The effect of trauma on the brain development of children

Evidence-based principles for supporting the recovery of children in care

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This practice paper provides an overview of what we know from research about cognitive development in children who have experienced trauma,[1] and provides principles to support effective practice responses to those children's trauma.

KEY MESSAGES

- Children in care experience symptoms and difficulties associated with complex trauma, however these may also be related to a number of other early life adversities such as ante-natal exposure to alcohol, placement instability, poverty, neglect, and pervasive developmental issues.
- Practice and policy documents focus on trauma-informed interventions to improve cognitive functioning; however there has been very little critical research that links trauma and cognitive development, or the interventions that are effective in helping affected children.
- Interventions that target complex trauma are necessary, but may not be sufficient to meet the developmental needs of children in care.
- Some principles to keep in mind for supporting children who have been traumatised include:
  - provide safe environments;
  - support children and caregivers to understand links between traumatic experiences and cognitive difficulties;
  - develop and support positive relationships in children's lives;
  - offer all children in care targeted trauma-specific interventions;
  - maintain these interventions throughout childhood and adolescence; and
  - ensure separate cognitive difficulties are addressed directly.

1 The Substance Abuse and Mental Health Services Administration's (SAMHSA) concept of trauma provides a comprehensive definition:

> Individual trauma results from an event, series of events or set of circumstances that is experienced by an individual as physically or emotionally harmful or life threatening and that has lasting adverse effects on the individual's functioning and mental, physical, social, emotional or spiritual well-being. (SAMHSA, 2014, p. 7)

Exposure to trauma is common in children who have been placed in care (Gabbay, Oatis, Silva, & Hirsch, 2004), and there is increasing interest in the unique needs of these children. Trauma is thought to have significant implications for the development of children's cognition,[2] language and self-identity: this paper will provide an overview of the state of the evidence that links trauma with delayed or disrupted cognitive development.

While children in care are likely to have been exposed to trauma, they are also likely to have been exposed to a range of other factors that may impact their cognitive development. Early-life adversities for these children may include exposure to alcohol and other substances in utero, and neglect. The potential impact of *all* these factors must be considered in developing supports for children in care.

This practitioner resource outlines what empirical research tells us about cognitive development in context of the adversities encountered by children placed in out-of-home care, and what it might mean for supporting them. It will also detail the limitations to current knowledge about the impacts of trauma on cognitive development, while emphasising the significant impact of antenatal alcohol exposure on later cognitive development. (The evidence in support of this link is considerable, when compared to the link between maltreatment and cognitive development.)

This resource summarises current evidence about the likely impact of trauma and other common adversities on children's cognitive development. By summarising the empirical evidence linking trauma and cognitive difficulties, it is hoped that this resource will provide some perspective on the current state of evidence, while highlighting the need to further develop the evidence base for interventions. It will also suggest some principles that might be applied to facilitate children's cognitive development in practice.

Although the focus of this resource is on children in care, the principles stated here are applicable to other children in contact with statutory child protection services and other similar services, who are likely to have experienced a similar range of adversity.

Background

Children who are placed in out-of-home care are likely to have experienced a range of early-life adversity. The range and complexity of these adverse circumstances are well known to practitioners, and they include trauma, abuse, neglect and antenatal substance exposure. The Adverse Childhood Experiences study (Anda, Felitti, & Bremner, 2006) has shown that this kind of exposure is associated with a range of adverse physical and mental health outcomes in adulthood (see also Price-Robertson, Higgins, & Vassallo, 2013).

Research suggests that the behavioural difficulties of many children in care are underpinned by cognitive vulnerabilities related to exposure to adverse and traumatic events in childhood. Indeed, children who are placed in out-of-home care experience higher levels of behavioural and mental health issues than children from similar backgrounds who are not in placed in care (Ford, Vostanis, Meltzer, & Goodman, 2007).

There has been a lot written about the effects that prolonged exposure to traumatic events is thought to have on brain development (see Atkinson, 2013; Cook, Blaustein, Spinazzola, & Van der Kolk, 2003; Cook et al., 2005; Perry, 2006, 2009; Van der Kolk et al., 2009). Many of the assumptions made in this literature have not been subject to critical review, despite the influence of these ideas in shaping service delivery for children in out-of-home care (see Box 1 for an overview). Similarly, there has not yet been any rigorous evaluation of the interventions that are being developed based on these assumptions.

While the broad symptoms of complex developmental trauma may well reflect the experiences of many children in care, other difficulties may be related not to trauma but to adversities such as antenatal alcohol exposure, placement instability, poverty, neglect and pervasive developmental issues (De Jong, 2010; Zilberstein & Popper, 2014). In other words, interventions that target complex trauma may be necessary, but not sufficient, to meet the developmental needs of children in care (Zilberstein & Popper, 2014).

2 Cognitive development refers to the process of acquiring increasingly advanced reasoning and problem-solving ability, from infancy to adulthood. Cognitive skills are the skills underpinning flexible problem-solving and effective learning: attention, memory, flexible thinking, speed of information processing and language. These skills underpin a child's learning, social and emotional development.

Box 1: Current assumptions influencing trauma-informed interventions

Many practice and policy documents highlight the potential for "trauma-informed" interventions to effect change in cognitive functioning and other areas of development. There has been some (limited) criticism of this paradigm as a basis for the treatment of all children in care.[3] The criticism is centred around three arguments:

- that the way in which brain development in the context of early adversity and trauma is represented may be an over simplistic representations of the science;
- that claims regarding the plasticity of the brain and what it might mean for therapeutic intervention are not justified by the available science; and
- that the therapeutic interventions that are based on these assumptions (e.g., song, rhythmic drumming, spinning), although popular, have not yet been subject to the systematic evaluation that other trauma-specific therapies have (see for instance Bisson & Andrew, 2007).

Dominant ideas

Complex developmental trauma: Complex trauma refers to the impact of children's exposure to traumatic events on their development and long-term outcomes, in the context of interpersonal relationships with caregivers (Cook et al., 2003; Cook et al., 2005). It is thought that in this context, the neurological development of the brain becomes distorted such that the "survival" mechanisms of the brain and body are more dominant than the "learning" mechanisms (Atkinson, 2013), resulting in wide-ranging impairments in arousal, cognitive, emotional and social functioning.

Although the description of complex trauma resonates with many practitioners, the lack of rigorous evidence in support of complex trauma as a construct, as well as paucity of evidence in favour of interventions for complex trauma, has meant that it has not yet been accepted as a formal diagnostic category by mental health professionals (DSM-V: APA). Unfortunately, published studies cited as demonstrating the impact of complex trauma tend to have included children who meet criteria for discrete post-traumatic stress disorder (PTSD) rather than those children raised in the context of maladaptive care (e.g., De Bellis et al., 2009; Gabowitz, Zucker, & Cook, 2008; Teicher et al., 1997; Teicher et al., 2004). This does not mean that complex trauma is not a valid construct, simply that there is a lack of empirical research in the area. Researchers have yet to develop agreed ways to define and measure complex trauma so that an evidence base for intervention can be established.

Neurosequential model: One popular description of the impact of early adversity and complex trauma in the context of neglect and abuse links these environmental events to chronic disruption of the child's stress hormones—leading to chronic hyper-arousal and ongoing sensitivity to stress (e.g., Perry, 2006, 2009).

Chronic stress hormone dysregulation is thought to lead to changes in the sequential development of brain structures and brain functioning, through the process of "use-dependent" synaptic pruning (Perry, 2009). These changes may be addressed, at least in part, by regular and intensive intervention that regulates the more "primitive" regions of the brain, through repetitive and rhythmic activities in the context of continuous therapeutic relationships (e.g., Perry, 2009; Perry, & Dobson, 2013).

While animal studies have supported the basic premise of a link between early stress and hormone dysregulation, there isn't yet parallel research that demonstrates the impact of early adversity on human brain development (Moffitt, 2013; Shors 2006; Teicher, Tomoda, & Andersen, 2006) nor research that demonstrates the impact of interventions that target brain development. Collaboration between practitioners and researchers is needed to advance this field and to document the effectiveness of services based on this model.

More research is needed to establish the relationship between the wide range of early life stressors, including changes in brain and hormone functioning and child development (McLaughlin, et al., 2014; Moffitt, 2013). There is great potential to draw on practitioner–research partnerships to better document, evaluate and inform emerging models of intervention for children in care. This will be an important step in developing and justifying interventions directed towards children in care (McCrory et al., 2011; Moffitt, 2013).

3 For a broader discussion of trauma-informed care see: *Trauma-Informed Care in Child/Family Welfare Services* (Wall, Higgins, & Hunter, 2016) <aifs.gov.au/cfca/publications/trauma-informed-care-child-family-welfare-services> and *Approaches Targeting Outcomes for Children Exposed to Trauma Arising from Abuse and Neglect* (Australian Centre for Posttraumatic Mental Health and Parenting Research Centre, 2013) <www.parentingrc.org.au/images/Resources/Child-trauma-abuse-neglect-Evidence-practice-implications/Trauma_Feb2014_web.pdf>.

The state of research evidence about the impact of trauma and adversity on brain development

Limits of the research

Very little research has explored the link between trauma and cognitive development, or the interventions that might be effective in helping affected children. Some of the reasons for this include:

- methodological and conceptual issues in defining and monitoring the impact of trauma;
- the absence of a suitable measure for assessing outcomes of interventions for children in care; and
- the need to better integrate neuroimaging and neuropsychological studies into a program of research that tracks cognitive development over time.

Research in this area is conceptually under-developed. Attempts to tease out the effects of different subtypes of abuse and trauma on brain development have been inconclusive (McLaughlin, Sheridan & Lambert, 2014; Wall et al., 2016). This is unsurprising, as many children will have experienced multiple forms of abuse and neglect. Despite this, the research has typically used abuse subtypes as selection criteria.

More recently, a dimensional model of childhood experience has been proposed, in which children who have predominantly experienced *deprivation* (omission of care) are distinguished from those whose predominant experience has been of *threat* (uncontrollable danger). This could help with better understanding children's support needs. It also makes intuitive sense: experiences of deprivation may indicate the need for interventions that focus on intensive learning and input, whereas experiences of threat may be better addressed through intervention targeting safety and cognitive integration (McLaughlin et al., 2014). Arguably, a dimensional model of childhood adversity could lead to new insights in this area.

As well as being conceptually underdeveloped, research in the area is methodologically under-developed. It relies on categorical, cross sectional and retrospective designs: this makes it difficult to disentangle the relative contribution of trauma and adversity, prenatal influences, genetics and mental health issues, and normal developmental changes in brain development (Pineau, Marchand, & Guay, 2014). This means that we still have relatively little empirical information about how the impact of abuse depends on the developmental stage(s) at which it occurs, or about which regions of the brain may be vulnerable at different stages of development (McCrory, De Brito, & Viding, 2011). These kinds of questions can only be answered by following children's development over time using longitudinal research design.

There is also a lack of rigorous evaluation of interventions for affected children. One reason for this is that there is no single measure or screening tool that can capture the full range of cognitive and behavioural difficulties found among children in care (De Jong, 2010; Oswald, Heil, & Goldbeck, 2010; Perry & Dobson, 2013; Schmid, Peterman, & Fegerd, 2013; Tarren-Sweeney, 2010; Van der Kolk et al., 2009). This makes it difficult for services to capture the cognitive difficulties that children experience and evaluate whether cognitive interventions[4] lead to an improvement in children's functioning.

Evidence for the effects of trauma on the brain

Studies that address the relationship between trauma and cognitive development generally take the form of either neuroimaging studies or neuropsychological studies. Neuroimaging studies focus on the growth of important brain structures, and on how efficiently the brain responds to emotional stimuli (e.g., a picture of an angry face). Studies in the field of neuropsychology use performance on well-established tasks to infer brain functioning, for example by measuring memory and attention span during defined tasks and make inferences about functioning and behaviour from these results (for reviews of neuroimaging and neuropsychological studies see McCrory et al., 2010; McCrory et al., 2011).

Collectively, this research suggests that the brain development of children in care is likely to be affected in some way by their early experiences. The neuropsychological impact of adversity can vary widely,

4 The term "cognitive interventions" is used to mean therapeutic programs or practices that target specific cognitive skills thought to be affected by trauma, such as memory or attention.

however, and not all children that experience adversity go on to develop difficulties related to learning, memory and attention. The impact of adversity on brain development may depend on whether children primarily have experienced *deprivation* or *threat* during their pre-care life: resulting in either delayed cognitive development or dis-integration of cognitive skills, respectively (see McLaughlin et al., 2014).

This field of research is not well developed and is conceptually and methodologically underdeveloped. For instance, antenatal alcohol exposure frequently affects later cognitive functioning (see McLean & McDougall, 2014; McLean, McDougall, & Russell, 2014), but studies of children in care rarely report on history of antenatal alcohol exposure.

Nonetheless, there are some common findings from the research that are summarised in the following sections.

Stress hormone dysregulation

Trauma and adversity is commonly described as leading to a hyper-arousal of the hypothalamic-pituitary-adrenal axis (HPA axis) that results in changes in brain development. In reality, this is almost certainly an oversimplification of the relationship between trauma and the stress hormone system (Frodl & O'Keane, 2013; McCrory et al., 2011; McLaughlin et al., 2014). While there is consensus that early stress leads to an ongoing dysregulation of the body's HPA axis stress response system (see McEwan, 2012), the exact nature of this dysregulation is debated (Frodle, & O'Keane, 2013; McCrory, De Brito, & Viding, 2010; Sapolsky et al, 1996). The research findings suggest that the stress response system can either become chronically over-activated *or under-responsive* over time (Frodl & O'Keane, 2013; McCrory et al., 2011; McEwan, 2012; McLaughlin et al., 2014) in response to a complex mix of factors (including chronicity and timing of abuse) that are currently unclear. Therefore, while the findings support the idea that childhood trauma is associated with a disruption in the HPA axis response, they do not uniformly support the idea of chronic hyper-activation, as is commonly assumed.

Although dysregulation of the stress response system is associated with changes in the development of key brain structures (e.g., hippocampus), the association is not as straightforward as is suggested by popular accounts (see Box 1). At present, the evidence in support of the link comes mainly from studies of adults that retrospectively report a history of abuse, rather than from studies of children, meaning that other influences cannot be discounted.

The precise relationship between timing and nature of adversity, HPA axis dysregulation and impaired brain development is unclear, and can only be determined by ongoing longitudinal research (McCrory, et al., 2011).

Changes in brain structure and functioning

Most brain imaging studies investigating the relationship between trauma and changes in the development, regulation and responsiveness of a child's brain over time are based on studies of adults who report a history of childhood abuse, rather than on studies that track children's development over time (McLaughlin et al., 2014; Teicher, Anderson, & Polcari, 2012).

In contrast, neuropsychological studies generally provide solid evidence for a link between trauma and brain function. Neuropsychological studies are more useful than neuroimaging studies in assessing children's everyday functioning because they provide us with more direct insight into the difficulties that children experience. On the whole, neuropsychological studies tend to show that children who have experienced or witnessed violence, trauma, abuse or neglect *do* experience cognitive difficulties in one or more areas, when compared to children who haven't experienced these adversities (McCrory et al., 2011; McLaughlin et al., 2014). Some of the main cognitive difficulties are summarised in the following sections.

General cognitive and language delay

On the whole, children exposed to neglect may be more vulnerable to general delays in cognitive and language development (De Bellis et al., 2009; Hart & Rubia, 2012; McLaughlin et al., 2014). Neglected

children and those raised in poverty may be more at risk of general cognitive delay than those exposed to abuse (Hilyard & Wolfe, 2002; McLaughlin et al., 2014).

Among abused children, increasing severity of abuse is associated with lowered IQ relative to matched controls (Carrey et al., 1995; Hart & Rubia, 2012; Prasad, Kramer, & Ewing Cobbs, 2005; Pollak et al., 2010). These studies don't generally control for other factors that can affect IQ scores, such as education level and presence of post-traumatic stress disorder (PTSD) or depression, which means these findings can't necessarily be generalised to all children in care. In other words, the evidence suggests that there are multiple factors affecting general intelligence development—in the context of abuse—besides trauma, and these factors include neglect and poverty.

The presence of PTSD appears to affect cognitive functioning. Studies show that children with PTSD subsequent to abuse have lower verbal IQ on assessment, suggesting that the presence of PTSD rather than abuse *per se* may be more relevant (Saigh, et al., 2006; Hart, & Rubia, 2012). One well-known study examined the relationship between IQ and exposure to domestic violence, using a large sample of twins to control for genetic influences on IQ (Koenen, et al., 2003). In this study, exposure to domestic violence was found to be related to IQ in a dose-dependent way: i.e., the more severe the traumatic exposure, the bigger the impact. The IQ scores of those children exposed to domestic violence was found to be eight points lower than children who were not exposed to violence; after controlling for the effects of genetics and other forms of maltreatment (Koenen, et al., 2003). This suggests that a history of exposure to violence and PTSD may both be important influences on cognitive development.

Problems with memory

There is reasonable evidence that memory is affected by trauma and adversity. Brain structures that are associated with memory consolidation have been found to differ in adults (but not children) who report a history of abuse. For example, adults with a history of abuse have been shown to have smaller hippocampal volume—an area of the brain associated with memory consolidation (Hart & Rubia, 2012; McLaughlin et al., 2014; Teicher et al., 2012). Compared with non-abused children, children with abuse-associated PTSD may also show less effective activation of this area of the brain during a memory recall task (Carrion et al., 2010; McLaughlin, et al., 2014).

Neuropsychological studies of children also support the idea that memory is affected by exposure to trauma and other adversity. Studies of children who have been diagnosed with PTSD in the context of abuse also suggest they may experience memory difficulties, but the findings depend on the way memory is measured.

While a few studies have found no difference in memory performance between children with and without abuse-related PTSD (e.g., Beers & De Bellis, 2002), other studies that use more realistic "everyday" tests of memory do show that children with PTSD secondary to trauma *do* have poorer memory compared with those without PTSD (Moradi, Doost, Taghavi, Yule, & Dalgeish,1999). In general there is good reason to believe that children who have are experiencing abuse-related PTSD will have difficulty with a wide range of memory tasks (Cicchetti, Rogosch, Gunnar, & Toth, 2010; DeBellis, et al., 2002; McLean, & Beytell, 2016).

Bias in the processing of social/emotional information

There is some evidence that social and emotional information is processed differently among children that have experienced abuse. The amygdala, an area of the brain associated with the automatic (pre-conscious) processing of emotional information, has been shown to be over-responsive to emotional stimuli (e.g., angry faces) in studies of abused children (McCrory et al., 2011; McLaughlin et al., 2014; Pollak, Klorman, Thatcher, & Cicchetti, 2001). Traumatised children are able to identify angry faces more quickly than non-traumatised children, suggesting they are "primed" to detect threat (McLaughlin, et al., 2014; Pollak & Sinha, 2002). Children who have been exposed to traumatic environments also have reduced thickness in an area of the brain responsible for emotional processing of social information (ventro medial Prefrontal Cortex, vmPFC) (De Brito et al., 2013; Kelly et al., 2013; McLaughlin et al., 2014), suggesting this area is less developed in these children compared with non-abused children.

Executive functioning (cognitive flexibility and behaviour regulation)

There is some evidence that executive functioning difficulties can develop as a result of early adversity. Executive functioning is a coordinated set of cognitive skills that includes two broad domains: metacognitive skills (attending to task, planning, organisation, cognitive flexibility) and skills of behaviour regulation (response inhibition, emotional regulation) (Goia, Isquith, Retzlaff, & Espy, 2002).

Metacognitive skills

Neuropsychological research suggests that children who have experienced neglect and physical abuse can experience problems in auditory attention and cognitive flexibility (problem-solving and planning) (Nolin & Ethier, 2007). Children with abuse-related PTSD have been found to have significantly poorer attention and executive function compared with a matched sample of non-maltreated children: they made more errors in tasks of sustained attention, and were more easily distracted and more impulsive than their matched peers (DeBellis et al., 2009; Nolin & Ethier, 2007). One study has found that experiencing PTSD in the context of familial trauma may have more significant impact on executive functioning than non-familial trauma (DePrince Weinzierl, & Combs, 2009).

Behavioural regulation

Compared to non-neglected peers, emotionally neglected children may have less efficient brain activity during tasks that require inhibitory control, suggesting that neglect is associated with poor ability to self-regulate and inhibit responses (Mueller et al., 2010; McLaughlin et al., 2014). This may also be resistant to intervention (McLean & Beytell, 2016).

Summary of the evidence

As a whole, the research suggests that children in care are likely to experience one or more cognitive difficulties. Much more research is needed to explore:

- the impact of timing of abuse;
- whether it matters that the trauma is familial or not; and
- and whether cognitive difficulties are due to abuse per se or the PTSD that arises as a result of traumatic experiences.

In the research reviewed here, PTSD is commonly linked with cognitive functioning, suggesting that it may be especially important to address cognitive vulnerabilities in children showing signs of PTSD.

In general, the evidence base linking abuse and cognitive impairment is not as strong as it is for other factors, including the impairment arising from foetal alcohol syndrome (McLean & McDougall, 2014). Taking into consideration the range of factors that are known to affect cognitive development, the broader literature on cognitive functioning in children in care suggests several areas that can be affected by childhood adversity.

Taken as a whole, the literature suggests that children in care are likely to experience:

- compromised executive functioning;
- difficulty regulating arousal levels in response to emotional and sensory stimulation (high and low emotional responsiveness);
- difficulty with attention and memory;
- distinct patterns of social information processing;
- reactivity to sensory stimuli;
- disruptions to sleep and other circadian rhythms; and
- compromised language development, including difficulty in the comprehension and social use of language despite apparently adequate verbal abilities.

(See Cook et al., 2005; De Lisi & Vaughn, 2011; Lansdown, Burnell, & Allen, 2007; Mc Crory et al., 2010; McLean & McDougall, 2014; Noll et al., 2006; Ogilvie, Stewart, Chan, & Shum, 2011; Perry & Dobson, 2013.)

Factors supporting children's development following trauma and adversity

The following section outlines six principles that might be useful in supporting the development of cognitive skills in children who have been exposed to trauma and other adversity. These principles are based on conclusions drawn from current theory and empirical research.

There is relatively little research on interventions to support the recovery of cognitive skills in children affected by trauma and adversity (see McLean & Beytell, 2016). Studies have only just begun to include improvements in cognitive skills as part of outcome measurement (Pears et al., 2013; Tordon, Vinnerljung, & Axelsson, 2014). As a result our knowledge is limited, although this is an emerging field of research.

The National Child Traumatic Stress Network (NCTSN; www.nctsn.org) and Adults Surviving Child Abuse (ASCA; www.acsa.org.au) have produced practice guidelines for addressing trauma that emphasise the importance of:

- providing physical and psychological safety for the child;
- supporting safe, positive and stable relationships;
- supporting the child to develop emotional regulation skills; and
- enlisting coordinated support and self-care for personal and professional stress.

The guidelines are useful for supporting recovery of traumatised children, but they do not necessarily address the other needs that children in out-of-home care might have.

The guiding principles outlined below are aimed at supporting the cognitive development—and responding to the diverse experiences—of children in care. These experiences can include neglect, antenatal substance exposure, disrupted relationships, unfamiliar and threatening environments and people, and complex mental health needs (DeJong, 2010; Zilberstein & Popper, 2014).

Six principles for supporting the cognitive development of children in out-of-home care who have been traumatised

Six principles for supporting children in care who have been traumatised

1. Provide safe environments and rich experiences that stimulate and enrich brain growth.
2. Support children and caregivers to understand the link between traumatic events and cognitive difficulties.
3. Develop and support positive relationships and connections in children's lives.
4. Maintain targeted interventions throughout childhood and adolescence.
5. Offer all children in care targeted and trauma-specific interventions.
6. Ensure that specific cognitive difficulties are addressed directly.

1. Provide safe environments and rich experiences that stimulate and enrich brain growth

Cognitive development will be supported by stable caregiving. Continuous and nurturing caregiving will support brain development by fostering psychological safety. The experience of psychological safety reduces the need to be engaged in constant vigilance, enabling children to make the most of learning and development opportunities. There are often barriers to children in care experiencing psychological safety. It is important not to equate physical safety (achieved via placement in care) with psychological safety, which may take time to develop. Children may not experience psychological safety when first placed in care due to (an often justified) belief that adults are dangerous. Out-of-home care environments may also inadvertently undermine psychological safety (e.g., through placement with strangers or

other abusive children; placement in volatile residential care facilities; or placement without sufficient transition planning). Children placed with people whose behaviour is frightening or dangerous may not experience the necessary psychological safety, and their capacity for new learning will be diminished.

2. Support children and caregivers to understand the link between traumatic events and cognitive difficulties

Carers and children need an explanation for the difficulties they may be encountering. Providing an explanation for gaps or deficits in learning, organisation skills and memory can empower both children and caregivers if it leads to more realistic self-identity and a more optimistic outlook on the possibility of learning new skills. Linking pre-care experiences and poorly developed cognitive skills can help carers to persist in the face of challenging behaviour.

Providing support for their caregivers is also an important way to support the child. Caregivers who are raising children with cognitive difficulties can experience significant strain that can impact on their emotional availability and the quality of care provided (Octoman & McLean, 2012). This is significant, as synchronous, nurturing caregiving has also been shown to improve children's cognitive functioning (Lewis-Morrarty, Dozier, Bernard, Terracciano, & Moore, 2012; McLean & Beytell, 2016). For example, foster parents trained in Attachment & Bio-Behavioral Catch-Up, a program focused on responsive caregiving, were able to improve cognitive skills such as perspective-taking in children (Sprang, 2009).

Caregiver emotional regulation has been linked to children's capacity for cognitive flexibility (i.e., the ability to rapidly respond and adapt to changing circumstances) in children exposed to intimate partner violence (Samuelson, Krueger, & Wilson, 2012). In the same study, positive parenting[5] was linked to children's capacity for organisation and planning, suggesting that children's interaction with caregivers can be central to the development of cognitive skills following trauma.

3. Develop and support positive relationships and connections in children's lives

Any placement of a traumatised child should ensure the child's safety and connect him or her to positive influences and relationships in the home, school, and broader community. Positive family functioning, safe living environments and positive relationships in school and community are likely to facilitate cognitive development.

Special attention may be needed to maximise the positive aspects of family contact or to protect the child from ongoing exposure to trauma via family contact. Supporting placement stability will ensure continuity of relationships and a necessary foundation for recovery by facilitating predictability and safety. Ensuring placement stability will increase the likelihood that there is a person that is available who understands well the impact of trauma on the child.

This caregiver can help the child, the child's statutory caseworker and other significant players to make sense of how trauma and adversity has affected the child, and what is needed to move forward. Interventions with young children in care demonstrate that continuous, consistent and responsive caregiving can change brain stress hormone levels (Dozier, et al., 2009; Dozier, Peloso, Lewis, Laurenceau, & Levine, 2008) and improve their capacity for self-regulation (Pears et al., 2013).

Positive and stable connection with education services is also important. The child's school can provide an environment in which intensive and continuous interventions can be delivered. A program that combined foster parent training and brief school-based training that focussed on literacy and self-regulation skills showed that consistency in approach between the school and foster parents resulted in improved behaviour, inhibitory control and emotional regulation in young children (McLean & Beytell, 2016; Pears et al., 2013). Schools can offer the stability and continuity needed to address specific difficulties (McLean & Beytell, 2016; Tordon et al., 2014).

5 Positive parenting is "the continual relationship of a parent(s) and a child or children that includes caring, teaching, leading, communicating, and providing for the needs of a child consistently and unconditionally" (Seay, Freysteinson, & McFarlane, 2014, p. 207).

4. Maintain targeted support throughout childhood and adolescence

The window of opportunity for addressing underdeveloped cognitive skills may be greater than previously thought. Certain areas of the frontal lobes, responsible for making sense of social information, may be most affected by abuse between the ages of 14 to 16 (McCrory et al., 2011), implying that the brain may be malleable and benefit from targeted interventions well into adolescence. Executive function skills mature later and over a more prolonged period than other cognitive skills (Hedges & Woon, 2011; Pechtel & Pizzagalli, 2010), meaning that there is a long period of time during which interventions may be possible.

There is evidence that trauma-specific interventions can improve aspects of cognitive functioning well into adolescence (e.g., Developmentally Adapted Cognitive Processing Therapy; see Matulis, Resick, Rosner, & Steil, 2013); contradicting the often-expressed view that it is difficult to support older children. Longitudinal research is still needed to clarify the exact windows during which targeted interventions may be most effective, but there is every reason to believe that improvement in discrete cognitive skills such as memory and attention is possible for most children throughout adolescence.

5. Offer all children in care targeted and trauma-specific interventions

Children in care are likely to have experienced a complex mix of neglect, trauma and adversity. There is an urgent need to develop tailored interventions for the difficulties faced by these children. In the meantime, all children in care should be offered interventions based on the best current evidence, and that target trauma symptoms and cognitive skills.

Targeted strategies include:

- Trauma-Focused CBT (Cohen, Mannarino, & Iyengar, 2011);
- Dialectical Behaviour Therapy (Matulis et al., 2013); and
- interventions that focus on the development of specific cognitive skills (CogMed, Amsterdam Memory training; see Rasmussen, Treit, & Pei, 2010).

At present, Trauma-Focused CBT is the approach that has most empirical support (e.g., Cohen et al., 2011). This trauma-specific intervention has also been shown to improve broad aspects of executive functioning such as cognitive skills and emotional regulation (Cohen et al., 2011; Matulis et al., 2013). Therefore, until more tailored interventions are developed for the complex needs of children in care, trauma-specific therapy should be offered as part of the support plan for children who have been exposed to traumatic events. Ideally, this input will occur in the context of a trauma- aware organisational framework (Wall et al., 2016).

6. Ensure that specific cognitive difficulties are addressed directly

It seems likely that children in out-of-home care will experience some degree of cognitive difficulty and discrete trauma symptoms, depending on their unique experiences. Although safe and consistent caregiving will create the *necessary* conditions for recovery, it may not be *sufficient* to meet the needs of many children. Studies of children in care and related populations—including children with neurodevelopmental issues or acquired head injury (Melby-Lervag & Hulme, 2013), children affected by fetal alcohol spectrum disorders (FASD; McLean & McDougall, 2014), and children with PTSD—all suggest that cognitive skills can be improved with specific and targeted interventions, delivered in the context of a safe and nurturing relationship. Caregivers also need to provide a structured and predictable environment in order to accommodate children with cognitive vulnerabilities.

Specific cognitive difficulties and suggested interventions

A recent review (Melby-Lervag & Hulme, 2013) of interventions for children with neurodevelopmental difficulties suggests that it is beneficial to develop specific approaches to addressing each difficulty (e.g., building memory, attention, or language skills) separately.

Specific difficulties, together with targeted strategies for their intervention, are described below.

General delays in language acquisition

Language acquisition delays (i.e., delays in developing speech and vocabulary) mean that affected children may struggle with verbally mediated counselling approaches that rely on oral language competence, such as narrative therapies and restorative justice approaches. Children will benefit from use of simple language, repetition of key concepts, visual strategies (cartoon social stories) and visual prompts to support the uptake of ideas from therapy or discussions with caregivers.

Difficulty in executive functioning

Difficulty with cognitive flexibility means that children may struggle with adapting behaviour to suit different settings, to transition from task to task, and to plan, initiate or complete school work.

Children with this kind of difficulty can benefit from highly structured environments where expectations are clear. They can benefit from prompts to stay on task and the use of pre-arranged strategies to let them know when a transition is pending. These can include advanced warnings, using timers, and visual cues (e.g., paper chain links or a timer to count down to the end of an activity).

Difficulty with behavioural regulation and impulse control may be supported by learning and rehearsing "Stop-Think-Do" strategies and by the use of prompts to remind the child to monitor their behaviour (e.g., snapping elastic band around wrist) and to act as a "stop gap" between impulse and action. Visual cues and reminders of the steps between impulse and action can also be helpful.

Difficulty in emotional regulation

Children in care can experience a range of difficulties related to the ability to identify, recognise, experience, tolerate and appropriately express emotions. Depending on the difficulty, children can benefit from training in the recognition of emotions and support with learning the name of (increasingly complex) emotions to increase their emotional literacy.

Positive role modelling is also an important means by which children can learn socially acceptable ways to experience emotions. Children who have experienced trauma may have difficulty in fully experiencing some emotions, and providing an environment in which the child can begin to safely experience these emotions will be helpful. If caregivers can tolerate trauma-related emotions, then children can learn that it is safe to express these emotions over time. Interventions, such as Dialectical Behaviour Therapy, that support children and adolescents to tolerate strong emotions are helpful, and can lead to improvements in self-control over time (Bohus et al., 2009; Steil, Dyer, Priebe, Kleindienst, & Bohus, 2011; Matulis et al., 2013).

Difficulty in paying attention and remembering

Children with these difficulties may appear as though they are not complying with instructions, or that they are being wilfully disobedient. Caregivers may need assistance in adapting the way that they give instructions and make requests to children. Caregivers may need support with strategies to gain children's attention prior to engaging in conversation.

Rehearsal and repetition techniques can improve children's difficulties with attention and short-term memory (Loomes, et al., 2008; Manji, Pei, Loomes, & Rasmussen, 2009). Verbal memory can be strengthened by instructing children and caregivers in the use of written reminders, cue sheets, diaries and electronic reminders (e.g., phone alarms).

Computerised programs have been shown to improve memory and attention skills in clinical populations. The CogMed program and the Amsterdam Memory and Attention Training for Children program (Rasmussen et al., 2010) have shown promising results, although they have not yet been evaluated with children in care settings.

Changes in social information processing

Children's automatic reaction to social stimuli is likely to be biased towards fear or hostility. Caregivers can support children in re-appraising social situations by teaching and modelling the appropriate reactions to social situations, conveying trust in other adults, and modelling appropriate social interaction skills.

Children can sometimes display poor social discrimination, leading to poor choices regarding social interactions. Appropriate social boundaries can be reinforced using visual teaching aids such as circle diagrams that can be used to distinguish family from non-family, and friends from strangers.

There is also some evidence that computerised programs that target social anxiety may be helpful in addressing eye contact aversion in children and adults.

Heightened arousal, alterations in consciousness and intrusive imagery

Children can experience PTSD symptoms following discrete traumas, in which sensory information and emotions become disconnected. Later reminders of trauma can cause fragments of the memory or sensations associated with the trauma to be re-experienced out of context ("flashbacks" and nightmares). Children may learn to avoid reminders of traumatic events in an attempt to avoid experiencing unpleasant emotions associated with the trauma.

PTSD symptoms can be minimised by providing the opportunity for children to talk about unpleasant events, thoughts and feelings. In trauma therapy, children are encouraged to learn to recognise and tolerate the strong emotions associated with trauma, and this helps minimise avoidance and other symptoms over time. Children can find it reassuring to know that an adult can tolerate their strong emotions without becoming overwhelmed.

Relaxation training and mindfulness strategies can also be helpful to calm heightened arousal and in learning to tolerate strong feelings associated with past events. Specific sleep hygiene strategies may also be needed due to heightened arousal interfering with sleep–wake cycles (e.g., support with learning bedtime routines and night time wakening).

Practice resources

Several websites provide useful resources regarding intervention and support for children who have experienced trauma and adversity. The resources listed below provide information about evidence-informed interventions targeting trauma:

- The National Child Traumatic Stress Network (NCTSN) provides detailed information on evidence informed supports for children who have experienced trauma. (See: www.nctsn.org/resources/topics/treatments-that-work/promising-practices)
- The Australian Centre for Posttraumatic Mental Health (ACPMH) and Parenting Resource Centre (PRC) have reviewed practice and evidence base for intervention for traumatised children. See *Approaches targeting outcomes for children exposed to trauma arising from abuse and neglect* (ACPMH and PRC, 2013) <www.parentingrc.org.au/index.php/resources>.
- Targeted supports will be most effective when delivered in the context of a supportive environment that is situated within a trauma-informed service provider that ensures all key adults in the child's life are also trauma-aware. For a discussion of the importance of trauma-informed context, see *Trauma-informed care in child/family welfare services* (Wall et al., 2016) <aifs.gov.au/cfca/publications/trauma-informed-care-child-family-welfare-services>.
- The Eureka Benevolent Foundation has funded the production of resources for foster carers that address the domains affected by trauma and other adversity. For more information about these resources please contact the author.

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