one-hour intervention helped children increase their coping ability more than a preceeding two-month interval (that undoubtedly included some forms of school-based assistance) is particularly encouraging as a platform for such future research.

In terms of some other relevant issues raised in the literature (e.g. Saylor, 1993), concern has been raised about interventions (or outside experts) potentially sensitizing some children in a negative way. This idea was not upheld in the current research. Findings indicated that the whole sample – consisting of both symptomatic and non-symptomatic children – showed significant benefit on both the symptom and coping measure. In particular as relates to this issue, non-symptomatic children did not show negative effects. On the contrary, they too derived some benefits. Based on other research and our own experience, this group very likely contained a subset of children who were distressed – self-report measures will only identify those who admit to distress (Dadds *et al.*, 1997; Ronan and Deane, 1998). Another concern in a brief intervention of this type is regression to the mean – that is, children scoring in the more severe direction reporting the most benefit. That concern was not upheld in this study as indicated in regression analyses.

A limitation of the current study was that it did not meet the criteria for a controlled, clinical trial. The inability to randomly assign individual children to a no-treatment control condition precluded that possibility. However, given the naturalistic conditions that often arise following a disaster, and within a school setting (e.g. Saylor, 1993), it was decided to assess the effects of time through a within subject assessment (i.e. using a prospective design). Furthermore, with regard to the interventions, while we were not able to randomly assign individual children to condition, it was possible to assign randomly by school. Such a technique is not uncommon in school-based early interventions (e.g. Dadds *et al.*, 1997). However, even with some control established, time and maturation cannot be entirely ruled out as threats to the conclusion that the interventions accounted for the beneficial change.

On the other hand, some evidence against these possibilities was apparent. For example, that the overall positive change (i.e. effect size) in CQ scores over a two-month interval was less than that seen following the one-hour intervention provides some evidence against the effects of time or maturation solely accounting for this pattern of findings.

Thus, while our study does provide preliminary support for behaviourally-based, brief interventions, future studies need to confirm this potential with a controlled trial.

A related limitation included the reliance on self-report measures. However, it is also the case that self-reports often play a significant role in helping to identify children and for measuring change in early gate interventions (Dadds *et al.,* 1997; Long *et al.,* in press). When many children are involved in a brief and large group intervention, self-report measures can improve efficiency. Of course, as already discussed, this may mean that those children who don't readily admit to distress can potentially be left out of interventions of this type. However, in our case, we found that the whole sample – those who admitted some distress and those who reported lower levels – derived benefit.

Future early intervention-based research might also include an efficient form of teacher or parent nomination to identify more specifically the subset of distressed children who do not admit to distress on self-reports (e.g. Dadds *et al.,* 1997). Additionally, future research needs to use multiple methods (e.g. teacher and parent reports) to assess both early and later gate interventions through a combination of school- and group-based interventions that are followed up by more intensive intervention for those who do not make necessary gains (Johnston and Ronan, in press). We would add that various forms of collaboration between social and physical scientists in relation to disasters merit future research attention.

Notes

1 It was also the case that the school assigned to the exposure condition was reluctant to have children undergo follow-up assessment for a number of legitimate and logistical (school-based) reasons.

2 Analyses also addressed the issue of whether such an intervention might negatively sensitize children who were not symptomatic prior to the intervention. Results confirmed our expectation that such children would not be negatively impacted. On the contrary, a beneficial effect was noted for non-symptomatic children on the RI scale indicating that children improved from pre- to post-intervention ($t(63) = 2.04$, $p < 0.05$; PRE2 = 4.73, SD = 3.2; POST = 3.83, SD = 3.7). For the CQ scale, non-symptomatic children showed nonsignificant improvement ($t(65) = 1.00$, $p > 0.10$; PRE2 = 20.23, SD = 1.9; POST = 20.41; SD = 1.6).

References

American Psychiatric Association (1994), *Diagnostic and Statistical Manual of Mental Disorder* (4th ed.), Washington, DC.

Borenstein, M., Rothstein, H. and Cohen, J. (1997), *Power and Precision: A Computer Program for Statistical Power Analysis and Confidence Intervals*, Biostat, Teaneck, NJ.

Dadds, M.R., Spence, S.H., Holland, D.E., Barrett, P.M. and Laurens, K.R. (1997), "Prevention and early intervention for anxiety disorders: a controlled trial", *Journal of Consulting and Clinical Psychology*, Vol. 65 No. 4, pp. 627-35.

Frederick, C. (1985), "Selected foci in the spectrum of post-traumatic stress disorders", in Laube, J. and Murph, S.A. (Eds), *Perspectives on Disaster Recovery,* Appleton-Century-Croft Publishing, Norwalk, CT, pp. 110-31.

Frederick, C.J., Pynoos, R.S. and Nader, K. (1992), *Reaction Index to Psychic Trauma,* University of California, Los Angeles (UCLA), Los Angeles.

Johnston, D.M. and Ronan, K.R. (in press), "Risk education and intervention", in Siggurdson, H. (Ed.), *Encyclopedia of Volcanoes,* Academic Press, New York, NY.

Kendall, P.C. (1994), "Treating anxiety disorders in children: results from a randomized clinical trial", *Journal of Consulting and Clinical Psychology*, Vol. 62 No. 1, pp. 100-10.

Kendall, P.C. and Ronan, K.R. (1990), "Assessment of children's anxieties, fears, and phobias", in Reynolds, C.R. and Kamphaus, R.W. (Eds), *Handbook of Psychological and Educational Assessment of Children,* Guilford Press, New York, NY, pp. 223-44.

Kendall, P.C., Chansky, T.E., Kane, M.T., Kim, R.S., Kortlander, E., Ronan, K.R., Sessa, F.M. and Siqueland, L. (1992), *Anxiety Disorders in Youth: Cognitive Behavioral Interventions*, Allyn & Bacon, Boston, MA.

Kovacs, M. (1981), "Rating scales to assess depression in school aged children", *Acta Paedopsychiatrica,* Vol. 46, pp. 305-15.

La Greca, A.M., Silverman, W.K., Vernberg, E.M. and Prinstein, M.J. (1996), "Symptoms of post-traumatic stress in children following Hurricane Andrew: a prospective study", *Journal of Consulting and Clinical Psychology,* Vol. 64 No. 4, pp. 712-23.

Long, N.R., Ronan, K.R. and Perreira-Laird, J. (1998), "Victims of disaster", in Singh, N. (Ed.), *Comprehensive Clinical Psychology: Applications in Diverse Populations*, Pergamon Press, New York, NY, pp. 375-90.

Lonigan, C.J., Shannon, M.P., Taylor, C.M., Finch, A.J. and Sallee, F.R. (1994), "Children exposed to disaster: II. Risk factors for the development of post-traumatic symptomatology", *Journal of the American Academy of Child and Adolescent Psychiatry*, Vol. 33, pp. 94-105.

Ronan, K.R. (1996), "Bridging the gap in childhood anxiety assessment: a practitioner's resource guide", *Cognitive and Behavioral Practice,* Vol. 3 No. 1, pp. 63-90.

Ronan, K.R. (1997), "The effect of a series of volcanic eruptions on emotional and behavioural functioning in children with atopic disorders", *The New Zealand Medical Journal,* Vol. 110 No. 1, pp. 11-13.

Ronan, K.R. and Deane, F.P. (1998), "Anxiety disorders", in Graham, P. (Ed.), *Cognitive Behaviour Therapy for Children and Families,* Cambridge University Press, Cambridge.

Ronan, K.R. and Wilson-Grey, K. (1999), "Prediction of post-traumatic stress in children following volcanic eruptions", manuscript in preparation.

Ronan, K.R., Kendall, P.C. and Rowe, M. (1994), "Negative affectivity in children: development and validation of a self-statement questionnaire", *Cognitive Therapy and Research*, Vol. 18 No. 6, pp. 509-28.

Saylor, C.F. (1993), *Children and Disasters,* Plenum Press, New York, NY.

Shannon, M.P., Lonigan, C.J., Finch, A.J. and Taylor, C.M. (1994), "Children exposed to disaster: I. Epidemiology of post-traumatic symptoms and symptom profiles", *Journal of the American Academy of Child and Adolescent Psychiatry,* Vol. 33, pp. 80-93.

Spielberger, C. (1973), *Manual for the State-Trait Anxiety Inventory for Children,* Consulting Psychologist Press, Palo Alto, CA.

Vernberg, E.M., La Greca, A.M., Silverman, W.K. and Prinstein, M.J. (1996), "Prediction of post-traumatic stress symptoms in children after Hurricane Andrew", *Journal of Abnormal Psychology*, Vol. 105 No. 2, pp. 237-48.

Yule, W. (1994), "Post-traumatic stress disorder", in Ollendick, T.H., King, N.J. and Yule, W. (Eds), *International Handbook of Phobic and Anxiety Disorders in Children and Adolescents,* Plenum Press, New York.

Further reading

Belter, R.W. and Shannon, M.P. (1993), "Impact of natural disasters on children and families", in Saylor, C.F. (Ed.), *Children and Disasters,* Plenum Press, New York, NY.