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Topical Review

Topical Review: Medical Trauma During Early Childhood

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Abstract

Objective Early childhood is a high-risk period for exposure to traumatic medical events due to injury/illness. It is also one of the most important and vulnerable periods due to rapid development in neurobiological systems, attachment relationships, cognitive and linguistic capacities, and emotion regulation. The aim of this topical review is to evaluate empirical literature on the psychological impact of medical trauma during early childhood (0–6 years) to inform models of clinical care for assessing, preventing, and treating traumatic stress following injury/illness. **Methods** Topical review of empirical and theoretical literature on pediatric medical traumatic stress (PMTS) during early childhood. **Results** There are important developmental factors that influence how infants and young children perceive and respond to medical events. The emerging literature indicates that up to 30% of young children experience PMTS within the first month of an acute illness/injury and between 3% and 10% develop posttraumatic stress disorder. However, significant knowledge gaps remain in our understanding of psychological outcomes for infants and young children, identification of risk-factors and availability of evidence-based interventions for medical trauma following illness. **Conclusions** This topical review on medical trauma during early childhood provides: (a) definitions of key medical trauma terminology, (b) discussion of important developmental considerations, (c) summary of the empirical literature on psychological outcomes, risk factors, and interventions, (d) introduction to a stepped-model-of-care framework to guide clinical practice, and (e) summary of limitations and directions for future research.

Key words: Infants; toddlers; preschoolers; young children; early childhood; developmental considerations; medical trauma; illness; accidents; injuries; risk factors; screening; prevention; intervention; pediatric medical traumatic stress; posttraumatic stress disorder; models of care.

Introduction

Early childhood is a high-risk period for exposure to medical trauma due to injury/illness (Australian Institute of Health and Welfare, 2020). Early childhood is also one of the most important and vulnerable periods of development (Shonkoff & Garner, 2012). Developmental factors greatly influence how infants and young children understand, respond, and adjust to medical trauma. These factors present many challenges for assessment and intervention. However, due to these challenges and widely held beliefs that young children do not experience mental health difficulties, this age-group has been largely neglected. This topical review provides a synthesis of the literature on medical trauma during early childhood (defined herein as children aged 0–6 years). Specifically, this review aims to (a) define medical trauma terminology, (b) discuss key developmental considerations, (c) present the empirical literature on the prevalence, comorbidity, course, risk factors, and interventions for pediatric medical traumatic stress (PMTS), (d) introduce a stepped-model-of-care framework to guide future assessment, prevention and treatment of PMTS during early childhood, and (e) identify priority areas for further research.

Terminology

Although *medical trauma* is widely used and recognized, there are different interpretations depending on the context and definitions used. In a medical setting, the term "trauma" can refer to *physical trauma* or *psychological trauma*. For example, a "major trauma" is defined as "an injury or combination of injuries that are life-threatening and could be life changing because it may result in long-term disability" (National Clinical Guideline Centre (UK), 2016). The Diagnostic and Statistical Manual of Mental Disorders (5th edn; DSM-5; American Psychiatric Association, 2013 defines *psychological trauma* as any event that involves "exposure to threatened death or actual or threatened serious injury." The examples listed in the DSM-5 include "severe" motor vehicle accidents and medical events that are sudden, "serious" or "catastrophic" (e.g., waking during surgery). However, this definition does not adequately describe the complexity of medical trauma as it uses objective severity descriptions and focuses on discrete/external events (De Young & Landolt, 2018). Research consistently shows objective injury/illness severity characteristics do not reliably predict psychological outcomes in children (De Young et al., 2011; Haag & Landolt, 2017; Price et al., 2016). Young children are also less likely to perceive their injury/illness as "life-threatening" in the same way as older children and adults, because developmentally, they typically do not understand key aspects of death (e.g., permanent/irreversible; Panagiotaki et al., 2018). Young children can be exposed to many events in a medical setting that may be equally or more traumatic than the original injury/illness, resulting in the potential for repetitive, and chronic trauma exposure. The subjective appraisal of threat during the acute injury/illness and/or subsequent medical treatment underpins the psychological impact of the medical trauma experience (Haag & Landolt, 2017; Price et al., 2016). Given young children typically look to their caregivers to determine potential threats/danger and rely on them to feel safe, a caregiver's emotional reaction and subjective appraisal is also likely to influence the child's perception of threat (Haag & Landolt, 2017).

PMTS is the term most frequently used in the pediatric medical trauma literature to describe "psychological and physiological responses of children and their families to pain, injury, serious illness, medical procedures, and invasive or frightening treatment experiences" (National Child Traumatic Stress Network, 2003). PMTS is not a traumatic stress disorder, but rather *posttraumatic stress symptoms* (PTSS) that manifest after medical trauma. PMTS occurs on a wide spectrum (from normal to problematic) and may present at various phases across the child's medical journey. In this review, *posttraumatic stress disorder* (PTSD) is used when the presentation of PTSS meets DSM-5 PTSD diagnostic criteria for children <6 years (American Psychiatric Association, 2013).

Although the PMTS definition provides a broad description of potentially traumatic medical events (PTEs), we are not aware of a definition in the pediatric literature that clearly describes the unique and complex nature of *medical trauma* specifically. We, therefore, propose the following working definition of *medical trauma*:

> Exposure to a single or series of medical event/s related to injury/illness, painful or invasive medical intervention and/or other hospital experiences that may be perceived by the child and/or caregiver as threatening, overwhelming or frightening.

The specific reference to subjective perception of threat by the child and/or caregiver is the important element in this definition. We acknowledge that it is challenging to determine a child's perception of threat; however, we include subjective perception in the definition to prompt professionals to consider the child's perception of threatening and potentially traumatic experiences, regardless of its objective severity. We propose "medical trauma" is used to describe the context/event/s that might be experienced as traumatic, whereas PMTS is used to describe the psychological/physiological response to the medical trauma. The following section and Supplementary Table 1 provide further guidance to help determine what medical events might be perceived as threatening and a corresponding list of PMTS symptoms across the developmental stages.

Developmental Considerations

Early childhood represents a time of particularly rapid and complex development, where the child is forming attachment relationships; progressing from basic sensorimotor functioning to emerging cognitive-linguistic capacities; and moving towards developing self-emotion regulation skills within the context of coregulation with caregiver/s (Humphreys et al., 2015; Sameroff, 2010). Adverse experiences that occur during this stage have the potential to influence brain architecture, pain sensitivity, caregiving relationships, and social, emotional, and physical development (Shonkoff & Garner, 2012). How young children process and respond to medical trauma is influenced by age and developmental maturity (Salmon & Bryant, 2002). Therefore, the impact of medical trauma must be considered within the context of their social, emotional, and relational developmental competencies. Refer to Supplementary Table 2 for detailed summary.

Infants

Infants (0–12 months) are especially dependent on their caregivers for physical safety and to meet their needs for physical comfort, food, sleep, stimulation, pain management, and emotion regulation (Sameroff, 2010). Developing a secure attachment with a primary caregiver is a crucial task for this stage of development (Humphreys et al., 2015). Beyond signaling via distress behaviors, infants have minimal skills to communicate or cope with pain or strong emotions (Humphreys et al., 2015). Thus, separation from and/or change in caregiver responsiveness during medical event/s can be particularly distressing.

Toddlers

Toddlers (1–2 years) are gaining a sense of autonomy and learning how to feed, dress, and toilet themselves (Humphreys et al., 2015). Medical events can affect their confidence and prompt a delay or regression in development. Toddlers are becoming more aware of their relative powerlessness which can increase perceptions of threat during their medical care. They are still highly dependent on their caregivers to help them feel safe, to understand their experiences, and to cope and can experience anxiety during separation. Toddlers become aware of how others think and feel, and are highly sensitive to how family members and pediatric providers respond to their injury/illness and treatment (Humphreys et al., 2015).

Preschoolers

Preschoolers (3–5 years) still need support to manage pain and regulate emotions. Their thinking becomes more logical through storing and processing memory, although it remains egocentric and limited to concrete information (Salmon & Bryant, 2002). They are, therefore, especially prone to confusion, misinterpretation or magical thinking about their medical experience (e.g., "The needles are punishment for being bad," "I can make this illness go away with my superpowers"), or may catastrophize or overgeneralize (e.g., "All children die when they come to hospital"). Young children are unlikely to understand the reason for certain events (e.g., painful medical procedures). Consequently, preschoolers can develop distorted or confused memories and increased threat appraisals. Preschoolers' distress responses are largely expressed through behavior (e.g., crying, tantrums, aggression, hyperarousal), which can result in misinterpretation or failure from caregivers and pediatric providers to accurately interpret trauma signs, thereby exacerbating distress (De Young et al., 2012).

Psychological Outcomes following Medical Trauma

For young children, the most common PMTS symptoms during the acute trauma period include clinginess, avoidance, irritability, and temper tantrums, distress at reminders, sleep disturbance, disobedience, nightmares, and increased aggression (De Young et al., 2011, 2012). For the majority of young children, PMTS is normal and transient during the acute period following medical trauma (De Young et al., 2012). However, for some, these symptoms cause significant functional impairment and can develop into psychological disorders (De Young et al., 2012). Trajectory analyses examining PMTS recovery patterns following intensive care admission found the majority of children (aged 2–16 years, 44% < 6 years) were *resilient* (83.8%), 3% experienced elevated PMTS but *recovered* gradually and 12.9% exhibited a *chronic* symptom trajectory with clinically elevated symptoms persisting for at least 12 months (Le Brocque et al., 2020).

There are now 16 studies that report acute and longer-term psychological consequences of medical trauma during early childhood (Table I summarizes this literature). Most of these studies are with injury populations and the primary outcome is PTSD. Studies that used diagnostic interviews reported PTSD prevalence rates of 7–29% within the first month of medical trauma, 10% at 6 months, and 2.4% up to 3 years after the initial injury/illness. Only one study has reported the prevalence of other psychological disorders and comboridity with PTSD (De Young et al., 2012), finding 10–16% of young children met diagnostic criteria for other disorders including oppositional defiant disorder, separation anxiety disorder or specific phobia. Up to 85% of children with PTSD also met criteria for at least one other diagnosis. The high rates of comorbidity raises concerns relating to

Table I. *Prevalence of PTSD and Other Psychosocial Outcomes for Infants and Young Children Following Medical Trauma*

Author (year)	*N*	Age	Trauma	Country	Time of assessment posttrauma	DSM-5 PTSD < 6Y[a]/PTSD-AA[b]	Other psychosocial outcomes
Acute: within 1 month[c]							
Haag & Landolt (2017)	138	1–4	Burn injury	Switzerland	*M* = 19 days	11.7%	—
Meiser-Stedman et al. (2008)[d]	62	2-6	MVA	United Kingdom	2–4 weeks	6.5%	—
Stoddard et al. (2006)	52	1–4	Burn injury	United States	Within 1 month	29%	—
Posttrauma: 1–6 months							
De Young et al. (2012)	130	1–6	Burn injury	Australia	1 month	25%	MDD (3%), ADHD (5%), ODD (16%), SAD (16%), specific phobia (5%)
					6 months	10%	MDD (0%), ADHD (6%), ODD (14%), SAD (8%), specific phobia (10%)
Stoddard et al. (2017)	42	1–4	Burn injury	United States	1 month after discharge	3%	—
Scheeringa et al. (2006)	21	0–6	Injuries	United States	2 months	14.3%	—
Ben-Ari et al. (2018)	79	1–6	Surgery	Israel	3–5 months	—	Internalizing and externalizing (11%), re-experiencing (55.7%), avoidance (30.4%), and hyperarousal (32.9%)
Meiser-Stedman et al. (2008)[d]	62	2–6	MVA	United Kingdom	6 months	10%	—
Posttrauma: 12+ months							
Le Brocque et al. (2020)	194	2–16	Admission to PICU	Australia	*M* = 3.68 weeks 3, 6, and 12 months	—	PMTS trajectory: Resilient 83.8%; Chronic 12.9%; Recovery 3.3%
Graf et al. (2011)	76	1–4	Burn injury	Switzerland	*M* = 15 months (3–48 months)	13.2%	Internalizing (5.1%), externalizing (3.4%)
Graf et al. (2013)	48	0–4	Cancer	Switzerland	*M* = 15 months	18.8%	—
Cox et al. (2019)	136	2–5	Cancer	United States	0–5 years (*M* = 1.84)	—	Externalizing (21.7%), internalizing (22.8%), behavioral symptoms (28.3%), adaptive skills (20.7% in concerning range)
Tillery et al. (2019)	97	3–6	Cancer	United States	*M*: 2.36 (SD = 1.30) years postdiagnosis	6%	—
Gigengack et al. (2015)	98	0–7	MVA, falls, burns	The Netherlands	*M* = 35 months (4–69 months)	7%	—
Meiser-Stedman et al. (2017)	42	2–6	MVA	United Kingdom	3 years	2.4%	—
Denniss et al. (2019)	87	1–5	Congenital heart disease	Australia	Not reported	—	60% had total health-related quality of life scores within at-risk range. Overall, scores significantly lower than norm.

Note. ADHD = attention-deficit/hyperactivity disorder; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, fifth edition; MDD = major depressive disorder; MVA = motor vehicle accident; ODD = oppositional defiant disorder; PICU = pediatric intensive care unit; PTSD = posttraumatic stress disorder; SAD = separation anxiety disorder.

[a]PTSD < 6Y stands for the DSM-5 PTSD subtype for children 6 years and younger.

[b]PTSD-AA was the original developmentally sensitive PTSD alternative algorithm proposed for children 6 years and younger by Scheeringa et al. The DSM-5 PTSD < 6Y is based on the PTSD-AA.

[c]PTSD criteria applied without the time criterion, as no separate criteria for acute stress in young children exist.

[d]Results derived from the same study.

the risk of misdiagnosis and a focus on the emerging externalizing behavior difficulties, without addressing the underlying trauma presentation (De Young et al., 2012).

Risk Factors for PMTS

Empirical literature on risk factors for PMTS during early childhood is limited. Pretrauma child-specific risk factors include temperament (negative affectivity; Tillery et al., 2019) and preexisting internalizing/externalizing difficulties (De Young et al., 2014; Le Brocque et al., 2020; Scheeringa et al., 2006). Injury/illness-related risk-factors include elevated pulse rate, larger burn size, pain, and frequent invasive medical intervention (Ben-Ari et al., 2020; De Young et al., 2014; Haag & Landolt, 2017; Stoddard et al., 2006). The most important social risk factors for experiencing elevated PMTS throughout the acute and post trauma periods are parent-related variables. Child and parent psychological distress are positively associated across injury/illness and medical intervention literature (Ben-Ari et al., 2020; De Young et al., 2014; Graf et al., 2013; Haag & Landolt, 2017; Le Brocque et al., 2020; Meiser-Stedman et al., 2017). Observational research has found the relationship between parent psychological distress and child procedural distress during painful procedures was mediated through parenting behavior (e.g., avoidant coping, excessive reassurance; Brown et al., 2019). Other social risk factors include low family social support (Ben-Ari et al., 2020) and poor family functioning (Graf et al., 2011).

Assessment, Prevention, and Intervention for PMTS

The Pediatric Psychosocial Preventive Health Model (Kazak, 2006) and the integrative trajectory model of PMTS (Price et al., 2016) are widely used frameworks to guide understanding, assessment, prevention, and treatment of PMTS. This section briefly examines the existing literature on assessment and intervention for PMTS in young children. Based on the PMTS models and existing evidence, we introduce a stepped-model-of-care framework that outlines the goals, level of intervention, treatment strategies and references/links for developmentally appropriate evidence-based resources (see Table II for the cited studies and/or to access the recommended resources). This framework provides a foundation to guide research to develop evidence-based clinical practice, and to develop and refine models of care for medical trauma during early childhood.

Universal Trauma-Informed Care

Responsive trauma-informed care and age-appropriate procedural preparation and pain management should be provided to all children and families to promote feelings of safety and to minimize exposure to PTEs in the hospital setting (Marsac et al., 2014). There are a number of excellent resources to train and support pediatric providers to provide trauma-informed care for children of all ages (see Table II).

Screening and Targeted Early Intervention

Universal screening for PMTS is recommended during the acute phase (1–4 weeks post-PTE) of stepped-care intervention models to identify children/caregivers who should be monitored or referred for more comprehensive targeted assessment and psychological support following medical trauma (Price et al., 2016). The Pediatric Emotional Distress Scale-Early Screener (PEDS-ES) completed by caregivers of young, injured children (1–6 years) has demonstrated feasibility, acceptability and predictive validity (Haag et al., 2020; Kramer et al., 2013).

A randomized control trial has demonstrated the efficacy of providing early brief psychological intervention (one to two sessions) to caregivers of young children (1–6 years) screening "high risk" on the PEDS-ES. The CARE intervention, compared with usual-care, was found to accelerate children's recovery from acute PMTS following traumatic injury (Haag et al., 2020). The hypothesized key elements of CARE include (a) supporting parents to identify, understand and support their child's distress and prioritize their own self-care, (b) promoting emotion regulation (e.g., soft toy, relaxation activities, responsive caregiving), and (c) using developmentally appropriate therapeutic resources to help the child (and parent) understand, contain, structure, and process their experience in a safe way and provide opportunities to talk about and correct unhelpful appraisals (e.g., therapeutic storybook).

As part of routine clinical care, we recommend caregivers of children aged 1–6 years complete the PEDS-ES within the first 2–4 weeks following an acute injury. Caregivers of children who screen "high risk" on the PEDS-ES should be provided with psychoeducation and coping strategies and resources such as those provided in CARE.

Indicated Clinical Intervention

The goal for this stage is to conduct a diagnostic assessment and provide specialized mental health intervention, as indicated, to reduce distress and functional impairment in children presenting with persistent pain, PTSD, anxiety, dysregulated behavior, and/or parent–child relationship difficulties. Evidence for the feasibility and effectiveness of trauma-focused cognitive behavioral intervention has been demonstrated with preschool children (>3 years) exposed to mixed traumatic events (Scheeringa et al., 2011).

Table II. *Stepped-Model-of-Care Framework to Guide Assessment, Prevention and Intervention for Pediatric Medical Traumatic Stress During Early Childhood*

Phases	Intervention level and goals	Assessment/intervention approaches	Tools and resources
Peritrauma: 0–7 days	Universal: Prevent or modify the subjective experience of PTEs	• Responsive trauma-informed care • Procedural preparation • Pain management	• Health care toolbox: https://www.healthcaretoolbox.org/ • PMTS Toolkit for health providers: https://www.nctsn.org/sites/default/files/resources/pediatric_toolkit_for_health_care_providers.pdf • Pain prevention and management resources: • https://societyofpediatricpsychology.org/procedural_pain • https://kidsinpain.ca/ • http://phm.utoronto.ca/helpinkids/resources.html • https://www.megfoundationforpain.org/resources-home • https://www.rch.org.au/kidsinfo/fact_sheets/Reduce_childrens_discomfort_during_tests_and_procedures/
	Universal: Provide psychoeducation to caregivers, and children when age appropriate, to normalize PMTS and promote positive coping.	Psychoeducation	• Early childhood trauma animation: https://www.childrens.health.qld.gov.au/chq/our-services/mental-health-services/qcpimh/for-families/ • After the injury: https://www.aftertheinjury.org • KidTrauma: www.kidtrauma.org • Health Care toolbox: https://www.healthcaretoolbox.org/patient-education-materials/download-print-patient-handouts.html • PICOLO: https://www.picolo.org/
Acute trauma care: 1–4 weeks	Universal: Prevent or modify the subjective experience of PTEs. Screen and monitor child/family distress and risk factors.	• Screen for risk indicators, adverse childhood experiences, and acute PMTS • Responsive trauma-informed care • Procedural preparation and pain management • Promote positive coping strategies (e.g., relaxation)	• PMTS screening tool: Pediatric Emotional Distress Scale-Early Screener (Kramer et al., 2013) • Relaxing with Birdie—storybook and animation: https://www.childrens.health.qld.gov.au/chq/our-services/mental-health-services/qcpimh/natural-disaster-resources/storybooks/
	Targeted: Early brief psychological intervention (one to two sessions) with children/caregivers showing indicators of risk during screening. Aim is to accelerate recovery from PMTS and prevent development of PTSD and functional impairment.	• Psychoeducation • Parent self-care and coping • Emotion co-regulation strategies • Trauma processing • Promote responsive parenting and modify unhelpful parenting behaviors (e.g., avoidant coping, overprotection)	• CARE intervention program (Haag et al., 2020). • Refer to article for more information about CARE and results of RCT. Contact the lead author (ADY) for a copy of the manual and intervention resources
Ongoing care/post trauma: > 1 month	Indicated: Diagnostic assessment for children showing signs of persistent or escalating distress.	Diagnostic assessment for PTSD and other mental health disorders	Diagnostic Infant and Preschool Assessment https://medicine.tulane.edu/departments/psychiatry/dr-scheeringas-lab/manuals-measures-trainings
	Indicated: Specialist psychological intervention (>2 sessions) to reduce severe, persistent and/or escalating levels of PMTS, address treatment nonadherence, manage persistent pain and/or address parent–child relationship difficulties	• Psychoeducation • Affect identification and regulation • Cognitive appraisals • Trauma narrative and processing • Graded exposure • Parenting skills • Manage persistent pain • Parent–child relationship therapy	• TF-CBT Web: https://tfcbt2.musc.edu • Preschool PTSD Treatment https://medicine.tulane.edu/departments/psychiatry/dr-scheeringas-lab/manuals-measures-trainings • Child Parent Psychotherapy: https://childparentpsychotherapy.com/about/ • Persistent pain resources: • http://skip.mywhc.ca/wp-content/uploads/2021/03/SKIP_research_article_10.pdf • https://www.megfoundationforpain.org/chronic-pain

Note. PMTS = pediatric medical traumatic stress; PTSD = posttraumatic stress disorder; PTEs = potentially traumatic events.

Limitations and Future Directions

Recognition and understanding of the impact of medical trauma during early childhood has grown over the past 15 years; however, a lack of empirical research and significant knowledge gaps of how to assess, diagnose, and treat PMTS across early childhood remain. The majority of studies have focused predominately on injury populations and children aged >24 months. Few studies have used developmentally sensitive diagnostic assessment tools to assess and report PTSD prevalence and only one study to date has reported the prevalence of other psychological outcomes. Additionally, only single-informants (caregivers) have been used for all studies to diagnose PTSD. Although particularly challenging for this age group, future research should consider multi-informant, multi-method approaches.

Further research is needed to (a) determine the nature, frequency, and trajectories of PMTS symptoms and other psychological consequences across different stages (infants, toddlers, and preschoolers), medical trauma types and from underrepresented communities, (b) identify risk and protective factors and identify interactions that moderate or mediate PMTS over time, and (c) develop and validate age-appropriate and culturally sensitive psychological assessment tools and interventions across the stepped-care model that encompass developmental biopsychosocial complexities.

Conclusions

Trauma experiences in early childhood are often ignored or underestimated in their impact. There is a paucity of research into trauma experiences, the impact, and models of intervention in this age group. This topical review summarizes the current literature on prevalence, course, risk factors, assessment, and intervention for PMTS following medical trauma during early childhood. Recommendations for assessment and intervention within a stepped-model-of-care framework to prevent and treat persistent PMTS and functional impairment are presented. Findings can guide and stimulate future research and inform clinical practice.

Supplementary Data

Supplementary data can be found at: https://academic.oup.com/jpepsy.

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