A Web-Based Early Intervention Can Prevent Long-Term PTS Reactions in Children with High Initial Distress Following Accidental Injury: A Treatment Moderator Analysis

Justin A. Kenardy, PhD, FAPS
School of Psychology & Centre of National Research on Disability and Rehabilitation Medicine, The University of Queensland, Australia

Catherine M. Cox, PhD
School of Psychology, The University of Queensland, Australia

Felicity L Brown, PhD
Centre of National Research on Disability and Rehabilitation Medicine, The University of Queensland, Australia


Author Note

Correspondence concerning this article should be addressed to Justin Kenardy, Centre of National Research on Disability and Rehabilitation Medicine, Herston, Queensland, Australia 4029. E-mail: j.kenardy@uq.edu.au
Abstract

The present study explored the targeting of a preventative information provision intervention delivered to children following accidental injury by assessing impact of initial traumatic distress on response to treatment. Analyses were based on baseline and 6-month outcome of child traumatic stress in a control ($n = 28$) and an intervention group ($n = 31$). Moderation of treatment outcome by initial levels of child traumatic stress was assessed through multiple hierarchical regression analyses. Results indicated the interaction between treatment provision and initial level of posttraumatic stress significantly predicted 6-month outcome ($\beta = -.42, p = .019$). When initial distress was high, children in the control group demonstrated an increase in trauma symptoms, and had significantly higher trauma symptoms at follow-up than those in the treatment group ($d = 0.94, p = .008$). When initial distress was not elevated, no significant differences were noted between the groups. These results indicate that a preventative early intervention may be best targeted at children presenting with the specific risk factor of high initial distress.
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In addition to the physical trauma following accidental injury, children can also experience greater risk of posttraumatic stress symptoms (Bryant, Mayou, Wiggs, Ehlers, & Stores, 2004; Le Brocque, Hendrikz, & Kenardy, 2010). Up to 10%-18% will suffer from chronic symptoms from 1 month following the accident (Keppel-Benson, Ollendick, & Benson, 2002, Le Brocque et al., 2010). Our group and others have shown that child initial distress is a specific and sensitive predictor for the development of posttraumatic stress disorder (Cox, Kenardy, and Hendrikz, 2008; Kenardy, Spence, & MacLeod, 2006; Trickey, Siddaway, Meiser-Stedman, Serpell, & Field, 2012).

A number of psychological approaches to prevent ongoing difficulties have been evaluated (e.g. Roberts, Kitchiner, Kenardy, & Bisson, 2009; Cox, Kenardy, & Hendrikz, 2010). From a cost-effectiveness and sustainability perspective, however, the provision of psychological assistance would optimally be provided only to children of families at-risk of ongoing difficulties and therefore likely to benefit from treatment (March, Kenardy, Cobham, Nixon, McDermott & De Young, 2015). Previously, we evaluated a prevention intervention delivering information to children and their parents which aimed to normalise reactions, provide basic coping strategies, and build a child’s sense of personal strength (Cox et al, 2010). Results of that study indicated that the intervention significantly reduced anxiety compared to standard care at 6- month follow-up. These results were promising with regard to the capabilities of a preventative universal intervention aimed at all those injured. A critical extension, however, is to identify factors that influence treatment outcome. This will allow us to determine which children will benefit from early preventative interventions, and enable targeted, cost effective service delivery only to vulnerable children.
Accordingly, this brief report presents a moderator analysis (Kraemer, Wilson, Fairburn & Agras, 2002) of a randomised controlled trial of a preventative intervention (Cox et al, 2010) to investigate the influence of the level of child initial distress on the relationship between treatment and post-trauma adjustment 6 months after accidental injury. The aim was to test whether high levels of initial distress could be an appropriate indicator for provision of the preventative intervention.

**Method**

**Participants and Procedure**

Data for this study were derived from an RCT of a web-based universal prevention intervention for children and their parents following paediatric accidental injury (Cox et al., 2010). Inclusion criteria for the study were the following: (a) age 7-16 years, (b) overnight hospitalisation associated with accidental injury, and (c) the family had internet access. Exclusion criteria included these items: (a) parent or child insufficient English skills, (b) the child had a Glasgow Coma Scale score less than 14 at time of admission indicating a possible moderate-to-severe traumatic brain injury, or (c) the injury was intentional. The obtained sample consisted of 85 children (26 females and 59 males), ranging in age from 7 to 16 years ($M = 10.90; SD = 2.18$). Cause of injury included falls (48%), sport injuries (15%), motor vehicle accidents (7%), burns (7%), knock or blow (1%), and other (14%). Mean duration of hospitalisation was 2.00 nights ($SD = 2.83$, range= 1-13). A series of analyses indicated that the treatment and control groups did not differ significantly on any demographic variables, or the moderator variable of initial distress (see Cox et al, 2010 for more information).

Eligible children were recruited through the Royal Children’s Hospital in Brisbane, Australia within 72 hours of the accident. Parents were approached by a research nurse to explain the study and to seek consent (see Cox et al., 2010 for more detail). After the baseline
assessment was received (T1, within 1 week), children and parents were randomised into the intervention (web-based and booklet) or control (assessment only) groups and then followed up at 1 month (T2) and 6 months (T3) post accident.

The intervention consisted of a booklet that was sent to parents entitled, *So your child has been in an accident...Information for parents about dealing with accidents?*, and the link to a website entitled, *So you have been in an accident*, for children (see [http://kidsaccident.psy.uq.edu.au](http://kidsaccident.psy.uq.edu.au)). This had separate sections for children aged 10 years or younger and those aged 11 years or over. Information was aimed at normalising and relieving trauma reactions via the provision of psychoeducation, coping skills and resiliency strategies.

**Measures**

Initial child distress was measured using the Child Trauma Symptom Questionnaire (CTSQ; Kenardy, et al, 2006), 10-item self-report measure of trauma reactions, with acceptable reliability ($\alpha = .69$), and good sensitivity (.85) and specificity (.75) for identifying children at risk of PTSD 6 months post-trauma (Kenardy et al., 2006). Child outcome was assessed at pretreatment (T1), posttreatment (T2) and 6-month follow-up (T3) using the Trauma Symptom Checklist for Children-A (TSCC-A; Briere, 1996), a 44-item measure of post traumatic reactions. The TSCC-A has high reliability ($\alpha = .82-.89$) and good validity (Briere, 1996).

**Data Analysis**

In the present study the moderator analysis (Kraemer et al., 2002) examined whether a baseline or pre-randomization characteristic had an interactive effect with treatment on outcome; that is, did the effect of treatment for an individual subject depend on the value of the variable in question? Thus the moderator analysis involved examining whether initial distress (T1 CTSQ score) changed the relationship between the independent variable (treatment versus no treatment) and the dependent measure (poor post-trauma adjustment
measured by T3 TSCC-A total score adjusting for pre-treatment T1 TSCC-A total score. A hierarchical multiple regression was conducted with T3 TSCC-A as the outcome. The T1 score on the outcome measure (TSCC-A total score) was controlled for by entering it into the model first. Next, the intervention variable (treatment versus no treatment), moderator variable (T1 CTSQ score), and the intervention × moderator interaction term were entered. In line with recommendations, the continuous CTSQ variable was first centred before forming the interaction term, and one outlier whose score was greater than 3 standard deviations from the mean was removed (Kraemer et al., 2002). The significant interaction was modelled using three values of the moderator in the regression equation: the mean, plus low and high values of the 25th and 75th percentile. To further analyse and identify group differences within the significant interaction, simple slopes were examined via t tests. Missing data (9%) were imputed using last observation carried forward (Cox et al, 2010).

Results

Of the 85 families who completed T1 questionnaires, 62 (73%) completed T2 and 59 (69%) completed T3. Moderator analysis was conducted on the sample of N = 59 (Intervention n =31, Control n = 28). No significant differences were found between dropouts and completers on any outcome measures at T1. The analysis of outcome at the three time points have been reported previously (Cox et al, 2010) , however, for reference, means, and standard deviations for the TSCC-A total score for Control T1 M = 18.07 (SD = 12.99), T2 M = 17.30 (SD = 16.85), T3 M = 19.52 (SD = 18.05); and Intervention T1 M = 24.31 (SD = 13.73), T2 M = 18.90 (SD = 12.71), T3 M = 15.66 (SD = 14.28). The moderator analysis employed T3 TSCC-A as the outcome after adding T1 TSCC-A, hence T2 data were not utilised.

The simple correlation between CTSQ-T1 and TSCC-A –T3 was significant (α = 0.33, p <.01). After adding T1 levels of the TSCC-A to the model, $R^2adj = 0.19, F(1, 56) = 14.51$, p
< .01, the full regression model (treatment, CTSQ-T1, and treatment × CTSQ interaction) accounted for a significant proportion of variance in T3 TSCC-A scores, $R^2_{adj} = 0.29$, $F(4, 53) = 6.80$, $p < .01$; $\Delta R^2 = 0.13$, $\Delta F(4, 53) = 3.56$, $p = .02$). Treatment itself ($B = -5.42$, $SE_b = 3.29$, $\beta = -0.19$, $t = -1.64$, $p = .106$) did not predict TSCC-A-T3 scores, although CTSQ-T1 scores ($b = 3.35$, $SE_b = 1.16$, $\beta = 0.57$, $t = 2.89$, $p = .006$) and the interaction between treatment and CTSQ-T1 ($b = -3.31$, $SE_b= 1.37$, $\beta = -0.42$, $t = -2.41$, $p = .019$) were significant predictors. As depicted in Figure 1, analysis of simple slopes indicated that there was a significant difference between the intervention and control group on TSCC-A total score only for those children who reported high (75th percentile; total score 2.05) initial distress, $t(54) = 2.64$, $p = .008$, whereas no significant differences were noted between the groups for children who reported low (25th percentile; total score -1.95) or average (mean; total score 0.03) levels of initial distress, $t(54) = -0.23$, $p = .106$; $t(54) = 1.68$, $p = .805$, respectively. Therefore, it was only when high initial child distress was present that those who received the intervention fared better at follow-up than those in the control group. The corresponding within-group effect size for the high distress group receiving treatment was large ($d = 0.94$).

**Discussion**

High initial distress was found to be a significant moderator of treatment effect. In the regression model, after controlling for baseline scores, treatment alone was not a significant predictor of 6-month outcome. Significant differences in post-trauma adjustment at 6 months between treatment and control groups were only found when initial distress was high, when low or average initial distress was reported there were no differences between the groups on trauma responses 6 months later. Children displaying high levels of distress soon after accidental injury demonstrated a large reduction in posttraumatic stress symptoms when offered an intervention, however without intervention, they demonstrated an exacerbation.
This suggests that the intervention acted as a buffer against the negative and debilitating effects of high initial distress, but may not be necessary when initial distress is not high.

This result is in line with past findings that high child initial distress is a predictor of poor long-term adjustment (Trickey et al., 2012). It is possible that high initial distress is an indicator of poor coping skills, therefore without intervention to assist in developing these skills, symptoms may persist. Kazak and colleagues (2006) propose a stepped model of preventive intervention in an acute care setting to reduce post-trauma symptoms following injury, which entails screening children early, identifying those at-risk, and offering further intervention based on the intensity of an individual’s needs or the presence of risk factors. The results of this study provide evidence that high initial distress on the CTSQ could be used as a high-risk indicator in a hospital or community setting that children are likely to benefit from a preventative intervention like the one proposed here to attenuate detrimental longer-term outcomes (Cox et al., 2010). This approach would optimise the intervention’s effectiveness and conserve unnecessary use of time and resources. Furthermore, it needs to be considered whether high initial distress alone is sufficient as an indicator for intervention inclusion, or whether a combination of risk factors would better identify appropriate individuals (Winston, Kassam-Adams, García-España, Ittenbach, & Cnaan, 2003). The inclusion of mild TBI, the lack of compliance data, and the lack of information on injury mechanism may limit the generalizability of this study.

While the universal approach of the intervention was effective in reducing trauma responses, it appears that to optimise its effectiveness and reduce costs and burden of delivery, the intervention would be best targeted at children that present with high distress soon after injury. Therefore triage based on initial distress would serve to ensure the appropriate level of support and resources are provided to families, rather than being provided universally to
reduce potential risk of harm. It will be important for future research to consider the most effective strategies for implementing routine screening within busy hospital systems.
WEB-BASED INTERVENTION FOR CHILDREN WITH PTS

References


Figure 1. Child trauma symptoms at 6-month follow-up by initial distress and intervention group.