
Epidemiology of Trauma and Trauma-Related Disorders in Children and Adolescents

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How many children and adolescents are exposed to potentially traumatic events (PTEs)? Is exposure a random phenomenon or can we identify specific risk factors? Similarly, how many and which children and adolescents develop trauma-related disorders? The present chapter gives an overview of the current evidence base regarding exposure to PTEs, acute stress disorder (ASD), post-traumatic stress disorder (PTSD) and related predictors. The updated PTSD criteria in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA] 2013) include mood and cognitive symptoms and a new preschool subtype which will likely increase prevalence rates of these disorders for preschool-aged children compared to the *DSM-IV* (APA 2000). In general, only a small proportion of children and adolescents faced with a similar type of exposure develop high levels of symptoms or disorders. Therefore, consideration of potential demographic, biological, cognitive and family or environment predictors are important to help guide prevention, screening, assessment and intervention efforts. We also discuss methodological differences among studies that may affect empirical findings.

2.1 Exposure to Potentially Traumatic Events

2.1.1 Estimates of Exposure

Exposure to PTEs is common in children and adolescents. By the time young people reach their 18th birthday, many have faced the loss of a loved one, a serious accident, violence or other type of trauma. General population studies in the

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USA have found particularly high rates of exposure. For example, Copeland et al. (2007) reported that 68 % of adolescents in a large population sample had been exposed, about half of whom reported two or more events. These findings are similar to a recent study by McLaughlin et al. (2013) in which 62 % of over 6,000 American adolescents reported exposure. Again, about half of the exposed adolescents had been confronted with more than one event. Both American studies used the *DSM-IV* A1 criterion of objective exposure. A recent population study with Swiss adolescents reported around 56 % of adolescents reported at least one PTE (Landolt et al. 2013), a figure that is akin to US samples, likely due to a large proportion of migrants in the Swiss study. Most population studies focus on adolescents: population studies among primary school children are fairly rare. One such study in the Netherlands reported an exposure rate of 15 % (Alisic et al. 2008), suggesting that trauma is also a common experience in earlier childhood.

Studies that assessed exposure beyond *DSM-IV* A1 criterion events, including experiences such as divorce of parents and bullying, found high rates among young people. In Denmark, 78 % of a student sample reported exposure to at least one distressing or traumatic event (Elklit and Frandsen 2014; $N=1088$, age range=15–20 years), with approximately 60 % of the exposed students reporting two or more. Similar and even higher rates were reported for adolescents in Malaysia (78 %; Ghazali et al. 2014), Greenland (86 %; Karsberg et al. 2012) and Kenya (95 %; Karsberg and Elklit 2012).

In sum, around one in two adolescents report lifetime exposure to at least one PTE according to *DSM-IV*, with lower figures reported for younger children. However, a greater emphasis on developing nations in the literature is warranted. For example, 87 % of the peer-reviewed articles on traumatic stress published in 2012 regarded high-income countries and 51 % of all papers described studies in the USA (Fodor et al. 2014). By contrast, trauma exposure in developing nations tends to be substantially more common compared to developed countries (e.g. Karsberg and Elklit 2012), lending weight to the importance of these oft-overlooked nations. Refugee youth are a particularly under-researched heterogeneous minority. The next few paragraphs discuss specific types of events that children and adolescents are exposed to.

2.1.1.1 Exposure to the Sudden Loss of a Loved One

In the studies among adolescents in the USA (McLaughlin et al. 2013) and Switzerland (Landolt et al. 2013) and the study among primary school children in the Netherlands (Alisic et al. 2008), the most frequently reported trauma was the sudden loss of a loved one. In particular, the death of a parent or a sibling is one of the most stressful life events that a child or adolescent can experience (Melhem et al. 2011). In the study by McLaughlin et al. (2013), 28 % of the sample lost a loved one. Strictly speaking, not all of the deaths would meet the *DSM-5* stressor criteria, since some of these may not have been sudden or violent (but instead, after a long period of illness).

2.1.1.2 Exposure to Injury

Serious accidental injury is the global leading cause of death in the 10–19-year-old age bracket (World Health Organization (WHO) 2014). As is often mentioned, this is only the “tip of the iceberg”, with millions of children who are not fatally but seriously injured every year. Injuries in children most commonly occur due to motor vehicle accidents, drowning, burns and falls (WHO 2014). Motor vehicle accidents tend to be some of the most common PTEs overall (Elklit and Frandsen 2014; Ghazali et al. 2014).

While not all injuries would be considered serious or traumatic, those that warrant a hospital visit longer than 24 hours are often placed into this category (e.g. Olsson et al. 2008). Nevertheless, children may also experience trauma symptoms following an event that leads to an emergency department visit without subsequent hospitalisation (Bryant et al. 2004). For example, involvement in a motor vehicle accident without serious injury can be traumatic due to the perceived threat to life (Meiser-Stedman et al. 2008). In addition, invasive medical procedures are relatively common and may be experienced as traumatic, particularly when life-threatening (Marsac et al. 2014).

2.1.1.3 Exposure to Violence

Rates of exposure to violence are likely underestimated due to under-reporting of physical and especially sexual trauma (Saunders and Adams 2014). With this in mind, witnessing and experiencing violence and abuse are probably fairly common (Elklit and Frandsen 2014; Mohler-Kuo et al. 2014). Finkelhor et al. (2015) found that of 4000 US children and adolescents, 1.4 % had been sexually assaulted, 5 % had been physically abused, 15.2 % had suffered any type of maltreatment and 24.5 % had witnessed violence in the past year. Given that assault and abuse exposure increases with age (Finkelhor et al. 2015; Saunders and Adams 2014), the large age range in this study may have diluted findings for the adolescent age group. Relatively little is known about prevalence in different countries, which is likely to vary as for young females (aged 15–19 years), rates of physical or sexual intimate partner violence were 36.6 % in Johannesburg, South Africa, 32.8 % in Ibadan, Nigeria, 27.7 % in Baltimore, USA, 19.4 % in Delhi, India and 10.2 % in Shanghai, China (Decker et al. 2014). Considering contact or non-contact sexual abuse alone, a Swiss population study with adolescents showed that 40.2 % of girls and 17.2 % of boys reported at least one incident (Mohler-Kuo et al. 2014), highlighting its high frequency among adolescents, particularly females.

2.1.1.4 Exposure to Mass Trauma

Rates of exposure to natural disasters, terrorism and war differ from other forms of trauma as they are location specific. In many cases, countries with the fewest resources are hit the hardest (Neuner et al. 2006). While it is apparent that exposure to disaster, terrorism and mass conflict depend on geography and proximity to an event, mass trauma research often arises from high-income countries that are less prone to these disasters compared to low- and middle-income countries. In the

USA, rates of exposure to disasters ranged from 11.1 (Copeland et al. 2007) to 14.8 % (McLaughlin et al. 2013) in the general population. By contrast, the 2010 earthquake in Haiti was labelled “acute on chronic trauma”, given the existing systemic issues in the country and high rates of pre-existing trauma exposure (Gabrielli et al. 2014). Research in low- and middle-income countries post-trauma tends to lack baseline data, making population estimates of trauma exposure difficult to determine.

2.1.2 Predictors of Exposure

2.1.2.1 Demographic Predictors

Exposure to trauma is related to age. Older children and adolescents have had more time available for PTEs to occur (Copeland et al. 2007; Finkelhor et al. 2009) than younger children. In addition, mobility (Haller and Chassin 2012), sexual activity and in some cases risk taking (Forgey and Bursch 2013) increase with age, leading to a greater likelihood of trauma exposure. However, the type of PTEs experienced may differ across stages of development. For example, burn injuries are more prevalent in younger children (Stoddard et al. 2006), while risk of sexual trauma is higher for older children (Finkelhor et al. 2015).

It is unclear whether, overall, boys are more exposed to trauma than girls. While several recent studies have found such an effect (Elklit and Frandsen 2014; Haller and Chassin 2012; Karsberg and Elklit 2012; c.f. Karsberg et al. 2012), a few did not (Ghazali et al. 2014; Landolt et al. 2013; Salazar et al. 2013). However, there appear to be differences according to the type of trauma. Particularly, boys are more likely to be exposed to non-sexual violence (Atwoli et al. 2014; Finkelhor et al. 2015; Karsberg and Elklit 2012; McLaughlin et al. 2013; Salazar et al. 2013; Zona and Milan 2011) and accidental injury (e.g. Landolt et al. 2013; McLaughlin et al. 2013). The reason may be higher levels of externalising behaviour in boys compared to girls (Lalloo et al. 2003). For sexual trauma, the opposite gender difference has been found (e.g. Finkelhor et al. 2015; Landolt et al. 2013; McLaughlin et al. 2013; Salazar et al. 2013).

As mentioned above, while trauma occurs everywhere, exposure rates are related to geography. Within countries, differences in trauma exposure may be better explained by demographic characteristics such as minority status, nativity, parental education, poverty and justice system involvement than ethnicity per se (e.g. Landolt et al. 2013; McLaughlin et al. 2013; Milan et al. 2013).

2.1.2.2 Behavioural Predictors

Intuitively, children who engage in more externalising behaviour put themselves at greater risk of accidents (Lalloo et al. 2003). Additionally, poor sleep in young children may precipitate externalising behaviour and subsequent injury (Owens et al. 2005). More generally, behaviour disorders have been linked to a higher likelihood of trauma exposure in US adolescents (McLaughlin et al. 2013). Behaviour problems may have differing consequences in boys and girls (e.g. Haller and Chassin

2012; Zona and Milan 2011). For example, in males, but not females, internalising symptoms were protective against assaultive violence exposure (Haller and Chassin 2012). The authors suggested that socially withdrawn males may be less likely to engage in aggressive behaviour or to expose themselves to others engaging in such behaviour, thereby protecting them from violent trauma exposure to some extent.

2.1.2.3 Family and Social Environment Predictors

Poverty and the home environment can set a backdrop upon which trauma exposure is more likely. In lower socio-economic status (SES) households, there is often less supervision of children and consequently higher risk of trauma exposure (e.g. Morrongiello and House 2004). The mental health of family members and past parenting problems can also confer risk of trauma exposure (Copeland et al. 2007), and physical and sexual abuse often occur within the home environment (Landolt et al. 2013). Externalising problems are also more common in lower SES and single-/step-parent households (Lalloo et al. 2003; Landolt et al. 2013; McLaughlin 2013).

Looking at children and adolescents' broader context, belonging to a "deviant" peer group, may increase the risk of violence exposure in adolescents (Milan et al. 2013). In another study on environmental factors, physical and sexual abuse was highest in street children compared to households and orphanages, (Atwoli et al. 2014) as a lack of permanent address and safe place to sleep may leave these children more vulnerable. Living in the city may confer risk for particular traumas like assault-related injury (Irie et al. 2012), physical violence, robbery and being threatened with a weapon (Elklit and Frandsen 2014). Importantly, prior exposure to violence can predict future violence exposure, as one type of violence exposure increases the chances of experiencing other types of violence (Finkelhor et al. 2015; Milan et al. 2013).

2.1.3 Methodological Considerations

While it is clear that a substantial proportion of young people are exposed to (potential) trauma during their childhood, the risk of exposure is difficult to disentangle from definitions of what constitutes a PTE, assessment methodology and sample characteristics. Some studies used definitions of trauma that were broader than the *DSM-5* stipulates (e.g. Karsberg et al. 2012 included divorce and unplanned pregnancy). Therefore, comparisons across countries and studies are to be made with caution. As mentioned earlier, the geographical location of a study makes a difference, in terms of rates of exposure and potential predictors. In addition, the extent to which exposure is measured appears to play a role. For example, Copeland et al. (2007) reported substantially higher rates of exposure based on repeated assessments with the adolescents in their sample, than they would have based on a single assessment. The same is likely to apply to children.

Study methodology may also influence outcomes in other ways. For example, it is common for parents to report on trauma exposure on behalf of their young

children. However, parent and child reports can conflict and may be subject to memory failures, mental health of the informant or a lack of knowledge, for example, if the primary caregiver was not present during exposure (Finkelhor et al. 2015). This effect may be more pronounced as a child ages (Saunders and Adams 2014). In self-report of exposure on the other hand, some memories may not be adequately salient to be recalled over time, or distressing memories may even be repressed (Finkelhor et al. 2009) or recalled more easily. Mandatory reporting of abuse by professionals in many countries may decrease willingness to disclose violence and abuse to researchers and clinicians (Copeland et al. 2007). In addition, cultural understandings of what constitutes trauma, in particular violence, may affect reporting (Saunders and Adams 2014). Finally, there is a need to replicate studies across a number of different regions and trauma types to gain a broader picture of trauma exposure across the globe.

2.2 Acute Stress Disorder

2.2.1 Prevalence Estimates of Acute Stress Disorder

Acute stress disorder (ASD) is the main trauma-related disorder diagnosed in the almost immediate aftermath of exposure. It signifies the experience of severe stress reactions in the first few weeks after the trauma. Our knowledge of ASD among children and adolescents is relatively limited, since research on this trauma-related disorder is not as plentiful as research on PTSD. According to *DSM-5* it requires identification and assessment of survivors within a month after exposure, which is not always feasible, either because the trauma is not detected (e.g. in the case of violence) or because the resources are not available (e.g. after a mass-scale trauma). The majority of currently available studies are hospital-based and regard injury, sometimes in the context of a natural disaster or abuse. Most are based on the *DSM-IV* criteria. Overall, ASD rates among exposed children and adolescents appear to vary from about 5 % (e.g. Ellis et al. 2009) to around 50 % (e.g. Liu et al. 2010). Dalgleish et al. (2008) combined the data of 367 road accident survivors (6–17 years old) and found that 9 % of them met criteria for ASD, with a further 23 % meeting criteria for subthreshold ASD. The most robust evidence comes from aggregated data from 15 studies involving 1,645 children and adolescents in four high-income countries (USA, Australia, UK and Switzerland; Kassam-Adams et al. 2012). The authors studied the proposed *DSM-5* criteria and found that 41 % of the children and adolescents reported clinically relevant impairment. Each ASD symptom was endorsed by 14–51 % of the sample. While the *DSM-5* eventually required nine symptoms for ASD criteria to be met, at the time of the study this was eight symptoms. This requirement was met by 12 % of the children and adolescents. It did not predict concurrent impairment very well. The authors found that requiring only three to four symptoms substantially improved sensitivity while maintaining moderate specificity.

2.2.2 Predictors of Acute Stress Disorder

2.2.2.1 Demographic Predictors

Age, gender and ethnicity are easily identifiable characteristics that would be useful in identifying youth in need of intervention and treatment in the direct aftermath of trauma. However, demographic characteristics have produced mixed results in predicting ASD, and because only a small number of studies have been conducted so far, conclusions are somewhat hard to reach.

Concerning age, some studies have found that young children have an elevated risk of ASD (Doron-LaMarca et al. 2010; Le Brocque et al. 2010; Saxe et al. 2005a) and may have more severe ASD (McKinnon et al. 2008). Le Brocque et al. (2010) found that younger children were more likely to have high levels of symptoms immediately post-trauma but recovered quickly. Still, other studies have not found evidence of age as a predictor of acute stress (e.g. Bryant et al. 2004; Daviss et al. 2000; Haag et al. 2015; Ostrowski et al. 2011).

Whenever a gender difference in ASD has been found, girls have been at higher risk than boys (Bryant et al. 2004; Doron-LaMarca et al. 2010; Haag et al. 2015; Holbrook et al. 2005; Karabekiroglu et al. 2008; Liu et al. 2010). Yet, it remains unclear what factors may interact with female gender to produce these findings in some studies and not others (e.g. Daviss et al. 2000; Ellis et al. 2009).

Ethnicity has not been studied as extensively as age or gender. So far, there is a lack of support for the role of race or ethnicity in predicting ASD (e.g. Ostrowski et al. 2011). Further, with respect to SES, parental income has not predicted acute stress either (Ostrowski et al. 2011).

2.2.2.2 Exposure Characteristics as Predictors

There is some evidence to suggest a “dose-response relationship” whereby a greater extent of exposure is related to higher risk of acute trauma symptoms. For example, after an earthquake ASD was more common in bereaved children and those whose residence had been damaged, compared to those who did not suffer a loss or were further away from the earthquake (Demir et al. 2010). It has further been suggested that disasters in less well-resourced areas are generally more traumatic due to a lack of infrastructure and therefore greater secondary traumas, death and general distress (Demir et al. 2010).

Injury characteristics may predict ASD in children. For example, among those exposed to a motor vehicle accident, children with injuries who sought medical assistance were at a greater risk of ASD than those who did not (Winston et al. 2005). Additionally, experiencing pain following injury predicted ASD symptoms in children (McKinnon et al. 2008; Saxe et al. 2005a). Yet, injury severity itself does not appear to predict ASD (Bryant et al. 2004; Daviss et al. 2000; Haag et al. 2015; Ostrowski et al. 2011) nor does hospitalisation after a motor vehicle accident (Bryant et al. 2004). For children with burns, burn size was a risk factor for ASD only by its association with increased parental ASD and elevated heart rate (Saxe et al. 2005b).

ASD appears more likely in violently injured youth compared to those with unintentional injuries or medical illnesses (Hamrin et al. 2004; Holbrook et al. 2005; c.f. Meiser-Stedman et al. 2005). These findings lend support to the idea that intentional traumas are more difficult to cope with than unintentional traumas.

2.2.2.3 Cognitive and Emotion-Related Predictors

ASD has been associated with negative cognitive appraisals about the experienced trauma and perceived threat of serious injury (Ellis et al. 2009). Specifically, ASD is more likely when the child perceives that they are going to die during the trauma (Ellis et al. 2009; Holbrook et al. 2005) or that they are vulnerable to consequent harm (Salmon et al. 2007). The role of cognitions may differ depending on age (Salmon et al. 2007) and injury type. For children with burns, a positive body image despite the injury was a protective factor (Saxe et al. 2005b). Data-driven processing of the perceptual and physical aspects of the trauma, self-reported memory quality and peri-traumatic fear was also associated with ASD in injured children (McKinnon et al. 2008). In addition, peri-traumatic guilt has predicted ASD in children following motor vehicle accidents (Haag et al. 2015).

2.2.2.4 Biological Predictors

Biological predictors of ASD have only been studied sporadically. Elevated heart rate appears to be a risk factor for ASD in children with burns (Saxe et al. 2005b), and average heart rate mediated the relationship between burn size and ASD symptoms (Stoddard et al. 2006).

2.2.2.5 Behavioural Predictors

Pre-existing internalising and externalising behaviours may precipitate acute stress following an injury (Daviss et al. 2000). However, in another study, only higher pre-injury externalising scores predicted initial trauma symptoms in injured children and adolescents, while internalising scores did not (Doron-LaMarca et al. 2010). In the latter study, gender interacted with behaviour such that females with higher externalising scores experienced more symptoms than males with externalising behaviours (Doron-LaMarca et al. 2010).

2.2.2.6 Family and Social Environment Predictors

Caregiver and general family stress have presented as a risk factor for child ASD following injury (Daviss et al. 2000; Haag et al. 2015; Saxe et al. 2005a, b). In a study of survivors of assaults and motor vehicle accidents, both parental depression and parental worrying were associated with child acute trauma symptoms (Meiser-Stedman et al. 2006). While social support more broadly has been found to be protective against PTSD in children (Langley et al. 2013), it does not appear to hinder initial ASD development (Ellis et al. 2009); potentially, social support takes some time to have an effect post-trauma.

2.2.3 Methodological Considerations

Parent and child reports of ASD symptoms can differ (Kassam-Adams et al. 2006; Meiser-Stedman et al. 2007, 2008), with internal experiences and symptoms likely being more difficult for parents to estimate (Doron-LaMarca et al. 2010; c.f. Meiser-Stedman et al. 2007). Given the finding that parental ASD and child ASD are related, it is possible that parents with ASD rate their child's symptoms as more severe (Daviss et al. 2000; Haag et al. 2015) or, conversely, normalise acute responses (Meiser-Stedman et al. 2007). Therefore, studies involving both parent and child reports are likely to elicit more accurate estimates of the child's acute response to trauma.

As mentioned before, the study of ASD in children and adolescents is relatively new. Early studies did not use proper screening measures for children as they had not yet been developed (e.g. Hamrin et al. 2004) and some have used PTSD criteria within 1 month of the trauma (e.g. Karabekiroglu et al. 2008; Ostrowski et al. 2011). Despite ASD criteria being present in *DSM-IV* and *DSM-5*, studies have used varying combinations of "subthreshold" symptomatology to derive a measure of general acute stress (e.g. Meiser-Stedman et al. 2005). Particularly, criticism of the dissociative criterion led studies to use a variety of definitions of ASD. Now that dissociation is no longer a necessary criterion, the new *DSM-5* criteria may unite these definitions (see Chap. 1).

2.3 Post-traumatic Stress Disorder

2.3.1 Prevalence Estimates of Post-traumatic Stress Disorder

Post-traumatic stress disorder (PTSD) is the predominant mental health problem taken into consideration after trauma exposure in children and adolescents. Rates of PTSD among youth who have been confronted with a PTE have varied considerably in previous studies. The most robust information on the conditional risk for PTSD after trauma among children and adolescents comes from a meta-analysis that combines information of studies among 3,563 children who had been assessed with well-established diagnostic interviews. The overall rate of PTSD was 16 % (Alisic et al. 2014). Children and adolescents do not randomly experience posttraumatic stress after exposure: specific groups of children appear to be more at risk than others (Alisic et al. 2011; Cox et al. 2008; Kahana et al. 2006; Trickey et al. 2012).

2.3.2 Predictors of Post-traumatic Stress Disorder

2.3.2.1 Demographic Predictors

Gender differences have been reported quite consistently for PTSD, with higher prevalence rates for girls than boys (e.g. Elklit and Frandsen 2014; Haller and Chassin 2012; Karabekiroglu et al. 2008; Karsberg and Elklit 2012; Landolt et al.

2013; Lavi et al. 2013; McLaughlin et al. 2013). There have been a few exceptions, where no gender differences were found (e.g. Ghazali et al. 2014; Milan et al. 2013), but, overall, meta-analyses indicate a gender difference with girls being more prone to PTSD than boys (Alisic et al. 2011, 2014; Cox et al. 2008; Trickey et al. 2012). Despite the consistency, the effect sizes of this overall gender difference tend to be rather small. There has been some suggestion that certain types of trauma may affect males and females differently (Elklit and Frandsen 2014; Landolt et al. 2013) but that, overall, PTSD rates are higher for females.

Regarding age, the findings are inconsistent. There is some evidence to suggest that PTSD prevalence increases with age, with one study finding significantly more lifetime subclinical PTSD in adolescence than in childhood (Copeland et al. 2007). A review by Nooner et al. (2012) also suggested that adolescents are generally at greater risk of PTSD than children. However, this result may be an artefact of applying *DSM-IV* criteria to young children, whose verbal abilities are unlikely to enable detection of some symptoms (Friedman 2013). Meta-analyses have found no or relatively small effects for age as a predictor of posttraumatic stress (Alisic et al. 2011; Cox et al. 2008; Kahana et al. 2006; Trickey et al. 2012). Even though there may be no observable age effect in PTSD rates or posttraumatic stress severity scores, it is likely that symptom patterns differ across various developmental stages. For example, younger children may show more behavioural disturbances, while adolescents may express more guilt and shame (Scheeringa et al. 2011).

Concerning race and minority status, these appear to predict overall risk for PTSD or rates of posttraumatic stress to a negligible or small extent (Alisic et al. 2011; Trickey et al. 2012). Like with age however, it is possible that ethnicity is related to posttraumatic stress in specific circumstances. For example, African-American adolescents in Chicago were more likely to be exposed to violence but less likely to develop PTSD than their White or Latino counterparts, highlighting a possible influence of ethnicity in this population (Milan et al. 2013).

Socio-economic status (SES) may predict PTSD but is rarely studied and yielded zero or small effect sizes in meta-analyses so far (Alisic et al. 2011; Kahana et al. 2006; Trickey et al. 2012). As an example, markers of SES in Kenyan adolescents, like parental education, number of meals per day and household resources, did not predict posttraumatic stress (Karsberg and Elklit 2012). Although, in Greenland, fathers' limited education did predict posttraumatic stress in adolescents (Karsberg et al. 2012).

2.3.2.2 Exposure Characteristics as Predictors

Children are more likely to develop PTSD following an interpersonal compared to a non-interpersonal trauma. In a recent meta-analysis, the pooled PTSD rate after interpersonal trauma was 25 % (with a 95 % confidence interval of 17–36 %), versus 10 % after non-interpersonal trauma (with a 95 % confidence interval of 6–15 %; Alisic et al. 2014). Within both types of exposure, further differences may exist. For example, adolescents who experienced violence perpetrated by a parent were more likely to develop PTSD than those exposed to other types of violence (Milan et al. 2013). Both groups of events may also have differential outcomes for witnesses and direct victims. Following motor vehicle accidents, witnesses reported less

internalising symptoms compared to those involved in the accident (Tierens et al. 2012). Conversely, Bayarri Fernández et al. (2011) found that children who were witnesses, perpetrators or direct victims of violence were all similarly affected.

Objective ratings of trauma severity, like injury severity or amount of exposure, have shown limited predictive value (e.g. Lavi et al. 2013). In prospective studies among injured children, injury severity failed to predict subsequent posttraumatic stress (Alisic et al. 2011). In a meta-analysis of cross-sectional studies including a range of indications of trauma severity, a moderate effect was found (Trickey et al. 2012). However, this effect showed substantial heterogeneity that could not be explained within the available models; we do not yet know under which circumstances or in what way trauma severity may predict posttraumatic stress.

2.3.2.3 Prior Exposure as a Predictor

Prior trauma exposure has predicted PTSD in US adolescents (McLaughlin et al. 2013) and is a robust predictor of posttraumatic stress following an accident (Cox et al. 2008). A study on mental health in children in New Orleans 15 months after Hurricane Katrina found that gender, social support and lifetime trauma exposure, but not hurricane exposure, significantly predicted PTSD. Lifetime trauma exposure was the strongest predictor (Langley et al. 2013). Likewise, previous violence exposure has been linked to an increased likelihood of PTSD (Salloum et al. 2011). Generally, as the number of PTEs increases, poor psychiatric outcomes increase as well, providing evidence for a “dose-response” relationship (Copeland et al. 2007; Catani et al. 2008; Karsberg and Elklit 2012; Karsberg et al. 2012; Salazar et al. 2013). This has particular relevance for refugees who have often experienced multiple traumas, leading to high reported prevalence of posttraumatic stress symptoms (PTSS) in these populations (Neuner et al. 2004). As for many predictors, also in this case, there are exceptions. A study on Hurricane Gustav showed that children who had endured prior exposure to violence and Hurricane Katrina did not experience an elevation in PTSS following exposure to Hurricane Gustav (Salloum et al. 2011). The authors suggested that either posttraumatic stress levels had reached a threshold or Hurricane Gustav was not as traumatic as previous PTEs and therefore did not worsen PTSS.

2.3.2.4 Psychiatric History as a Predictor

ASD has emerged as a strong predictor of long-term PTSD among children and adolescents (Alisic et al. 2011; Kahana et al. 2006). Nevertheless, ASD has not predicted PTSD as well as was hoped; children with ASD do not all continue to develop PTSD, and not all children who develop PTSD had ASD first. Le Brocque et al. (2010) propose that some children with ASD may follow a “recovery” trajectory, where initial symptoms dissipate, while others follow a “chronic” trajectory, who continue to suffer long-term symptoms. Thus far, the *DSM-IV* criteria have not adequately differentiated these groups. However, alternative criteria for ASD requiring less symptoms have emerged in the literature and are better predictors of PTSD than *DSM-IV* ASD in young (2–6 years; Meiser-Stedman et al. 2008) and older children (7–13 years; Bryant et al. 2007) exposed to motor vehicle accidents and/or injuries. As alternate definitions of ASD often did not necessitate dissociative symptoms, these criteria may be more akin to the current *DSM-5* criteria for ASD. In

adult samples, the *DSM-5* criteria have improved prediction of PTSD from ASD (Bryant et al. 2015); this may also be the case for children and adolescents.

More generally, meta-analyses have revealed that prior psychopathology is a robust predictor of PTSD following an accident (Cox et al. 2008) and depression and anxiety are moderate predictors of PTSD in children (Alisic et al. 2011; Kahana et al. 2006). In single studies, a history of anxiety (Copeland et al. 2007) and prior internalising disorders (McLaughlin et al. 2013) also significantly predicted PTSD in US children and adolescents.

2.3.2.5 Biological Predictors

So far, relatively little empirical knowledge is available regarding biological correlates and predictors of posttraumatic stress in children and adolescents. Of these variables, fluctuations in cortisol, heart rate, norepinephrine levels and interleukin-6 have been studied most frequently to determine their relationship with PTSD (Kirsch et al. 2011). Contrary to research conducted in adults, not low but high cortisol levels appear to be related to PTSD in children (Pervanidou 2008). More specifically, elevated post-trauma evening salivary cortisol levels and morning interleukin-6 predicted PTSD in children 6 months later (Pervanidou et al. 2007). Elevated heart rate immediately following a PTE has also predicted PTSS 6 weeks and 6 months later (e.g. Neuner et al. 2006) yet has yielded small effect sizes in meta-analyses (Alisic et al. 2011) and may be moderated by parental PTSS (Nugent et al. 2007). In addition, higher post-trauma norepinephrine has predicted PTSS in children (Kirsch et al. 2011).

2.3.2.6 Cognitive Predictors

Both peri-trauma and post-trauma cognitive factors appear to predict PTSD in children. Although the number of underlying studies is still fairly small, perceived life threat during or in the direct aftermath of a PTE appears to predict PTSD to a moderate to strong extent (Kahana et al. 2006; Meiser-Stedman et al. 2009; Trickey et al. 2012). Following motor vehicle accidents and assault, cognitions regarding “permanent and disturbing change” seem to affect PTSD symptoms (Meiser-Stedman et al. 2009). More in general, posttraumatic thought suppression has been strongly related to PTSD, although, again, the number of studies involved is small (Trickey et al. 2012). A recent study has underlined the potential strength of rumination in predicting PTSD in children and adolescents (Meiser-Stedman et al. 2014). There is also some evidence to suggest an effect of IQ or academic performance, albeit with small to medium effect sizes (Trickey et al. 2012).

2.3.2.7 Behavioural Predictors

High externalising and internalising behaviour puts children and adolescents at greater risk of consequent trauma symptoms, whether acutely or long term. Specifically, injured children with greater externalising and internalising traits were significantly more likely to belong to “recovery” or “chronic” trajectories, than the “resilient” trajectory, that do not develop PTSS (Le Brocque et al. 2010). In a longitudinal study with urban adolescents, Zona and Milan (2011) found that violence exposure itself

increased internalising and externalising symptoms, as well as PTSD and dissociative symptoms. Therefore, this relationship may be multifaceted, with trauma exposure increasing behavioural symptoms, which increase posttraumatic stress in tandem. However, the substantial overlap between, in particular internalising, behavioural symptoms and posttraumatic stress is potentially blurring these findings.

2.3.2.8 Family and Social Environment Predictors

Parental posttraumatic stress has emerged as a strong predictor of child posttraumatic stress (Alisic et al. 2011; Cox et al. 2008; Landolt et al. 2012). In fact, initial traumatic stress symptoms in children have also predicted PTSS in parents (Stowman et al. 2015), highlighting the bidirectional nature of the relationship (cf. Scheeringa and Zeanah 2001). Poor family functioning in general has been associated with child posttraumatic stress (Trickey et al. 2012), and separation from family has predicted PTSS in resettled refugee youth (McGregor et al. 2015). Social support more broadly can be protective against PTSD for children and adolescents (e.g. Langley et al. 2013), and low levels of social support are a moderately strong predictor of PTSD in children (Trickey et al. 2012). However, social support is a complex relational construct, and potential resources for social support may not be utilised post-trauma for fear of being misunderstood or overburdening others (Thoresen et al. 2014).

2.3.3 Methodological Considerations

As in ASD, reporting of PTSD in children may be over- or underestimated by parents and nursing staff (Daviss et al. 2000). Prediction of PTSD in older children may be improved by the use of child instead of parent reports (Meiser-Stedman et al. 2007) or combined child and parent reports, which show even greater predictive ability than either type alone (Meiser-Stedman et al. 2008). Furthermore, the timing of reports is an important consideration. Several studies have assessed lifetime trauma exposure with current PTSD, and post-trauma assessment timing differs across studies and types of samples (Cox et al. 2008). For example, ill youth were often examined years after their trauma and had significantly lower rates of PTSD compared to injured youth, who were examined within months of the trauma (Kahana et al. 2006). Rates of PTSD in injured youth might decrease with time and eventually be comparable to that of ill youth (Kahana et al. 2006). Variables of interest are often examined in cross-sectional studies, making causal relationships difficult to establish, and a general lack of consistency in how predictors are examined makes comparisons between studies difficult (Alisic et al. 2011; Kahana et al. 2006).

Conclusion

Exposure to potential trauma is common in childhood. Some types of exposure, such as the sudden loss of loved ones, happen everywhere including in the safest parts of the world. Others, such as disaster and war, are more tied to specific locations and are more prevalent in low and middle-income than high-income countries. For many parts of the world, we have relatively little knowledge of exposure,

especially among children under 13 years of age. The most important factors to keep in mind as predictors of exposure are prior exposure, age (older children have faced more trauma), gender with respect to specific types of trauma (e.g. accidents for boys, sexual trauma for girls), externalising behaviour and stressors in the home environment.

Relatively little is known about ASD among children and adolescents. The best estimate of how many children develop ASD according to the *DSM-IV* criteria is 9 % (with a further 23 % of exposed children showing subthreshold levels of ASD; Dalgleish et al. 2008). Especially the dissociation symptom appeared to be problematic in diagnosis of ASD. The current *DSM-5* criteria no longer require dissociation as a necessary criterion, and it is likely that prediction of PTSD from ASD will improve with the current criteria. In terms of predictors of ASD, the findings remain inconclusive as well. At this point, the extent of exposure (although not severity of an injury), the intentionality of the trauma, peri-traumatic cognitions, emotions and processing, externalising behaviour and parental depression and worrying have shown some effect and merit further investigation.

Finally, PTSD is experienced by a substantial minority of children and adolescents exposed to trauma. The best estimate of overall average PTSD rates after exposure is 16 % (Alisic et al. 2014). Factors that are more closely linked to the trauma – and generally take more effort to measure – such as acute stress, cognitive appraisals and family or social support and the interpersonal or non-interpersonal nature of the exposure appear to be more powerful predictors of PTSD than demographic characteristics such as age, ethnicity and gender (although some gender effect has been found). There is substantial methodological variation between studies, in particular with regard to time points of detection of trauma-related disorders, which make comparisons across studies and trauma types less than straightforward. However, some patterns are emerging. In particular, cognitive and family or social support factors appear to merit further investigation.

Rather than static conditions, trauma-related disorders and symptom levels appear to show dynamic patterns. We are only just starting to understand what exposure and recovery trajectories in children and adolescents look like. In the future, we will hopefully be able to understand and predict these trajectories much more adequately.

Highlights

Prevalence

Trauma exposure is relatively common in childhood and adolescence

By contrast, a small proportion of trauma-exposed children develop acute stress disorder (ASD) or post-traumatic stress disorder (PTSD)

Not all who develop ASD develop PTSD, and vice versa

Predictors

Females are at a greater risk of some types of trauma (e.g. sexual)

Younger children may be at a greater risk of ASD

Highlights

- Generally the perceived severity of the trauma (e.g. intentionality, risk of death) is more predictive of consequent trauma symptoms than the objective severity
- Life stress may precipitate both exposure and consequent trauma symptoms
- Behaviour problems have been bidirectionally linked to trauma exposure and disorders
- Children who have been exposed to multiple traumas may be predisposed to experiencing trauma symptoms and even subsequent trauma
- Social support may be one of the most important protective factors against PTSD
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