



A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents

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ABSTRACT

Post-traumatic stress disorder (PTSD) is a complex and chronic disorder that causes substantial distress and interferes with social and educational functioning. Consequently, identifying the risk factors that make a child more likely to experience traumatic distress is of academic, clinical and social importance. This meta-analysis estimated the population effect sizes of 25 potential risk factors for PTSD in children and adolescents aged 6–18 years across 64 studies ($N = 32,238$). Medium to large effect sizes were shown for many factors relating to subjective experience of the event and post-trauma variables (low social support, peri-trauma fear, perceived life threat, social withdrawal, comorbid psychological problem, poor family functioning, distraction, PTSD at time 1, and thought suppression); whereas pre-trauma variables and more objective measures of the assumed severity of the event generated small to medium effect sizes. This indicates that subjective peri-trauma factors and post-event factors are likely to have a major role in determining whether a child develops PTSD following exposure to a traumatic event. Such factors could potentially be assessed following a potentially traumatic event in order to screen for those most vulnerable to developing PTSD and target treatment efforts accordingly. The findings support the cognitive model of PTSD as a way of understanding its development and guiding interventions to reduce symptoms.

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Psychological reactions of children and adolescents to potentially traumatic events have been studied for more than 20 years. Although other reactions such as depression, anxiety and behaviour problems do occur, the most commonly studied reaction is post-traumatic stress disorder (PTSD). PTSD can be a complex and chronic disorder that commonly co-occurs with other disorders including other anxiety disorders, mood disorders and substance use disorders (Brewin, Dalgleish, & Joseph, 1996). Symptoms of PTSD can cause substantial distress and interfere with social and educational functioning (National Institute for Health & Clinical Excellence, 2005). A meta-analysis of rates of PTSD in children and adolescents exposed to trauma, which combined the results of 34 studies, including a total of 2697 individuals found that overall, 36% were diagnosed with PTSD (Fletcher, 1996). However rates vary widely across studies from 0% to 100% (Dalgleish, Meiser-Stedman, & Smith, 2005), indicating that exposure to a potentially traumatic event is necessary, but not sufficient for a young person to develop PTSD. It is therefore increasingly accepted that factors other than the potentially traumatic event play a role in explaining PTSD in both adults and children (e.g. Brewin, Andrews, & Valentine, 2000; Foy, Madvig, Pynoos, & Camilleri, 1996).

1. Rationale for the present study

Knowing reliably which factors make a child more likely to develop traumatic distress (whether that is measured by a diagnosis of PTSD, or by severity of PTSD symptoms) is of both academic and clinical interest. Firstly if clinicians know which children and adolescents are most likely to be adversely affected following exposure to events, then those children and adolescents can be most closely monitored with a view to providing treatment as necessary before difficulties become chronic (Pine & Cohen, 2002). Secondly, robust knowledge of risk factors may help our understanding of PTSD and its causes, by confirming or disconfirming current models. In turn, a better understanding of PTSD may assist in assessment, prevention and intervention leading to better outcomes for children and young people exposed to potentially traumatic events.

Thirdly, such knowledge will also highlight areas for further research.

The extent to which knowledge can be robust relates not just to obtaining precise estimates of population effect sizes for risk factors, but also estimating the bias in these estimates. One likely source of bias is publication bias (the 'file drawer problem'): studies that yield non-significant risk factors may be less likely to be submitted for publication; where multiple risk factors are investigated authors may choose to report only the statistically significant one; and editors

and reviewers may be unwilling to publish non-significant findings or ask for non-significant effects to be trimmed to save space. Therefore, it is important to estimate the likely effects of publication bias on the conclusions we draw about risk factors.

1.1. Existing research

In trying to examine how different factors may be associated with the development of post-traumatic distress, we have categorised the wide range of different factors into the following categories: demographic factors, pre-trauma factors, objective trauma characteristics, subjective trauma characteristics, post-trauma individual factors, post-trauma psychological environment. The research relating to each of these categories is outlined in more detail subsequently.

1.2. Demographic factors

Demographic characteristics have been examined in many studies. Whilst data concerning these factors may in themselves not lend support to any particular theoretical account of PTSD, they are easy to assess and thus may aid efforts to identify youth at high risk of developing PTSD following exposure to a potentially traumatic event. Age has received particular attention and although results are mixed (Foy et al., 1996), a number of mechanisms have been proposed for how age may alter a young person's vulnerability to developing PTSD. For example, younger children have less prior knowledge and less language which affects their understanding and appraisal of the event as well as the amount of detail that is encoded; similarly younger children are less able to regulate their emotions which will also affect the way in which they process the event (Salmon & Bryant, 2002). Gender has also been considered to play a role in the development of symptomatic distress. Mechanisms that have been proposed to account for this include that female survivors exhibit more extreme acute reactions which may lead to increased risk of later PTSD (Pine & Cohen, 2002), and the fact that females are more likely to use rumination (Hampel & Petermann, 2005) which may influence the development of PTSD (Ehlers & Clark, 2000).

1.3. Pre-trauma factors

The question of how pre-trauma factors, such as previous traumas, may increase a young person's vulnerability or resilience following a potentially traumatic event has been explored in a number of studies. Viewing a child's response to a traumatic stressor within the context of their pre-trauma life experiences and mental health is consistent

with a developmental psychopathological perspective, and may identify important risk factors for the development of chronic PTSD. Foy and colleagues have suggested several ways in which various pre-trauma factors may play a role in the development of PTSD. Some factors may interact with the effects of the traumatic experience to heighten reactivity and thereby increase an individual's vulnerability, whilst others may increase distress independent of the effect of the traumatic experience. They go on to suggest that other factors may act both by interacting with the impact of the event and causing independent distress (Foy et al., 1996).

1.4. Objective trauma characteristics

Several commentators have noted that objective characteristics such as severity of event, or level of exposure, consistently predict subsequent PTSD symptoms (Foy et al., 1996; Pine & Cohen, 2002). Quantifying the strength of association between objective trauma characteristics and PTSD allows for an examination of the relative importance of such trauma characteristics compared to other factors, as well as the identification of further ways of identifying youth at high risk.

1.5. Subjective trauma characteristics

Within the current DSM-IV criteria for PTSD, subjective characteristics of an event (the experience of intense fear, helplessness or horror) – are an essential requirement for conferring this diagnosis. Some commentators have questioned whether this criterion is appropriate for young children given the difficulties inherent in assessing peri-trauma reactions in this age group (Scheeringa et al., 1993). However, subjective factors, such as the perception of threat and peri-traumatic affect, are highly likely to be linked to the onset of PTSD (Perrin, Smith, & Yule, 2000). Indeed, perceived life threat and fear have already been included in screening measures for trauma-exposed youth (Winston, Kassam-Adams, Garcia-España, Ittenbach, & Cnaan, 2003).

1.6. Post-trauma individual factors

Comorbid psychological difficulties, acute post-traumatic stress symptoms, and coping styles are among the factors intrinsic to the child that have been considered as risk factors for PTSD. Other cognitive (Dalglish et al., 2005; Meiser-Stedman, 2002; Salmon & Bryant, 2002) and biological mechanisms (De Bellis et al., 1999) have also been suggested as playing an important role in the aetiology of PTSD. However, it remains to be seen whether there is any consistent pattern in the literature concerning such factors.

1.7. Post-trauma psychological environment

Pine and Cohen's review found that in addition to trauma exposure, levels of social support were consistently associated with mental health outcomes for children exposed to a potentially traumatic event (Pine & Cohen, 2002). Furthermore, Pynoos and colleagues suggested that child-extrinsic factors such as parental and family functioning may be associated with a child's vulnerability by moderating the impact of the event, the impact of proximal reminders and the impact of secondary stresses (Pynoos, Steinberg, & Piacentini, 1999).

2. Existing reviews of research

There are a number of reviews of the literature that have attempted to increase our understanding of the development of child PTSD (Foy et al., 1996; Pine & Cohen, 2002). Pine and Cohen's review identified two factors consistently related to adverse outcome: trauma exposure and disrupted social support. Foy also argued

that parental distress might act as a powerful mediating factor in the development of the child's symptoms. Whilst such reviews are helpful, a more systematic review and meta-analysis of factors considered by research would add significantly to our understanding by enabling a closer examination of the consistency of the relationship between a particular factor and outcome across different studies. It would also enable results from different studies to be combined to produce a more accurate estimate of the population effect size for different risk factors.

Individual studies may report very different strengths of associations between a given risk factor and PTSD. Meta-analyses are able to explore this variation between studies, by examining how sample and study characteristics act as moderators to the association.

3. Other meta-analyses of risk factors for PTSD

There are two meta-analyses of studies examining risk factors for PTSD in adults (Brewin et al., 2000 and Ozer, Best, Lipsey, & Weis, 2003). Brewin and colleagues conducted meta-analyses of 14 risk factors and analysed moderating effects of various sample and study characteristics. The effect size of all the risk factors was modest; but factors operating during or after the trauma, such as trauma severity, lack of social support, and additional life stress, had larger effect sizes ($r=0.23$ to 0.40) than pre-trauma factors ($r=0.05$ to 0.19). Their analysis of moderators revealed that some risk factors (such as gender, age at trauma and race) predicted PTSD only in some populations whilst some predicted PTSD more consistently (such as education, previous trauma, and general childhood adversity). Results varied depending on the population studied (e.g. civilian or military) and the methods used; and some factors (such as psychiatric history, reported childhood abuse, and family psychiatric history) predicted PTSD more consistently. Ozer and colleagues conducted a meta-analysis of data concerning seven separate risk factors, all of which produced significant but modest effect sizes. Peri-traumatic psychological processes rather than prior characteristics were found to be the strongest predictors of PTSD symptoms or diagnostic status.

Cox and colleagues reviewed the literature concerning risk factors following accidental trauma in children and adolescents and found that eight factors had been measured in studies that met their inclusion criteria for their meta-analysis (Cox, Kenardy, & Hendrikz, 2008). Whilst all risk factors were statistically significant, only threat to life ($r=0.38$) and pre-trauma psychopathology ($r=0.29$) were considered to be strong predictors of PTSD. Female gender ($r=0.18$) and pre-trauma psychopathology ($r=0.22$) were weak predictors, whilst younger age ($r=-0.04$), exposure to prior trauma ($r=0.08$), injury severity ($r=0.09$), and involvement of family or a friend in the accident ($r=0.09$) were even weaker predictors. Most risk factors were significantly varied across studies with only pre-trauma psychopathology and threat to life showing consistent effect sizes across studies. Restricting their analysis to studies of accidental trauma may have limited the generalisability of results. The present study therefore included research that investigated a broader range of events, including natural events, and intentional violence.

Brewin et al. (2000) and Cox et al. (2008) both employed Rosenthal's fixed-effects model of meta-analysis (Rosenthal, 1991). However, random-effect meta-analyses are generally more appropriate for several reasons (see Field, 2001; 2003; 2005; Hunter & Schmidt, 2000). First, real-world data are likely to have variable population parameters (Field, 2003; Hunter & Schmidt, 1990, 2000; National Research Council, 1992; Osburn & Callender, 1992). Second, Hedges and Vevea (1998) have suggested that fixed-effect models are appropriate only when making inferences about the studies included in the meta-analysis and generally researchers want to generalise their conclusions beyond the studies within the analysis. Finally, applying fixed effects meta-analytic models to random-effect data can have undesirable effects on the outcomes of analyses but the

Table 1

Risk factors extracted from included studies and descriptive statistics of the overall effect sizes from each study (different psychological problems were combined for analysis).

Risk factor	Article name	Assessment of risk factor	K	Mean <i>r</i>	SD	Min.	Max.
Bereavement	Goenjian et al., 1995	Death of family members	3	0.19	0.04	0.14	0.22
	Lengua, Long, Smith, & Meltzoff, 2005	Knowing someone that died	1	0.16			
	Pfefferbaum et al., 1999	Knowing someone killed	3	0.16	0.03	0.12	0.19
Blame others	Wickrama & Kaspar, 2007	Death of someone close	2	0.35	0.01	0.34	0.35
	Stallard, Velleman, Langsford, & Baldwin, 2001	Kidcope	1	0.29			
	Vernberg, LaGreca, Silverman, & Prinstein, 1996	Kidcope	1	0.56			
Comorbid anxiety	Goenjian et al., 1995	Diagnostic Interview Schedule for Children and Adolescents	1	0.19			
	Kilic, Ozguven, & Sayil, 2003	State-Trait Anxiety Inventory for Children	2	0.22	0.03	0.20	0.24
	Lack & Sullivan, 2008	Tornado Exposure Questionnaire	1	0.24			
	Lengua et al., 2005	Revised Children's Manifest Anxiety Scale	1	0.69			
	Linning & Kearney, 2004	Anxiety Disorders Interview Schedule for Children – Child Version	3	0.24	0.01	0.24	0.25
	Lonigan, Shannon, Finch, Daugherty, & Taylor, 1991	Revised Children's Manifest Anxiety Scale	2	0.41	0.20	0.27	0.55
	Saxe et al., 2005	Multidimensional Anxiety Scale for Children	1	0.68			
	Schafer, Barkmann, Riedesser, & Schulte-Markwort, 2006	Anxiety Disorders Interview Schedule – Revised	1	0.21			
	Udwin, Boyle, Yule, Bolton, & O'Ryan, 2000	Revised Children's Manifest Anxiety Scale	3	0.35	0.12	0.22	0.45
	Comorbid conduct problem	Lengua et al., 2005	Youth Self Report – Delinquent & Aggressive Behaviour Subscales	1	0.35		
Comorbid depression	Goenjian et al., 1995	Depression Self Rating Scale	4	0.42	0.11	0.28	0.55
	Goenjian et al., 2001	Depression Self Rating Scale	4	0.68	0.11	0.56	0.81
	Jaycox et al., 2002	Children's Depression Inventory	1	0.54			
	Kilic et al., 2003	Children's Depression Inventory	1	0.10			
	Lengua et al., 2005	Children's Depression Inventory	1	0.46			
	Linning & Kearney, 2004	Anxiety Disorders Interview Schedule for Children – Child Version	2	0.41	0.04	0.38	0.44
	Overstreet, Dempsey, Graham, & Moely, 1999	Children's Depression Inventory	1	0.18			
	Roussos et al., 2005	Depression Self Rating Scale	3	0.54	0.03	0.51	0.56
	Schafer et al., 2006	Children's Depression Inventory	1	0.22			
	Thabet, Abed, & Vostanis, 2004	Short Mood and Feelings Questionnaire	2	0.34	0.11	0.26	0.42
	Udwin et al., 2000	Depression Self Rating Scale	3	0.37	0.10	0.29	0.48
	Wickrama & Kaspar, 2007	Youth Self Report – depression items	1	0.54			
	Otto et al., 2007	Behavioural Inhibition	2	0.12	0.05	0.08	0.15
Comorbid internalising	McDermott, Lee, Judd, & Gibbon, 2005	Strength and Difficulties Questionnaire	1	0.22			
Comorbid psychological problem	Udwin et al., 2000	Child and Adolescent Psychopathology Interview	2	0.18	0.03	0.16	0.20
Distraction	Stallard & Smith, 2007	Two questions to assess cognitive coping strategies	1	0.58			
	Stallard et al., 2001	Kidcope	2	0.29	0.01	0.28	0.30
Female gender	Delahanty, Nugent, Christopher, & Walsh, 2005	Standard demographic information	1	0.36			
	Goenjian et al., 1995	Standard demographic information	4	0.14	0.15	–0.07	0.26
	Goenjian et al., 2001	Standard demographic information	4	0.20	0.09	0.07	0.28
	Goenjian et al., 2005	Standard demographic information	2	0.21	0.12	0.13	0.29
	Heptinstall, Sethna, & Taylor, 2004	Standard demographic information	1	–0.18			
	Husain et al., 1998	Standard demographic information	1	0.15			
	Jaycox et al., 2002	Standard demographic information	1	0.09			
	Kilic et al., 2003	Standard demographic information	1	0.36			
	Korol, Green, & Gleser, 1999	Standard demographic information	1	0.06			
	Landolt, Vollrath, Ribi, Gnehm, & Sennhauser, 2003	Standard demographic information	1	0.12			
	Landolt, Vollrath, Timm, Gnehm, & Sennhauser, 2005	Standard demographic information	2	0.05	0.06	0.01	0.09
	Lengua et al., 2005	Standard demographic information	1	0.05			
	Linning & Kearney, 2004	Standard demographic information	1	0.35			
	Lonigan et al., 1991	Standard demographic information	1	0.15			
	McDermott et al., 2005	Standard demographic information	1	0.07			
	Mirza, Bhadrinath, Goodyear, & Gilmour, 1998	Standard demographic information	4	0.27	0.03	0.22	0.29
	Ostrowski, Christopher, & Delahanty, 2007a	Standard demographic information	2	0.24	0.07	0.18	0.29
	Otto et al., 2007	Standard demographic information	2	0.11	0.03	0.09	0.14
	Overstreet et al., 1999	Standard demographic information	1	0.14			
	Pfefferbaum et al., 2000	Standard demographic information	1	0.21			
	Roussos et al., 2005	Standard demographic information	1	0.16			
	Runyon & Kenny, 2002	Standard demographic information	1	0.19			
	Schafer, Barkmann, Riedesser, & Schulte-Markwort, 2004	Standard demographic information	1	0.25			

(continued on next page)

Table 1 (continued)

Risk factor	Article name	Assessment of risk factor	K	Mean r	SD	Min.	Max.
Low intelligence	Shannon, Lonigan, Finch, & Taylor, 1994	Standard demographic information	1	0.20			
	Stallard & Smith, 2007	Standard demographic information	1	0.29			
	Stallard, Salter, & Velleman, 2004	Standard demographic information	1	0.30			
	Thabet et al., 2004	Standard demographic information	1	0.01			
	Udwin et al., 2000	Standard demographic information	1	0.18			
	Vernberg et al., 1996	Standard demographic information	1	0.10			
Low SES	Saltzman, Weems, & Carrion, 2006	Wechsler Abbreviated Scales of Intelligence	9	0.25	0.11	0.12	0.40
	Udwin et al., 2000	Presence of learning difficulties	2	0.18	0.00	0.18	0.18
Low social support	Delahanty et al., 2005	Parental income	1	0.26			
	Landolt et al., 2003	Paternal occupation & maternal education	1	0.06			
	Landolt et al., 2005	Paternal occupation & maternal education	2	0.03	0.01	0.02	0.03
	Max et al., 1998	Hollingshead Four Factor Index	4	0.27	0.05	0.20	0.30
	Nugent, Ostrowski, Christopher, & Delahanty, 2007	Parental education	2	0.16	0.09	0.10	0.22
	Ostrowski, Christopher, & Delahanty, 2007b	Parental income	1	0.48			
Maternal anxiety	Otto et al., 2007	Hollingshead Four Factor Index	2	0.05	0.04	0.02	0.08
	Heptinstall et al., 2004	Feeling isolated or excluded	2	-0.15	0.15	-0.26	-0.04
	Stallard & Smith, 2007	Perceived alienation	1	0.59			
	Udwin et al., 2000	Social Support Scale	3	0.29	0.08	0.22	0.38
Maternal depression	Vernberg et al., 1996	Social Support Scale for Children and Adolescents	5	0.35	0.22	0.20	0.73
	Smith, Perrin, Yule, & Rabe-Hesketh, 2001	State – Trait Anxiety Inventory	1	0.24			
Maternal psychological problem	Kilic et al., 2003	Beck Depression Inventory	1	0.19			
	Smith et al., 2001	Beck Depression Inventory	1	0.17			
Maternal PTSD	Wickrama & Kaspar, 2007	Center for Epidemiological Studies Depression Scale	1	0.23			
	Kilic et al., 2003	General Health Questionnaire	1	0.26			
Parental depression	Smith et al., 2001	General Health Questionnaire	1	0.19			
	Landolt et al., 2003	Post-traumatic Diagnostic Scale	1	-0.01			
Parental psychological problem	Landolt et al., 2005	Post-traumatic Diagnostic Scale	2	0.15	0.13	0.06	0.24
	Ostrowski et al., 2007a	Clinician Administered PTSD Scale	3	0.37	0.16	0.23	0.55
	Punamaki, Qouta, Sarraj, & Montgomery, 2006	PTSD Reaction Index	3	0.11	0.11	0.00	0.22
	Smith et al., 2001	Impact of Events Scale – Revised	2	0.35	0.03	0.33	0.37
	Wickrama & Kaspar, 2007	DSM-IV diagnostic interview items	1	0.40			
	Meiser-Stedman, Yule, Dalgleish, Smith, & Glucksman, 2005	Beck Depression Inventory	2	0.42	0.03	0.40	0.44
Parental PTSD	Linning & Kearney, 2004	Family Environment Scale	1	0.28			
	Nugent et al., 2007	Symptom Checklist – 90 revised	1	0.50			
Paternal depression	Koplewicz et al., 2002	Adult Post-traumatic Stress Reaction Index	4	0.48	0.30	0.08	0.81
	Landolt et al., 2005	Post-traumatic Diagnostic Scale	1	0.52			
	Magal-Vardi et al., 2004	Davidson Trauma Scale	2	0.55	0.11	0.47	0.63
	Nugent et al., 2007	Impact of Events Scale – Revised	3	0.38	0.13	0.23	0.45
	Shemesh et al., 2005	Impact of Events Scale	2	0.33	0.01	0.32	0.34
	Kilic et al., 2003	Beck Depression Inventory	1	0.58			
Paternal psychological problem	Kilic et al., 2003	General Health Questionnaire	1	0.52			
	Landolt et al., 2003	Post-traumatic Diagnostic Scale	1	0.02			
Perceived life threat	Landolt et al., 2005	Post-traumatic Diagnostic Scale	2	0.16	0.21	0.01	0.31
	Punamaki et al., 2006	Adult Post-traumatic Stress Reaction Index	3	0.15	0.10	0.10	0.26
	Lack & Sullivan, 2008	Trauma Exposure Questionnaire – Children	1	0.41			
	Landolt et al., 2005	Threat appraisal question	2	0.33	0.06	0.29	0.37
	McDermott et al., 2005	Threat appraisal question	1	0.40			
	Solomon & Lavi, 2005	Threat appraisal question	3	0.31	0.12	0.17	0.39
Peri-trauma fear	Udwin et al., 2000	Threat appraisal questions	2	0.27	0.06	0.22	0.31
	Vernberg et al., 1996	Hurricane-Related Traumatic Experiences Questionnaire	1	0.39			
	Aaron, Zaglul, & Emery, 1999	Likert scale question	1	0.56			
	Lack & Sullivan, 2008	Trauma Exposure Questionnaire	2	0.36	0.17	0.24	0.48
	Udwin et al., 2000	Fear and panic questions	3	0.18	0.06	0.12	0.24
	Kilic et al., 2003	McMaster Family Assessment Device	7	0.07	0.09	-0.03	0.21
Poor family functioning	Meiser-Stedman et al., 2005	Family Functioning Questionnaire	1	0.43			
	Otto et al., 2007	Parental expressed emotion (criticism or over-involvement)	4	0.05	0.02	0.03	0.07
	Pelcovitz, Kaplan, DeRosa, Mandel, & Salzinger, 2000	Parental Bonding Instrument, Family Adaptability and Cohesion Evaluation Scale III, Family Disagreements Interview	4	0.78	0.10	0.65	0.87
	Roussos et al., 2005	Difficulties at home	1	0.31			
	Udwin et al., 2000	Child & Adolescent Psychopathology Interview (violence at home)	1	0.15			
	Wickrama & Kaspar, 2007	Parent-child relationship quality	1	0.79			
Post-trauma life events	Heptinstall et al., 2004	Uncertain asylum application	7	0.17	0.18	-0.03	0.49
	Landolt et al., 2005	Occurrence of 12 major life events	2	-0.15	0.08	-0.20	-0.09

Table 1 (continued)

Risk factor	Article name	Assessment of risk factor	K	Mean r	SD	Min.	Max.
Post-trauma media exposure	McDermott et al., 2005	Having to live elsewhere	1	0.06			
	Udwin et al., 2000	Life Events Scale	3	0.34	0.08	0.28	0.44
	Wickrama & Kaspar, 2007	Number of days displaced from home	1	0.29			
	Lengua, Long, & Meltzoff, 2006	Parental responses to questions about child media exposure	1	−0.16			
	Otto et al., 2007	Parental responses to questions about child media exposure	4	0.11	0.05	0.05	0.17
Pre-trauma anxiety	Pfefferbaum et al., 2000	Child responses to questions about media exposure	3	0.37	0.04	0.34	0.41
	Asarnow et al., 1999	Revised Children's Manifest Anxiety Scale	2	0.19	0.01	0.19	0.20
	Lengua et al., 2005	Child Behaviour Checklist, Revised Children's Manifest Anxiety Scale	3	0.08	0.03	0.05	0.11
	Mirza et al., 1998	Revised Children's Manifest Anxiety Scale	2	0.20	0.02	0.18	0.21
	Otto et al., 2007	Reported history of child anxiety disorder	2	0.07	0.02	0.06	0.08
Pre-trauma conduct problem	Udwin et al., 2000	Retrospective Experiences and Child and Adolescent Psychopathology Interview	1	.17			
	Lengua et al., 2005	Child Behaviour Checklist and Achenbach Youth Self Report – Delinquent and Aggressive Behaviour Subscales	3	0.14	0.09	0.05	0.22
Pre-trauma depression	Mirza et al., 1998	Young Person's Questionnaire (Parent Version) – Behaviour Indicator Scale Subscale	2	0.16	0.19	0.02	0.29
	Lengua et al., 2005	Child Behaviour Checklist, Child Depression Inventory	3	0.14	0.12	0.00	0.22
	Mirza et al., 1998	Mood and Feelings Questionnaire (Parent report)	2	0.21	0.00	0.21	0.21
Pre-trauma family psychological problem	Otto et al., 2007	Kiddie Schedule for Affective Disorders and Schizophrenia, Epidemiologic Version (KSADS-E)	2	.07	.01	.07	.08
	Max et al., 1998	Family History Research Diagnostic Criteria	2	0.14	0.18	0.01	0.27
Pre-trauma internalising life events	Aaron et al., 1999	Child Behaviour Checklist	1	0.39			
	Heptinstall et al., 2004	Number of pre-migration traumas	2	0.48	0.09	0.41	0.54
	Landolt et al., 2003	Recent significant life events	1	0.05			
	Landolt et al., 2005	Occurrence of major life events	2	0.20	0.08	0.14	0.25
	Lengua et al., 2006	General Life Events Schedule for Children	1	0.38			
	Overstreet et al., 1999	Life Events Checklist	1	0.16			
	Stallard & Smith, 2007	Previous RTA, previous accident	2	0.16	0.04	0.13	0.19
	Stallard et al., 2004	Previous RTA	1	0.10			
	Udwin et al., 2000	Medical problems	1	0.23			
	Lengua et al., 2005	Perceived Competence Scale for Children-Self-worth Subscale	2	0.18	0.04	0.15	0.21
Pre-trauma parental anxiety	Mirza et al., 1998	Parent's version of Young Persons' Questionnaire.	2	0.14	0.10	0.08	0.21
	Otto et al., 2007	Structured Clinical Interview for DSM-III-R (SCID)	2	0.06	0.03	0.04	0.09
Pre-trauma parental depression	Otto et al., 2007	Structured Clinical Interview for DSM-III-R (SCID)	2	0.15	0.09	0.08	0.21
	Max et al., 1998	Family History Research Diagnostic Criteria	2	0.22	0.03	0.20	0.24
Pre-trauma psychological problem	Max et al., 1998	Pre-injury internalising disorder	4	0.34	0.04	0.30	0.38
	Mirza et al., 1998	Rutter's Questionnaire (parent)	1	0.11			
	Udwin et al., 2000	Retrospective Experiences and Child and Adolescent Psychopathology Interview	1	0.16			
PTSD (T1)	Koplewicz et al., 2002	Child PTSD Reaction Index	2	0.79	0.01	0.78	0.79
	Landolt et al., 2005	Child PTSD Reaction Index	2	0.31	0.47	−0.02	0.64
	Nugent et al., 2007	Clinician Administered PTSD Scale – Child and Adolescent	1	0.75			
Race (BME)	Udwin et al., 2000	Impact of Events Scale	1	0.22			
	La Greca, Silverman, Vernberg, & Prinstein, 1996	Standard demographic information	6	0.20	0.04	0.15	0.25
	Lengua et al., 2005	Standard demographic information	2	0.10	0.12	0.02	0.18
	Lonigan et al., 1991	Standard demographic information	1	0.05			
	Nugent et al., 2007	Standard demographic information	2	0.13	0.08	0.08	0.19
Social withdrawal	Shannon et al., 1994	Standard demographic information	1	0.06			
	Stallard et al., 2001	Kidcope	2	0.35	0.01	0.35	0.36
	Vernberg et al., 1996	Kidcope	1	0.37			
Thought suppression	Aaron et al., 1999	White Bear Suppression Inventory	3	0.62	0.07	0.55	0.69
	Stallard & Smith, 2007	Child rating of use of two strategies of suppression	1	0.59			
Time post-trauma	Goenjian et al., 2005	Time between event and assessment	3	−0.29	0.02	−0.32	−0.27
	Koplewicz et al., 2002	Time between event and assessment	1	−0.13			
	La Greca et al., 1996	Time between event and assessment	3	−0.18	0.08	−0.27	−0.12
	Lengua et al., 2005	Time between event and assessment	1	−0.06			
	Lengua et al., 2006	Time between event and assessment	1	−0.03			
	Nugent, Christopher, & Delahanty, 2006	Time between event and assessment	1	−0.15			
	Otto et al., 2007	Time between event and assessment	3	0.15	0.00	0.15	0.15
	Schafer et al., 2006	Time between event and assessment	1	−0.33			
Trauma severity	Thabet & Vostanis, 1999	Time between event and assessment	2	−0.53	0.06	−0.57	−0.49
	Aaron et al., 1999	Number of days in hospital	1	0.32			
	Bal et al., 2003	Type of trauma	1	0.30			
	Bradburn, 1991	Distance from epicentre	1	0.57			
		Injury severity	1	0.10			

(continued on next page)

Table 1 (continued)

Risk factor	Article name	Assessment of risk factor	K	Mean r	SD	Min.	Max.
	Bryant, Salmon, Sinclair, & Davidson, 2007b	Injury severity	1	0.91			
	Bryant, Salmon, Sinclair, & Davidson, 2007a						
	Giannopoulou et al., 2006	Proximity to earthquake	1	0.15			
	Goenjian et al., 1995	Proximity to epicentre	1	0.50			
	Goenjian et al., 2001	Level of impact	3	0.58	0.16	0.45	0.76
	Goenjian et al., 2005	Proximity to epicentre	6	0.51	0.16	0.34	0.71
	Goenjian et al., 2009	Loss of parent	3	0.09	0.02	0.07	0.11
	Heptinstall et al., 2004	Violent death of family member, Experienced threats to life separated from parents	3	0.24	0.28	-0.05	0.50
	Koplewicz et al., 2002	Directly witnessed event or not	4	0.43	0.16	0.28	0.64
	La Greca et al., 1996	Number of life-threatening experiences	1	0.39			
	Lack & Sullivan, 2008	Tornado Exposure Questionnaire	1	0.11			
	Landolt et al., 2003	Days in hospital, functional status of child, type of trauma	3	0.09	0.15	-0.08	0.18
	Landolt et al., 2005	Injury severity, days in hospital, parent involved in accident, type of accident	7	0.02	0.09	-0.05	0.21
	Laor et al., 2002	Proximity to epicentre	1	0.05			
	Linning & Kearney, 2004	Duration of maltreatment	1	0.30			
	Lonigan et al., 1991	Hurricane exposure	1	0.23			
	Max et al., 1998	Glasgow Coma Scale	4	0.24	0.21	0.05	0.46
	McDermott et al., 2005	Child endorsement of various trauma variables	6	0.26	0.16	0.11	0.53
	Mirza et al., 1998	Type of accident	1	0.20			
	Nugent et al., 2007	Injury severity	4	0.07	0.04	0.03	0.11
	Otto et al., 2007	Dose of exposure	2	0.07	0.05	0.04	0.11
	Pfefferbaum et al., 1999	Relationship with deceased	2	0.09	0.01	0.08	0.10
	Pfefferbaum et al., 2000	Indirect Interpersonal Exposure	1	.48			
	Pfefferbaum, 2001	Physical exposure	2	0.18	0.02	0.17	0.19
	Rees et al., 2004	Severity of illness	1	0.10			
	Roussos et al., 2005	Proximity to epicentre	1	0.04			
	Runyon & Kenny, 2002	Trauma type	1	0.40			
	Saxe et al., 2005	Surface of body area burned	2	0.47	0.03	0.45	0.49
	Smith et al., 2001	Analogue Pain Scale	1	0.28			
	Solomon & Lavi, 2005	Number of experienced traumatic events	3	0.23	0.02	0.22	0.25
	Stallard & Smith, 2007	Type or RTA, arent involved in RTA, Triage rating, A&E Outcome	4	0.07	0.06	0.03	0.13
	Stallard et al., 2004	Type of accident, others involved, triage rating, priority rating, X-ray, blow to head, fractures, admitted to hospital	8	0.07	0.04	0.01	0.13
	Thabet & Vostanis, 1999	Number of experienced traumatic events	1	0.64			
	Thabet, Abed, & Vostanis, 2002	Exposure to bombardment	3	0.24	0.00	0.24	0.24
	Thabet et al., 2004	Gaza Traumatic Event Checklist	2	0.15	0.03	0.13	0.17
	Udwin et al., 2000	Saw blood, non-swimmer in the water, injury severity, trapped in wreckage	5	0.21	0.02	0.20	0.24
	Vernberg et al., 1996	Hurricane related traumatic experiences	3	0.51	0.08	0.43	0.59
	Wickrama & Kaspar, 2007	Property destruction index, social losses, displacement duration	3	0.25	0.07	0.18	0.31
Younger Age	Bryant et al., 2007a	Standard demographic information	1	0.40			
	Heptinstall et al., 2004	Standard demographic information	1	-0.07			
	Jaycox et al., 2002	Standard demographic information	1	-0.04			
	Korol et al., 1999	Standard demographic information	3	-0.01	0.18	-0.18	0.17
	Landolt et al., 2003	Standard demographic information	1	0.06			
	Landolt et al., 2005	Standard demographic information	2	-0.08	0.01	-0.09	-0.07
	Lengua et al., 2006	Standard demographic information	1	0.22			
	Lonigan et al., 1991	Standard demographic information	2	0.10	0.11	0.02	0.17
	McDermott et al., 2005	Standard demographic information	1	0.32			
	Nugent et al., 2007	Standard demographic information	2	0.10	0.06	0.06	0.15
	Otto et al., 2007	Standard demographic information	2	-0.08	0.09	-0.14	-0.02
	Overstreet et al., 1999	Standard demographic information	1	-0.18			
	Runyon & Kenny, 2002	Standard demographic information	1	-0.34			
	Saxe et al., 2005	Standard demographic information	1	0.17			
	Schafer et al., 2004	Standard demographic information	1	0.03			
	Stallard & Smith, 2007	Standard demographic information	1	-0.08			
	Stallard et al., 2004	Standard demographic information	1	0.05			
	Thabet et al., 2004	Standard demographic information	1	-0.12			

k = the number of effect sizes.

reverse is not true (Field, 2003; Hunter & Schmidt, 2000). Using Monte Carlo analysis Field (2003) demonstrated that fixed-effects model are unreliable (they inflate estimates of population effect-sizes and yield corresponding confidence intervals that are too narrow) when there is substantial or moderate heterogeneity: the chance of a Type I error rose from 5% to between 43 and 80%. For these reasons, we considered it important to employ a random-effect model.

3.1. The present study

The present study adds to the meta-analyses described earlier because it brings together all of the existing child and adolescent research of sufficient quality that investigates risk factors for PTSD following a variety of potentially traumatic events using random-effect meta-analytic techniques.

4. Method

4.1. Selection of studies for the meta-analysis

English-language articles published in peer-reviewed journals between 1980 (the first *DSM* definition of PTSD) and May 2009 were considered for inclusion. Various psychological and medical literature databases were searched, including the PILOTS database managed by the National Center for PTSD, Medline, PsychInfo, Embase and Web of Science. In addition, each issue of the *Journal of Traumatic Stress* was examined for relevant research. Secondary sources such as review articles, book chapters and the reference sections of selected articles were examined. Search terms for the literature databases included combinations of the following: PTSD, post-traumatic stress disorder or post-traumatic stress disorder; child or children or adolescent(s); and, risk, predictor, prediction or predisposition. A predictor or risk factor was operationally defined as any variable examined as a potential contributor to variability in PTSD symptom level or diagnostic status. This literature search yielded a preliminary database of 1210 published articles, which were then reviewed for inclusion in the meta-analysis using various inclusion and exclusion criteria.

4.2. Inclusion and exclusion criteria

There is some debate in the child PTSD literature as to whether PTSD manifests differently in children of different ages and developmental levels, and therefore how best to assess PTSD in children of different ages (e.g. Dehon & Scheeringa, 2006; Fletcher, 1996; Meiser-Stedman, Smith, Glucksmann, Yule, & Dalgleish, 2008; Scheeringa, Zeanah, Myers & Putnam, 2003). With the exception of assessments specifically for pre-school children (e.g. Scheeringa et al., 2003) most standardised assessments of PTSD in children have been validated on groups of children of school age and above. Thus, the age range for samples to be included in the present meta-analysis was set at 6–18 years as long as the measure of PTSD was appropriate for the age group of the sample. A more conservative approach would have been to set the lower age range at 8 years, however a random effect moderator analysis of effect-sizes across all risk factors demonstrates that there was no significant difference in overall effect-size between studies that breached the 8–18 years age range, and those that did not, ($\chi^2(1) = 0.079, p = 0.778$)

Bal, Oost, Bourdeaudhuij, and Crombez (2003) breached the upper age limit by just one year with their age range of 11–19. We decided to include this study because the vast majority of the sample was within the age range, and those that were not, were only just above it.

To be included in the analysis, studies had to have used measures of child PTSD that considered all three PTSD symptom clusters (intrusion, avoidance/numbing and hyperarousal), and demonstrated adequate reliability and validity as shown by publication of their psychometric properties in a peer-reviewed journal or by having a strong pedigree (e.g. minimal but necessary changes to a measure with proven reliability and validity such as the UCLA PTSD Reaction Index which has been modified in order to take into account changes in diagnostic criteria, Steinberg, Brymer, Decker, & Pynoos, 2004).

Articles were excluded on any of the following grounds:

- (a) The study measured only acute trauma response (e.g. Acute Stress Disorder or PTSD measured before 1 month post-trauma) rather than PTSD, which according to DSM-IV-TR, can be diagnosed only after 1 month (American Psychiatric Association, 2000)
- (b) The study used a categorical measure of PTSD and included in the same comparison group individuals meeting full diagnostic criteria for PTSD together with individuals with less severe post-traumatic symptoms or partial PTSD (e.g. 'subsyndromal PTSD'), and contrasted them with a group exposed to the same event but without PTSD;

- (c) The study sample consisted entirely of individuals who fulfilled the full diagnostic criteria for PTSD and therefore were unsuitable for ascertaining the frequencies of these phenomena
- (d) The study sample was selected on the basis that participants were experiencing a specific comorbid psychiatric disorder (e.g. depression, ADHD, substance abuse, learning difficulties, offenders), which would limit the generalisability of results
- (e) The study did not specifically assess *DSM*-defined PTSD symptoms (e.g. studies that reported only general symptoms)
- (f) Studies with insufficient data to calculate univariate effect sizes, and where such data could not be obtained from the study author
- (g) The article was a review that did not present new data or only presented qualitative analyses
- (h) The primary aim of the study was to investigate the efficacy of treatment; and
- (i) Single case studies.

Finally any study that examined a risk factor that was not also examined by at least one other study was excluded from further examination. All eligible studies were carefully reviewed by two authors (LS & AS) to ensure decision-rule consistency, with 100% agreement.

4.3. Coding of studies

Following this procedure, 62 studies with a total sample size of 32,238 participants yielded 453 effect sizes that were included in the meta-analysis. These studies are identified with an asterisk in the reference section. Table 1 provides a full list of the data extracted from each study for each risk factor and Table 2 provides a detailed list of characteristics of the studies used in the meta-analysis. Effect-sizes for both current and past PTSD symptoms, as well as longitudinal studies that presented multiple assessments of symptoms over time, were included. The simple mean was computed for studies contributing multiple effect-sizes for the same risk factor. We did not include multiple effect-sizes from the same study because the results could be biased by the studies contributing numerous effect sizes. Only single-*df* comparisons were appropriate for selection in the meta-analysis (Rosenthal, 1991). Different articles reporting analyses from the same data set were included if the studies provided effect-size estimates for different risk factors. On nine occasions, the same data were reported in more than one publication. When this occurred, estimates from the largest sample or from the most comprehensive article were used.

For obvious reasons, meta-analysis was not conducted on any risk factor for which only a single effect size was available (e.g. cortisol levels, handedness, dissociation and grief reactions risk factors). Where continuous (symptom severity) and categorical (diagnosis) measures of a given risk factor were both available within a study, we used the effect-size for PTSD symptom severity because of the statistical advantages of continuously measured variables in predictive research. Whenever the same risk factors had been assessed within a study using more than one measure (e.g., several separate aspects of previous psychiatric history might have been assessed), effect sizes were averaged across these measures. An effect size of zero was assigned for the few studies ($k = 2, 0.4\%$ of all effect sizes) that reported non-significant findings and did not provide an effect-size. Although this conservative strategy generally underestimates the true magnitude of effect sizes (Durlak & Lipsey, 1991; Rosenthal, 1995), this approach is preferable to excluding non-significant results from the meta-analysis, which would result in an overestimation of combined effect sizes (Rosenthal, 1995).

4.4. Computation and analysis of effect sizes

Meta-analyses were conducted using SPSS 18 and R 2.10 (R Development Core Team, 2010) using Field and Gillett's (2010) syntax. A separate meta-analysis was carried out for each risk factor. In the present study, Pearson's correlation coefficient, r , was chosen as the effect

Table 2
Characteristics of studies included in the meta-analysis.

Article	Trauma type	Sample size	PTSD measure	Interview or questionnaire	Age range	Mean age (SD)	Percentage of sample that were female	Location
Aaron et al., 1999	Mixed: RTA; other	40	CPTSD-RI	Interview	8–17	13.60 (2.95)	52	US
Asarnow et al., 1999	Natural disaster: earthquake	49	CPTSD-RI	Interview	8.59–18.60	13.66 (2.60)	40	US
Bal et al., 2003	Mixed: sexual abuse; accident; interpersonal violence; neglect; illness/injury; other	970	CAPS-CA	Interview	11–19	14.43 (1.49)	52	Belgium
Bradburn, 1991	Natural disaster: earthquake	22	CPTSD-RI	Interview	10–12	Not reported	45	US
Bryant et al., 2007b	Mixed: traumatic falls; RTA; other	62	UCLA PTSD Index for DSM-IV	Interview	7–13	9.64 (2.4)	34	Australia
Bryant et al., 2007a	Mixed: RTA; injury; other	76	UCLA PTSD Index for DSM-IV	Interview	7–12	Not reported	34	Australia
Delahanty et al., 2005	Mixed: RTA; sports injury; interpersonal violence; other	58	CAPS-CA	Interview	8–18	13.04 (3.05)	31	US
Giannopoulou et al., 2006	Natural disaster: earthquake	2037	RIES-C	Questionnaire	9–17	12.85 (2.45)	49	Greece
Goenjian et al., 2009	Natural disaster: earthquake	92	CPTSD-RI	Questionnaire	Not reported	14.0 (1.8)	40	Armenia
Goenjian et al., 1995	Natural disaster: earthquake	218	CPTSD-RI	Questionnaire	Not reported	13.7	57–65	Armenia
Goenjian et al., 2001	Natural disaster: hurricane	158	CPTSD-RI	Questionnaire	13	13.00 (0.35)	48	Nicaragua
Goenjian et al., 2005	Natural disaster: earthquake	125	CPTSD-RI	Questionnaire	15–17	16.4 (0.475)	59–63	Armenia
Heptinstall et al., 2004	Refugee	40	IES-R – 13 Item	Questionnaire	8–16	11.3	43	UK
Husain et al., 1998	War: siege	791	IES/CPTSD-RI	Questionnaire	7–15	11.0 (2.3)	51	Bosnia & Herzegovina
Jaycox et al., 2002	Violence	1004	CPSS	Questionnaire	8–15	11.4 (1.8)	49	US
Kilic et al., 2003	Natural disaster: earthquake	49	CPTSD-RI	Questionnaire	7–14	10.25	47	Turkey
Koplewicz et al., 2002	Terrorism	49	CPTSD-RI	Questionnaire	6–12	Not reported	69	US
Korol et al., 1999	Industrial accident	120	CPTSD-RI	Interview	7–15	11.44 (2.65)	50	US
La Greca et al., 1996	Natural disaster: hurricane	442	CPTSD-RI	Questionnaire	6–13	Not reported	58	US
Lack & Sullivan, 2008	Natural disaster: tornado	102	CPTSD-RI	Interview	8–12	10.40 (1.23)	53	US
Landolt et al., 2003	Injury/illness	209	CPTSD-RI	Interview	6.5–14.5	10.0 (2.3)	40	Switzerland
Landolt et al., 2005	RTA	68	CPTSD-RI	Interview	6.5–14.5	9.82 (2.55)	46	Switzerland
Laor et al., 2002	Natural disaster: earthquake	404	CPTSD-RI	Questionnaire	Not reported	8.52 (1.22)	55	Turkey
Lengua et al., 2005	Terrorism	145	CPSS	Questionnaire	9.13–13.65	10.93 (1.01)	53	US
Lengua et al., 2006	Terrorism	143	CPSS	Questionnaire	9.13–13.65	10.93 (1.01)	53	US
Linning & Kearney, 2004	Physical & sexual abuse	55	CPTSD-I	Interview	8–17	12.65 (2.58)	58	US
Lonigan et al., 1991	Natural disaster: hurricane	5687	CPTSD-RI	Questionnaire	9–19	14.02 (2.41)	51	US
Magal-Vardi et al., 2004	Injury/illness	20	CPTSD-RI	Interview	7–18	13.6 (3.6)	50	Israel
Max et al., 1998	Injury/illness	44	K-SADS-E	Questionnaire	6–14	10.30 (2.43)	36	US
McDermott et al., 2005	Natural disaster: fire	222	CPTSD-RI	Questionnaire	8–18	12.50 (2.48)	55	Australia
Meiser-Stedman et al., 2005	Mixed: interpersonal violence & RTA	66	RIES-C	Questionnaire	10–16	13.8 (1.9)	39–40	UK
Mirza et al., 1998	RTA	156	K-SADS-L	Questionnaire	8–16	13.61 (2.44)	31	UK
Nugent et al., 2006	Mixed: RTA; sports injury; interpersonal violence; other	82	CAPS-CA	Interview	8–18	13.19 (2.94)	31	US
Nugent et al., 2007	Mixed: RTA; sports injury; interpersonal violence; other	82	CAPS-CA	Interview	8–18	13.19 (2.94)	31	US
Ostrowski et al., 2007a	Mixed: RTA; other	61	CAPS-CA	Interview	8–18	13.32 (3.08)	46	US
Ostrowski et al., 2007b	Mixed: RTA; other	54	CAPS-CA	Interview	8–18	Not Reported	45	US
Otto et al., 2007	Terrorism	166	IES-R	Interview	7–15	11.0 (3.1)	53	US
Overstreet et al., 1999	Interpersonal violence	75	CCDS	Questionnaire	10–15	12.50 (1.0)	52	US
Pelcovitz et al., 2000	Mixed: interpersonal violence & physical abuse	185	K-SADS-E	Interview	12–18	15.35 (1.8)	54	US
Pfefferbaum et al., 1999	Terrorism	3218	PTSS	Questionnaire	11–18	Not reported	57	US
Pfefferbaum et al., 2000	Terrorism	119	PTSS	Questionnaire	12–13	Not reported	51	US
Pfefferbaum, 2001	Terrorism	2381	PTSS	Questionnaire	11–14	Not reported	Not reported	US
Punamaki et al., 2006	War	216	CPTSD-RI	Questionnaire	15–17	16.38 (1.14)	52	Palestine
Rees et al., 2004	Paediatric Intensive Care Admission	68	CAPS-CA	Questionnaire	5–18	Not reported	38	UK
Roussos et al., 2005	Natural disaster: earthquake	1937	UCLA PTSD Index for DSM-IV	Questionnaire	9–18	Not reported	56	Greece
Runyon & Kenny, 2002	Physical & sexual abuse	98	CPTSD-RI	Questionnaire	8–17	12.09 (2.84)	60	US
Saltzman et al., 2006	Mixed: physical & sexual abuse; witnessing violence	59	CAPS-CA	Interview	7.1–14.1	10.7 (1.9)	42	US
Saxe et al., 2005	Injury/illness	72	CPTSD-RI	Interview	7–17	11.2 (3.51)	33	US
Schafer et al., 2004	RTA	45	IES-R	Questionnaire	8–18	13 (3.20)	44	Germany
Schafer et al., 2006	RTA	72	IES-R: Total Score	Questionnaire	8–18	13.6 (3.3)	42	Germany
Shannon et al., 1994	Natural disaster: hurricane	5687	CPTSD-RI	Questionnaire	9–19	14.02 (2.41)	51	US
Shemesh et al., 2005	Injury/illness	76	UCLA PTSD Index for DSM-IV	Questionnaire	8–19	13.7 (3.2)	59	US
Smith et al., 2001	War	339	IES-R	Questionnaire	9–14	Not reported	Not REPORTED	Bosnia & Herzegovina
Solomon & Lavi, 2005	War/Terrorism	740	CPTSD-RI	Questionnaire	11.5–15	Not reported	49–54	Israel
Stallard & Smith, 2007	RTA	75	CAPS-CA	Interview	7–18	14.01 (3.36)	51	UK
Stallard et al., 2001	RTA	109	CAPS-CA	Interview	7–18	14.62 (3.16)	47–53	UK
Stallard et al., 2004	RTA	158	CAPS-CA	Interview	7–18	14.85 (3.11)	53	UK
Thabet & Vostanis, 1999	War	239	CPTSD-RI	Questionnaire	6–11	8.9	46	Palestine
Thabet et al., 2002	War	180	CPTSD-RI	Interview	9–18	13.85	50	Palestine

Table 2 (continued)

Article	Trauma type	Sample size	PTSD measure	Interview or questionnaire	Age range	Mean age (SD)	Percentage of sample that were female	Location
Thabet et al., 2004	War	403	CPTSD-RI	Questionnaire	9–15	12.0 (1.7)	53	Palestine
Udwin et al., 2000	Accident	217	CAPS	Interview	11–18	14.70 (1.14)	74	UK
Vernberg et al., 1996	Natural disaster: hurricane	568	CPTSD-RI	Questionnaire	6–13	Not reported	55	US
Wickrama & Kaspar, 2007	Natural disaster: tsunami	325	DSM-IV diagnostic interview	Interview	12–19	Not reported	Not reported	Sri Lanka

Note. CAPS = Clinician Administered PTSD Scale, CAPS-CA = Clinician Administered PTSD Scale for Children and Adolescents, CCDS = Checklist for Children's Distress Symptoms, CPSS = Child PTSD Symptom Scale, CPTSD-RI = Children's PTSD Reaction Index, K-SADS-E = Schedule for Affective Disorders and Schizophrenia for School-Age Children, IES-R = Impact of Events Scale-Revised, RIES-C = Revised Impact of Events Scale for Children, RTA = Road Traffic Accident.

size for a number of reasons. First, *r* is a common metric for which the greatest number of effect sizes could be reported or converted; second, *r* is easily computed from chi-square, *t*, *F*, and *d* (see Hunter & Schmidt, 2004); and third, *r* is readily interpretable in terms of practical importance (Field, 2001; Rosenthal, 1991; Rosenthal & DiMatteo, 2001).

For categorical data, correlation coefficients were computed such that a positive coefficient reflected a higher mean in the PTSD group than the control group, and a negative coefficient represented a lower mean in the PTSD group than the control group. For continuous data, correlation coefficients were computed such that a positive coefficient reflected more severe PTSD symptoms, and a negative coefficient reflected less severe PTSD symptoms. Higher values of *r* indicate a stronger positive association with PTSD. Table 1 shows the effect sizes included in the meta-analysis for each risk factor.

4.5. Method of meta-analysis

For reasons discussed earlier, a random-effect meta-analysis was used. Hedges' (Hedges & Olkin, 1985; Hedges & Vevea, 1998) method was applied using Fisher-transformed correlation coefficients with results reported after the back transformation to the Pearson product-

moment correlation coefficient (see Field, 2005; Overton, 1998). Using this method, each effect size is weighted by a value reflecting both the within study variance ($1/n - 3$ for correlation coefficients in which *n* is the sample size) and the between study variance (τ^2) (see Field & Gillett, 2010, for a guide to using Hedges and Vevea's method).

Moderator analyses were conducted using a random-effect general linear model in which each *z*-transformed effect size can be predicted from the transformed moderator effect (represented by regression coefficient, β). The moderator effect, β , is estimated using generalised least squared (GLS). In both the main analysis and moderator analyses, between study variance was estimated non iteratively** (e.g. Dersimonian & Laird, 1986). For a technical overview of the GLS moderator analysis that we employed see Overton (1998) or Field and Gillett (2010).

5. Results

5.1. Characteristics of studies

The method described earlier generated 25 risk factors that were explored by two or more studies, which could then be entered into the meta-analysis. Sample sizes from individual studies ranged from

Table 3
Individual meta-analyses of individual risk factors.

Risk factor	<i>k</i>	τ^2	χ^2	$\hat{\rho}$	95% confidence interval of $\hat{\rho}$		<i>Z</i>	ρ_{pb}
					Lower	Upper		
Demographic factors								
Female gender	29	0.002	31.20	0.154	0.126	0.182	10.77***	0.142
Low intelligence	2	0.000	0.28	0.198	0.079	0.317	3.25**	0.181
Low SES	7	0.013	6.71	0.165	0.047	0.282	2.75**	0.134
Race (BME)	5	0.001	6.12	0.081	0.041	0.121	3.93***	0.062
Younger age	18	0.015	23.84	0.030	-0.041	0.101	0.83	0.023
Pre-trauma factors								
Life events	8	0.209	6.98	0.209	0.109	0.309	4.09***	0.179
Psychological problem	14	0.000	8.57	0.152	0.107	0.196	6.64***	0.130
Parent psychological problem	4	0.000	1.11	0.121	0.024	0.218	2.45*	0.095
Pre-trauma low self-esteem	2	0.000	0.10	0.163	0.049	0.278	2.80*	0.142
Objective trauma characteristics								
Bereavement	4	0.008	2.63	0.217	0.116	0.319	4.19***	0.204
Time post-trauma	9	0.048	6.63	-0.183	-0.338	-0.028	2.32*	-0.148
Trauma severity	41	0.025	85.25***	0.292	0.236	0.347	10.32***	.0204
Subjective trauma characteristics								
Peri-trauma fear	3	0.029	2.24	0.361	0.132	0.590	3.09**	0.316
Perceived life threat	6	0.000	4.67	0.362	0.309	0.416	13.25***	0.346
Post-trauma individual factors								
Blame others	2	0.052	10.28**	0.474	0.143	0.806	2.80**	0.522
Comorbid Psychological Problem	25	0.023	38.13*	0.404	0.336	0.472	11.60***	0.361
Distraction	2	0.055	1.00	0.473	0.115	0.832	2.59*	0.424
PTSD (T1)	4	0.182	2.87	0.636	0.203	1.069	2.88**	0.541
Thought suppression	2	0.000	0.07	0.696	0.508	0.883	7.26***	0.601
Post-trauma psychological environment								
Low social support	4	0.032	6.69	0.327	0.127	0.526	3.21**	0.288
Life Events	5	0.027	4.45	0.212	0.145	0.279	6.20***	0.141
Parental psychological problem	25	0.021	26.06	0.290	0.220	0.360	8.08***	0.254
Poor family functioning	7	0.168	6.61	0.460	0.149	0.770	2.90**	0.405
Social withdrawal	2	0.000	0.04	0.385	0.310	0.461	9.98***	0.367
Media exposure	3	0.062	2.15	0.112	-0.186	0.410	0.74	0.097

Note. *** = $p < .001$, ** = $p < .01$, * = $p < .05$, *k* = number of studies.

20 to 5687. Characteristics of the studies included in the meta-analysis (trauma type, sample size, measure of PTSD, whether the measure was an interview or questionnaire, age range, mean age, percentage of sample that were female, and location of study) are contained in Table 2.

5.2. Risk factor estimates

The main results of the meta-analysis for each risk factor are contained in Table 3. For each risk factor this table shows the number of studies (k), the estimate of between-study variability (τ^2), test of significance of between study variability (χ^2), estimate of the population effect size ($\hat{\rho}$), 95% confidence intervals, test of the population effect size (z) and estimate of the population effect size under severe two-tailed publication bias (ρ_{pb}).

The estimate of the population effect size, the confidence intervals and the range of effect sizes from individual studies are shown diagrammatically in Fig. 1.

Two risk factors yielded population effect size estimates close to zero: race (Black and minority ethnic; BME) and younger age. However, the effect of race, whilst small, was nevertheless statistically significant unlike that of younger age, which was not.

Thirteen risk factors yielded small to medium population effect size estimates (i.e. with an absolute value between 0.1 and 0.3, explaining 1–9% of the variance in PTSD symptoms). It is worth noting that the effect of media exposure was not statistically significant, but this is likely to reflect the small number of studies on which the effect size estimate were based ($k=3$). The remaining 10 risk factors yielded medium to large effect sizes (i.e. greater than 0.3, explaining more than 9% of the variance in PTSD symptoms).

There are some noteworthy caveats to these results. First, most of these effects are based on very small numbers of studies. For example, the two largest effect size estimates (thought suppression and PTSD at time 1) are based on only 2 and 4 studies respectively. As such, these effect sizes could reflect idiosyncrasies in the studies, or may simply not be generalisable. The only risk factor to yield a relatively large effect size estimate that was based on a large number of studies

was post-trauma psychological problem ($k=25$). Second, three risk factors showed significant heterogeneity across effect sizes from individual studies (trauma severity, blame others and post-trauma psychological problem). However this is in contrast to other meta-analysis of risk factors for PTSD (e.g. Brewin et al., 2000 and Cox et al., 2008) in which a majority of factors had varied results from different studies. The heterogeneity of the effect sizes for trauma severity and post-trauma psychological problem can in part be explained by the relatively large number of studies, ($k=41$ and 25 respectively), the estimate of variability, τ^2 , itself was not large in either of these cases and so the significance could reflect the relatively large power of the test.

5.3. Moderator analysis

Four risk factors (trauma severity, comorbid psychological problems, younger age, and female gender) had sufficient numbers ($k \geq 18$ in the smallest category) of studies to enable an analysis of variables that might moderate the effect sizes. Five potential moderator variables were identified:

- (1) Whether PTSD was measured by interview or questionnaire (which in Brewin et al., 2000, moderated results for female gender, younger age at trauma, trauma severity and previous trauma).
- (2) Whether the trauma was a group trauma (i.e., the same event affecting very many people, such as an earthquake) or an individual trauma (an event happening to one individual, such as an assault). It is possible that social support following a group trauma manifests in different ways to social support following individual events, and given the importance of social support in Brewin's meta-analysis of adult risk factors, this was considered to be of interest as a possible moderating factor.
- (3) Whether the trauma was intended (e.g., war, terrorism, abuse, shooting) or not. In Fletcher (1996) rates of PTSD were found to be different depending on whether the event was a natural event or "human-caused", which may indicate that different meaning is attributed to different types of events, which have

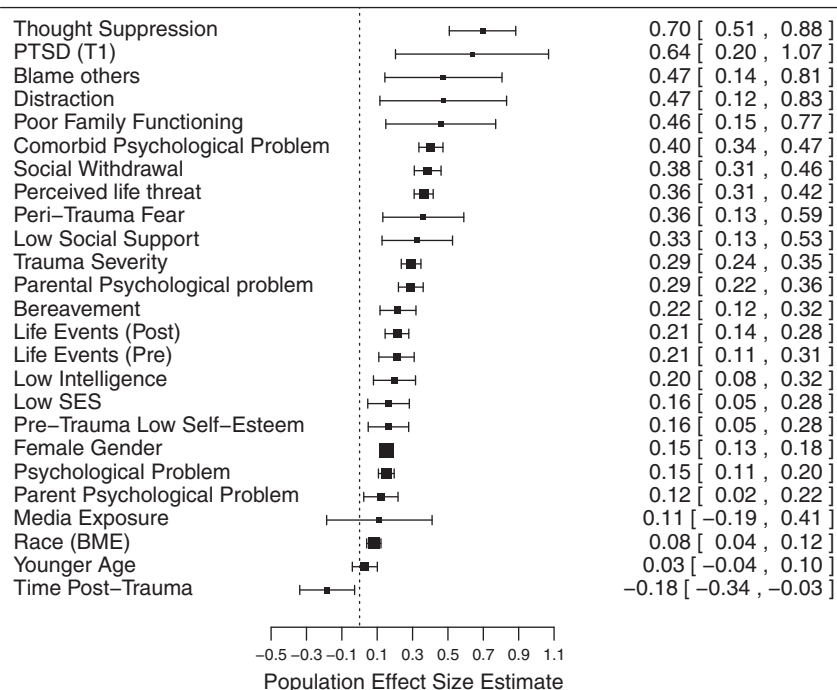


Fig. 1. Forest plot of all risk factors, showing their population effect size estimate, their confidence interval and the range of effect sizes from different studies.

Table 4
Moderator analyses of individual risk factors.

Risk factor	Moderator	k	b	95% confidence interval of b		Z	p
				Lower	Upper		
Trauma severity	Interview measure	41	-0.051	-0.165	0.064	-0.86	0.387
	Intended vs. unintended	34	-0.042	-0.171	0.088	-0.63	0.526
	Intended vs. mixed	20	0.124	-0.058	0.306	1.34	0.180
	Group trauma	41	0.091	-0.022	0.204	1.58	0.114
Comorbid psychological problem	Mean age	28	0.009	-0.023	0.041	0.57	0.567
	Anxiety vs. other	13	0.188	-0.005	0.380	1.91	0.056
	Depression vs. other	16	0.248	0.066	0.430	2.67	0.008
	Interview measure	25	-0.044	-0.189	0.100	-0.60	0.548
	Intended vs. unintended	24	0.390	0.323	0.459	11.16	<0.001
	Group Trauma	25	0.005	-0.153	0.164	0.07	0.947
	Mean Age	23	-0.018	-0.074	0.039	-0.61	0.545
	Younger age	18	0.050	-0.099	0.199	0.66	0.510
	Interview measure	15	0.149	0.016	0.283	2.19	0.029
	Intended vs. mixed	10	0.310	0.111	0.509	3.05	0.002
Female gender	Group trauma	18	0.196	0.063	0.004	2.90	0.004
	Mean age	17	0.009	-0.045	0.062	0.32	0.751
	Interview measure	29	0.009	-0.045	0.062	0.32	0.751
	Intended vs. unintended	27	0.061	0.006	0.116	2.18	0.029
	Intended vs. mixed	12	0.198	0.003	0.393	1.99	0.047
	Group trauma	29	0.004	-0.056	0.065	0.14	0.888
	Mean Age	26	0.028	0.009	0.046	2.90	0.004

k = number of studies, b = regression parameter for the moderator effect, z = test of the moderation effect.

subsequent effects on outcome. Categorising events as either intended or not was considered to be a more discriminating categorisation than natural or “human-caused”, as the fact that the harm was caused on purpose may be even more meaningful for the victims, than simply the fact that it was human caused.

- (4) Whether the measure of PTSD was categorical or continuous. This was a significant moderator of six factors in Brewin et al. (2000).
- (5) The mean age of the sample (which was considered worthy of further investigation given the discussion of age and PTSD in the introduction).

Table 5
Moderators of the impact of trauma severity as a risk factor for PTSD.

Moderator	Group	k	$\hat{\rho}$	95% confidence interval for $\hat{\rho}$		Z
				Lower	Upper	
Assessment	Interview	18	0.268	0.147	0.389	4.33***
	Questionnaire	23	0.310	0.244	0.377	9.17***
Intentional trauma	Intentional	13	0.293	0.203	0.384	6.36***
	Unintentional	21	0.254	0.180	0.328	6.75***
	Mixed	7	0.421	0.100	0.742	2.57*
Group trauma	Group	22	0.331	0.257	0.405	8.74***
	Individual	19	0.240	0.155	0.324	5.56***

Note. *** = p < .001, * = p < .05, k = number of studies, $\hat{\rho}$ = estimate of the population effect size, z = test of the population effect size estimate.

Table 6
Moderators of the impact of comorbid psychological problems as a risk factor for PTSD.

Moderator	Group	k	$\hat{\rho}$	95% confidence interval for $\hat{\rho}$		z
				Lower	Upper	
Type of disorder	Anxiety	9	0.406	0.275	0.537	6.06***
	Depression	12	0.471	0.383	0.559	10.51***
	Other	4	0.217	0.123	0.312	4.52***
Assessment	Interview	9	0.376	0.236	0.517	5.24***
	Questionnaire	16	0.421	0.339	0.502	10.12***
Intentional trauma ^a	Intentional	9	0.415	0.269	0.560	5.58***
	Unintentional	15	0.374	0.289	0.458	8.67***
Group Trauma	Group	17	0.405	0.322	0.488	9.60***
	Individual	8	0.396	0.244	0.548	5.10***

Note. *** = p < .001, k = number of studies, $\hat{\rho}$ = estimate of the population effect size, z = test of the population effect size estimate.

^a There was only one study that included mixed trauma, therefore, a comparison between intended and unintended trauma was the only one that could be made. The single effect size of ‘mixed’ was excluded from this particular analysis

For comorbid psychological problem we used an additional moderator variable that specified the type of psychological problem in three categories: anxiety, depression and ‘other’.

Table 4 shows the results of all moderator analyses, including betas for the moderator, 95% CIs, and their significance. These analyses will be discussed for each risk factor in turn. Tables 5–8 show the individual meta-analyses for these risk factors by moderating group (except for mean age, which was a continuous predictor and needed no sub-analysis). In all analyses, intended trauma had three groups (intended, unintended and mixed) and so was entered as two dummy variables (intended versus unintended, intended versus mixed), in this case the overall moderation effect is reported in the text (as Q), and the individual contributions of the dummy variables are in Table 4.

5.4. Trauma severity

For trauma severity, there were no significant moderators of the population effect size estimate i.e. the effect size for each group was not significantly different from their comparison group (Table 4). Although somewhat higher effect sizes were found for questionnaires (compared to interview), mixed trauma (compared to intended and unintended), and group trauma (compared to individual). The effect size for each group individually was significant (Table 5). The differences between groups may not have been statistically significant, however the fact that one is bigger than the other is still of interest.

5.4.1. Comorbid psychological problems

For the additional moderator of the type of psychological problem two dummy variables representing anxiety compared to ‘other’, and

Table 7
Moderators of the impact of younger age as a risk factor for PTSD.

Moderator	Group	k	$\hat{\rho}$	95% confidence interval for $\hat{\rho}$		z
				Lower	Upper	
Assessment	Interview	9	0.054	-0.039	0.147	1.14
	Questionnaire	9	0.005	-0.101	0.111	0.09
Intentional trauma	Intentional	7	-0.079	-0.185	0.027	-1.47
	Unintentional	8	0.075	-0.007	0.158	1.79
	Mixed	3	0.232	0.038	0.427	2.34*
Group trauma	Group	6	0.154	0.031	0.277	2.46*
	Individual	12	-0.045	-0.114	0.025	-1.26

Note. * = p < .05, k = number of studies, $\hat{\rho}$ = estimate of the population effect size, z = test of the population effect size estimate.

Table 8
Moderators of the impact of female gender as a risk factor for PTSD.

Moderator	Group	k	$\hat{\rho}$	95% confidence interval for $\hat{\rho}$		z
				Lower	Upper	
Assessment	Interview	10	0.191	0.124	0.259	5.55***
	Questionnaire	19	0.145	0.114	0.176	9.15***
Intentional trauma	Intentional	10	0.110	0.057	0.164	4.02***
	Unintentional	17	0.170	0.141	0.198	11.78***
	Mixed	2	0.306	0.122	0.491	3.26**
Group trauma	Group	15	0.160	0.135	0.186	12.37***
	Individual	14	0.171	0.101	0.241	4.78***

Note: *** = $p < .001$, ** = $p < .01$, k = number of studies, $\hat{\rho}$ = estimate of the population effect size, z = test of the population effect size estimate.

depression compared to 'other' were included. Overall, there was a significant moderation effect $Q(2) = 7.15$, $p = 0.028$. Table 4 shows that effect sizes for depression differed significantly to other, $p = 0.008$. For anxiety, effects were higher than for other, although this did not quite reach statistical significance, $p = 0.056$. Table 6 shows that the population effect size estimate for 'other' was significantly lower than both anxiety and depression; however, population effect size estimates were significantly different from zero in all three groups (anxiety, depression and other).

The only other significant moderator was whether the trauma was intended or not. Intended trauma gave rise to significantly higher effect sizes than unintended trauma, although both population effect size estimates were significantly greater than zero (Table 6).

5.4.2. Younger age

For the younger age risk factor, intentionality of trauma was a significant moderator overall, $Q(2) = 10.70$, $p < 0.005$. The dummy variables (Table 4) and sub-group analyses (Table 7) showed that effect sizes for intended trauma were significantly lower (and in the opposite direction) than both unintended trauma and mixed trauma. Mixed trauma was the only subgroup for which the population effect size estimate differed significantly from zero, however small numbers of studies indicate caution when drawing conclusions from these results. The only other significant moderator was group versus individual trauma (Table 4). Effect sizes were significantly larger for group trauma compared to individual trauma (Table 7), and the population effect size differed significantly from zero for group trauma, but not for individual trauma.

5.4.3. Female gender

For the female gender risk factor, intentionality of trauma was a significant moderator overall, $Q(2) = 7.30$, $p = 0.026$. The dummy variables (Table 4) and sub-group analyses (Table 8) showed that effect sizes for intended trauma were significantly lower than both unintended trauma and mixed trauma. Population effect size estimates differed significantly from zero in all three groups (Table 8). The only other significant moderator was mean age: the positive beta (Table 4) indicates that effect sizes increased significantly as a function of mean age. (In other words, the degree to which being female significantly increases risk increases with age.)

5.5. Publication bias

'Publication bias' (or the so-called 'file-drawer problem') describes the relationship between the decision to publish a paper and the results of the paper (Begg, 1994). Studies with non-significant findings are less likely to be published than studies with significant findings, which could result in a positive bias within the child PTSD literature. In addition, authors of studies that measure multiple risk factors may choose to report only those that were significant.

Although Rosenthal's fail-safe N is commonly used to quantify publication bias (Rosenthal, 1979), it is problematic because it emphasises significance testing the population effect size rather than estimating bias in the population effect size itself. We performed a sensitivity analysis, which 'corrects' the population effect size estimate for publication bias based on a weight function that reflects the nature of the bias. We applied Vevea and Woods (2005) methods because they can be applied to relatively small samples of studies. In Table 3 we report ρ_{pb} , which is an estimate of the population effect size under severe two-tailed publication bias. (We corrected for other models too, but the results were consistent with the reported model.) In Table 3, if ρ_{pb} and $\hat{\rho}$, are similar, then publication bias has had little effect. Table 3 shows that although the population effect size estimates are reduced when corrected for publication bias, our basic conclusions remain unchanged.

6. Discussion

This meta-analysis involved investigating 25 risk factors for PTSD in children and adolescents aged 6–18 years, across 64 studies published between 1980 and May 2009. The combined sample size for the studies considered was very large (32,238). A small effect size was observed for race and younger age as risk factors for PTSD; a small to medium-sized effect was observed for female gender, low intelligence, low SES, pre- and post-trauma life events, pre-trauma psychological problems in the individual and parent, pre-trauma low self-esteem, post-trauma parental psychological problems, bereavement, time post-trauma (an inverse relationship), trauma severity, and exposure to the event by media; whilst a large effect was observed for low social support, peri-trauma fear, perceived life threat, social withdrawal, comorbid psychological problem, poor family functioning, distraction, PTSD at time 1, and thought suppression. These findings are consistent with the earlier reviews of Foy et al. (1996) and Pine and Cohen (2002), but go further in quantifying the relative importance of these risk factors. It should be noted that in discussing and comparing the effect sizes of different factors, there is no implication that the difference is necessarily statistically significant.

However, only 6 out of the 25 variables examined were investigated in 10 or more studies. Despite the increase in the number of studies into child PTSD over the past 25 years, only a limited number of variables have been routinely investigated. In contrast, in Brewin and colleagues' meta-analysis examining factors related to PTSD in adult samples, 11 of the 14 variables under consideration had been examined in 10 or more studies (Brewin et al., 2000). The present meta-analysis therefore highlights the need for the further investigation of some very rudimentary potential risk factors (e.g. low intelligence, race, perceived life threat, low social support). Furthermore, it highlights some areas for future research about which we currently know relatively little but, based on preliminary evidence, may turn out to be very important. Examples of such factors are thought suppression, media exposure and social withdrawal.

In order to consider the impact on our results of publication bias, we estimated population effect sizes under severe two-tailed publication bias. This suggested that the aforementioned pattern of results was not substantially affected by publication bias. Whilst publication bias may not, therefore, have been a major factor in determining these findings, the results of this meta-analysis need to be interpreted in light of the wide variability in the number of effect sizes included for each risk factor, and the between-studies variability in effect sizes for some of the risk factors.

6.1. Demographic and pre-trauma factors

Clear theoretically-driven predictions as to the impact of younger age on the risk of developing PTSD have been difficult to make, given the often contradictory effects of age on different processes

underlying traumatic stress reactions (e.g. Meiser-Stedman, 2002; Pfefferbaum, 1997; Salmon & Bryant, 2002). A clear picture emerged from our meta-analysis concerning younger age as a risk factor for PTSD, with 18 studies included. The results of this meta-analysis strongly suggest that overall younger age is largely unrelated to whether a young person develops PTSD. Moderator analysis revealed that, unlike with female sex, there was a statistically significantly stronger relationship between being younger and PTSD when the index trauma was unintentional rather than intentional; however regardless of intentionality, the population effect size estimate remained non-significant. Similarly younger age was found to have a different association with PTSD depending on whether the potentially traumatic event was a group event or an individual one. Further analysis revealed that it was a significant risk factor albeit with a small effect size ($\hat{\rho} = 0.15$), for group trauma whereas it remained non-significant for individual trauma. This is intriguing as it suggests that if the event is experienced as part of a group, younger children may find it slightly harder to process than older ones.

Only five of the 64 studies that were included in the analysis examined the relationship between ethnicity and the development of PTSD. This is a smaller percentage of studies than other reviews or meta-analyses such as the review by Foy et al. (1996) or the meta-analysis of Brewin et al. (2000). In the present meta-analysis, ethnicity was found to have a consistent but small effect on the likelihood of developing PTSD. As with the Brewin et al. (2000) adult meta-analysis, it should be stressed that this variable was coded in a dichotomous fashion (white versus black or minority ethnic), which may have masked important differences between minority ethnic groups.

Low intelligence and low socio-economic status were more important, but still only yielded small to medium effect sizes consistently reported across studies. Intelligence was only examined in two studies and clearly needs further investigation.

A notable finding was the identification of female sex as a consistent, but ultimately small ($\hat{\rho} = 0.15$) risk factor for PTSD in children and adolescents. The direction of this effect tallies with the conclusions of previous reviews (Davis & Siegel, 2000; Foy et al., 1996; Pfefferbaum, 1997); however, this study helps to establish the limited extent of the relationship. Placing strong emphasis on female sex in PTSD screening programs would appear to be unwarranted. The observation of female sex as a significant if small risk factor also concurs with data for adult populations (Brewin et al., 2000).

Moderator analysis found that female sex became a stronger risk factor in older children and adolescents, and when the index trauma was unintentional. The age-related effect may reflect the emergence of more differential responses to stressful events, e.g. the tendency of female adolescents to use rumination (Broderick, 1998; Cutler & Nolen-Hoeksema, 1991; Hampel & Petermann, 2005; Nolen-Hoeksema & Girgus, 1994). That intentional traumatic stressors should be related to a larger risk of PTSD in female youth, than other types of trauma is an important observation. An increased sensitivity to interpersonal violence in female youth may be understood from a variety of developmental theories (e.g. neuroendocrinology, socialisation to particular sex roles), but presents an easily identifiable specific type of trauma where this risk factor may be more important.

Pre-trauma factors (i.e. pre-trauma psychological problems, life events and parental psychological problems) were also only small to medium risk factors. Objective trauma characteristics (i.e. bereavement, time post-trauma, and trauma severity) also yielded only small to medium effect sizes. Trauma severity (as indexed by objective criteria) was the trauma characteristic most strongly associated with risk of developing PTSD. It was also apparent, however, that this effect varied very widely. Clearly this is related strongly to the very wide range of measures of trauma severity used, all of which are assumed to be directly related to trauma severity.

Analysis revealed that none of the moderators that we investigated significantly moderated the effect sizes of trauma severity. This

might reflect the complexity of 'trauma severity', the objective measurement of which is complicated by a number of conceptual factors. For example, what is the essential property that makes a trauma traumatic; can trauma exposure be adequately differentiated from trauma severity; do measurable properties of a trauma correspond with the traumatic quality, so comparisons across trauma types are likely to be even more complex. For example, one interpretation of the tendency of group trauma to increase the link between trauma severity and risk of PTSD would be that in studies where large groups of young people are exposed to trauma, trauma severity may be indexing exposure (e.g. proximity to a natural disaster), rather than the severity of a trauma to which a young person was clearly exposed (e.g. degree of injury following a motor vehicle accident). Attempts to screen for children and adolescents at high risk of PTSD may therefore need to index severity in a trauma-specific way, possibly limiting the applicability of some screening tools.

6.2. Peri-traumatic factors and meaning-making

Peri-traumatic fear and the perception of threat to life during the trauma had large effect sizes as predictors of PTSD. Surprisingly, these variables had only been investigated in 3 and 6 studies respectively, underlining the need for further research examining peri-traumatic emotions and cognitions. Whilst these data are clearly preliminary, these variables are easily assessed using questionnaire measures and may prove to be of great utility in PTSD screening tools for trauma-exposed youth (e.g. Nixon, Ellis, Nehmy, & Ball, 2010; Winston et al., 2003).

6.3. Individual factors post-trauma

A number of features of participants' post-trauma coping and environment were significant risk factors for PTSD. Blame others was found to have a medium to large effect size, and all of the other individual post-trauma factors assessed (comorbid psychological problems, distraction, PTSD at time 1, and thought suppression) yielded large effect sizes.

The presence of comorbid psychological problems, as with trauma severity, was a significant risk factor for PTSD but with the degree of association varying considerably across different studies. Moderation analysis revealed that anxiety, depression and other psychological problems were all significant risk factors, depression was the most predictive of PTSD symptoms. Furthermore, the presence of a comorbid psychological problem was more of a risk factor for PTSD, in intentional trauma compared to unintentional trauma. The wide variation for comorbid psychological problems likely reflects again the broad range of traumas included within this meta-analysis, and the differing impacts that trauma can have on young people. The way in which the interpersonal dimension of intentional trauma may lead to wider psychiatric disturbance than unintentional trauma is an important issue. One possible mechanism for this is greater cognitive misappraisal (for preliminary evidence of this see Meiser-Stedman, Dalgleish, Glucksman, Yule, & Smith, 2009). An alternative explanation is that young people exposed to intentional trauma may be more likely to be living in toxic environments, thus implicating pre-traumatic factors. Regardless of how comorbidity precisely relates to PTSD, its importance as a risk factor for PTSD adds weight to two points concerning the way in which clinicians consider young people's responses to trauma. Firstly, psychiatric reactions other than PTSD should be considered in the aftermath of trauma, particularly certain types of trauma (e.g. intentional trauma). Secondly, understanding how other psychiatric reactions (particularly depression) are elicited by trauma exposure is vital. Work has begun to delineate the aetiology of different psychiatric responses in adults exposed to trauma (e.g., Ehrling, Ehlers, & Glucksman, 2008), but no such work has been conducted in youth.

Blame of others for the event was found to have a small to medium effect size, but with only two studies being considered, further research is required before drawing firm conclusions. However it is consistent with clinical experience where some clients are so wrapped up in blaming someone for *why* an event has happened, they appear to be unable to devote sufficient resources to processing *what* has happened. The emergence of distraction and thought suppression as major risk factors for PTSD, albeit in only two studies each at this stage, is significant, and these factors represent important targets for future investigation. This relationship may merely reflect the overlap with the core avoidance symptoms of PTSD, but, given the ease with which these psychological processes can be assessed, they may nevertheless have a very important function within screening batteries. Indeed, these variables compared favourably with the ability of an early index of PTSD to act as a risk factor for PTSD one month post-trauma. Additionally, the fact that distraction and thought suppression are amongst the largest effect sizes, supports the cognitive model's assertion that avoidance is central to the symptomatology.

The very large effect associated with T1 PTSD symptomatology as a risk factor for later PTSD is hardly surprising, but this finding does help to emphasise the utility of including early symptom levels within screening tools (e.g. the Trauma Screening Questionnaire for adults; [Brewin et al., 2002](#)). Theoretically, these suggest that early processes (i.e. either peri-trauma or in the immediate aftermath) play a major role in the development of more significant and persistent PTSD symptoms.

6.4. Psychological environmental factors post-trauma

All the features of the post-trauma psychological environment considered within this meta-analysis showed small to medium or large effect sizes, indicating the strength of the relationship between what happens after the event, with the development of PTSD. Life events and parental psychological difficulties showed small to medium effect sizes whilst low social support, family poor functioning and social withdrawal showed medium to large effect sizes. Whilst social support has been identified as being a factor of potential great importance to the successful resolution of traumatic experience (e.g. [Davis & Siegel, 2000](#); [Pine & Cohen, 2002](#)), this meta-analysis only found 4 studies that have adequately addressed this construct. Poor family functioning was a stronger risk factor for PTSD than poor parental mental health, though parental mental health is the more established correlate of PTSD (being examined in 25 studies), and its effect size was on the borderline between a medium and a large effect size ($p > 0.3$).

6.5. Limitations

The present study is limited by the highly heterogeneous nature of studies in this area, with the inclusion of papers that are widely ranging in terms of trauma type, assessment tools, and the indices for several putative risk factors. A majority of the studies included in the analysis used child-report measures of PTSD, with more studies it would be able to determine whether this makes a difference to how the risk factors operate. This may be particularly pertinent for younger children who may be less able to report reliably on internal states. Future meta-analyses and reviews may consider focussing on particular trauma types, in particular, distinguishing between intended versus unintended and collective versus individual trauma exposure (which accounted for much of the between-study variability in the present study). Nevertheless, the PTSD diagnosis is not intended to be specific to any given form of traumatic experience (within certain conceptual bounds), and between-trauma differences are worth highlighting. The initial search was restricted to publications in English language, and it is not known to what extent this limitation may have influenced the findings.

As already noted, many variables included in this meta-analysis have only been examined in a handful of studies. Clearly this limits

the conclusions that can be drawn about these risk factors, but it does also help to highlight areas that warrant further investigation.

6.6. Implications

Despite the limitations outlined earlier, the present analysis does have some implications for the theoretical understanding of PTSD in youth. First, the data concerning pre-trauma factors shed light on the ultimate aetiology of PTSD and the diagnostic distinctiveness of this construct. Whilst the relationship between pre-trauma life events or psychological problems and PTSD was significant across the studies that examined these variables, the strength of this association was only modest in comparison to most of the peri-trauma or post-trauma factors. This supports the suggestion that PTSD in youth is chiefly the result of a reaction to the specific event, and as such is not particularly closely related to the previous functioning of the young person, or to their previous experiences.

Second, the broadly consistent failure to observe a substantial relationship between young age and PTSD needs to be acknowledged by clinicians and theoreticians alike. Clinically, resources should not be devoted to younger children at the expense of adolescents. Whether younger children are as able to report their distress and access help outside of research studies is however a significant issue to be addressed in future studies. Theoretically, this finding may suggest that developmental considerations are not as important as is often thought. Developmental vulnerabilities for the onset and maintenance of PTSD may have already been passed by the age of 8 years. Alternatively, a more complex picture may emerge of young children being more vulnerable to developing PTSD because of some developmentally sensitive factors, but more resilient due to other age-related factors (see [Salmon & Bryant, 2002](#), for an extensive review of how development may differentially impact on the psychological processing of a potentially traumatic event). As the present meta-analytic study was restricted to 6–18 year olds, it is not possible to say whether an age-related vulnerability to developing PTSD is present or not in even younger children, though research within this younger population is clearly more problematic ([Scheeringa, Zeanah, Drell, & Larrieu, 1995](#)).

Third, the strong relationship between PTSD risk and aspects of young people's recovery environment underlines the importance – and feasibility – of developing efficacious post-trauma screening tools and interventions for children and adolescents. Demographic and pre-trauma factors, are only weakly related to PTSD risk and are therefore unlikely to have particular utility on their own as targets for screening tools (e.g. female gender, age, pre-trauma psychological problems). Post-trauma factors, however, appear to be more strongly implicated in the development of PTSD. Interventions based on these risk factors may include empirically based screening tools for diverting resources to the most vulnerable young people, and low intensity and cost effective interventions that do not rely on individual psychological therapy. Preliminary work has begun to this end (e.g. [Kenardy, Thompson, Le Brocq, & Olsson, 2008](#)), but further research is required to specify which features of the post-trauma recovery environment are actively toxic and which are epiphenomenal.

Some risk factors – namely, the perception of life threat, the use of distraction and thought suppression – offer tentative support for a cognitive approach to understanding PTSD in young people (e.g. [Brewin et al., 1996](#); [Dalgleish, 1999](#); [Ehlers & Clark, 2000](#); [Meiser-Stedman, 2002](#)). Such an account offers a framework for investigating the specific mechanisms by which robust risk factors (e.g. parental psychological problems, comorbidity, poor family functioning) may trigger or maintain post-traumatic stress in youth (see [Meiser-Stedman, 2002](#) for a fuller discussion), which would in turn inform the development of more targeted and efficacious interventions. Regardless of how such a cognitive research agenda turns out, a broadly psychosocial account of child and adolescent PTSD would appear to be a paradigm for directing future research in this area.

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