

Trauma-informed, neuroprotective care for hospitalised newborns and infants

The patient experience of neonatal intensive care exposes vulnerable preterm and critically ill newborns to numerous sources of stress: noxious environmental stimuli, painful procedures and prolonged separation from their mothers. This early life adversity alters the infant's developmental trajectory through epigenetic, neuroendocrine and psychosocial mechanisms. Providing trauma-informed, neuroprotective care consistently and reliably in the neonatal intensive care setting offers clinicians an effective evidence-based framework to transform the culture of care and improve short and long-term outcomes.

Mary Coughlin

RN, MS, NNP, RNC-E
President and Founder of Caring Essentials Collaborative
mary@caringsentials.net

Background

Children who experience early life adversity are at risk for adverse health outcomes that may not be realised until adulthood.^{1,2} Advances in developmental biology are now shedding light on our understanding of the fetal and neonatal origins of adult disease.¹ Primary prevention and earlier intervention through a trauma-informed framework may be integral in caring for vulnerable, at-risk patient populations to reduce the

societal burden of disease associated with early life adversity.¹

The Adverse Childhood Experience (ACE) Study, conducted by the US Centers for Disease Control and Prevention (CDC) with Kaiser Permanente (a California-based managed healthcare consortium), was one of the largest, groundbreaking investigations into the lifelong health and wellness implications of early childhood adversity. The researchers developed an ACE score that correlated with an

Keywords

early life adversity; toxic stress; trauma-informed care; developmental care; neuroprotective care; neonatal intensive care

Key points

Coughlin M. Trauma-informed, neuroprotective care for hospitalised newborns and infants. *Infant* 2017; 13(5): 176-79.

1. Adverse childhood experiences impact on the biology of the developing infant with lifelong implications for health and well-being.
2. Prematurity is an early life adversity characterised by exposure to toxic stress and limited maternal care.
3. Trauma-informed care in the NICU provides neuroprotection and may reduce the disease-independent long-term morbidity observed in NICU survivors.

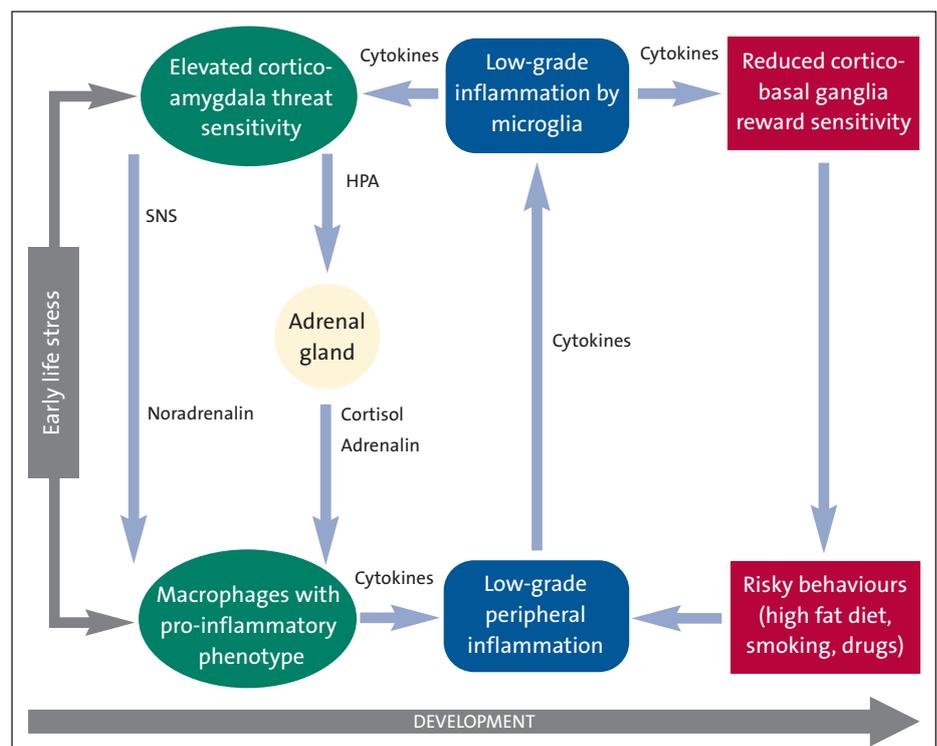


FIGURE 1 Depiction of the neuroimmune network hypothesis. Key: SNS = sympathetic nervous system, HPA = hypothalamic-pituitary-adrenal axis (based on Nusslock & Miller 2016).¹¹

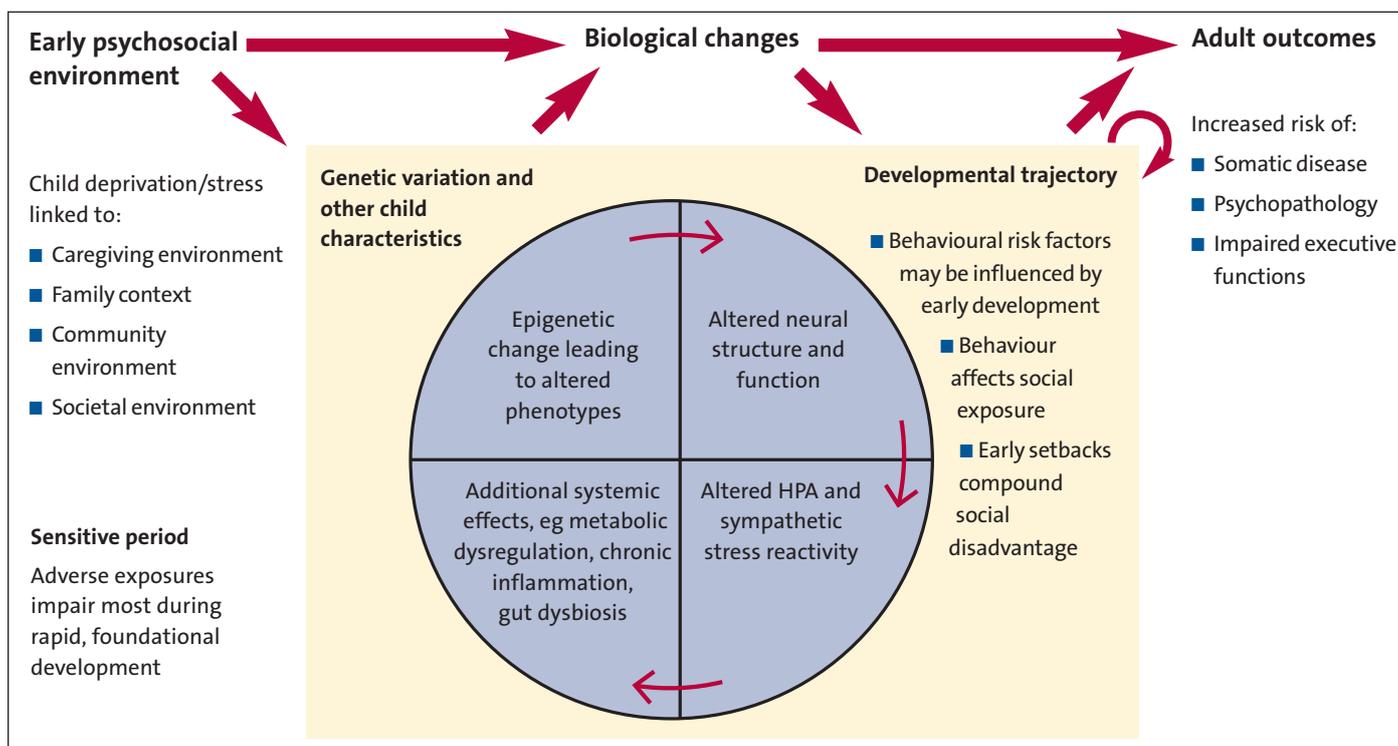


FIGURE 2 Conceptual model of the biological embedding of early psychosocial adversity (adapted from Berens et al 2017¹²). Key: HPA= hypothalamic-pituitary-adrenal axis.

individual's risk for chronic disease (likened to a cholesterol level for childhood toxic stress). Study participants answered 10 questions regarding adverse events that may have occurred during the first 18 years of their life. Each item selected was assigned one point and responses were then tallied to provide an ACE score. The higher the ACE score the higher the risk for chronic illness as well as social and emotional disturbances.³

Understanding that toxic stress is a mediator between early life adversity and suboptimal outcomes in learning, behaviour and health opens new opportunities in trauma-informed primary prevention and early intervention for infants, families and healthcare professionals. The quality of the early caregiving environment plays a pivotal role in the maturation of the immune system as well as hypothalamic-pituitary-adrenal (HPA) axis reactivity.^{4,5} Caregiving environments that are responsive, nurturing and supportive provide a buffer to stress in the environment and this buffer preserves physiologic integrity and may even cultivate resilience in the developing child.

Early life adversity and toxic stress

The stress response, or allostasis, is a constellation of adaptive behavioural, physiological and cellular responses that

strives to maintain homeostasis.⁶ Learning how to adapt to stress or adversity is a healthy part of development, however when the stressor overwhelms the individual's ability to cope, it is characterised as toxic and becomes an allostatic load.^{6,7} Toxic stress, or sustained activation of the stress response system in the absence of supportive adult care, results in damage to the hippocampus, an area of the brain critical for learning and memory, and initiates an inflammatory response that over time can lead to a state of chronic inflammation, undermining health and wellness (FIGURE 1).⁸⁻¹¹

Childhood adversity has been repeatedly linked to physical and mental illness across the lifespan (FIGURE 2).^{8,12} The elements that characterise adversity include physical threat, disrupted caregiving and unpredictable environmental conditions.^{7,8} Researchers have investigated the implications of allostasis and allostatic load on brain structural development, complications and morbidities mediated by inflammation, epigenetics and critical illness.^{8-10,13,14} The findings categorically link toxic stress and early life adversity to derangements in physiologic function and integrity subsequently derailing healthy development.

The infant who requires neonatal intensive care is put into a life-threatening

- Maternal separation; maternal deprivation
- Social isolation
- Unmanaged or undermanaged pain/stress
- Nutritional deprivation
- Sleep deprivation, sleep fragmentation

TABLE 1 Traumatic experiences in the NICU.

situation (physical threat) with altered parental proximity (disrupted caregiving), and unpredictable environmental conditions, which characterise an adverse experience.⁸ These adverse experiences create an allostatic load that alters neuroendocrine responsiveness, epigenetic processes, and imposes long-lasting alterations to the developing brain architecture.^{4,14,15} Early exposure to extremely fearful events, within a life-threatening context, is tantamount to trauma (TABLE 1). Perceiving the world as a scary and threatening place predisposes newborns and infants to a wide range of conditions mediated by fear and anxiety, which subsequently impairs their ability to learn and interact socially.¹⁶ Alternatively, early life experiences that are nurturing and responsive modulate the reactivity of the HPA-axis and confer a protective buffer against neonatal intensive care unit

(NICU)-related stress that may reduce or even eliminate epigenetic alterations.^{4,15,17}

Trauma and trauma-informed care in the NICU

Trauma, by definition, causes physical, emotional and psychological distress or harm and is perceived as a threat to one's safety. It can be a single event, or a repeating or enduring event that overwhelms the individual's ability to cope. Trauma, like early life adversity, is mediated by the stress response system to toxic stress. Understanding the biology of this highly-regulated response through central and peripheral components of the autonomic nervous system and the neuroendocrine HPA axis, facilitates a shift in interpreting the infant's and family's experience of the NICU from a 'what is wrong with you' view, to a 'what has happened to you' view.¹⁸

D'Agata et al introduced the Infant Medical Trauma in the NICU (IMTN) model as a conceptual framework to understand the needs of the critically ill newborn and infant within the NICU context.^{19,20} The critical components of the model define the traumatic experience of the infant and includes stress and allostasis, parental separation and pain.¹⁹ The unique feature of IMTN, as opposed to paediatric medical trauma, is that it hinges on the impact these abnormal and cumulative NICU experiences have on the neurodevelopmental and genetic vulnerability of the hospitalised newborn and infant.¹⁹ The IMTN model provides language to help articulate the infant's lived experience in the NICU and allows NICU clinicians to examine how they can do better employing a trauma-informed paradigm.^{19,20}

Trauma-informed care for hospitalised newborns and infants:

- *realises* that traumatic experiences influence biology
- *recognises* the signs and symptoms of trauma in patients, families and colleagues
- *responds* by fully integrating knowledge and best practices about trauma into policies, procedures and practices
- *resists* re-traumatisation.

These cornerstones of trauma-informed care are supported by the American Academy of Pediatrics (AAP) ecobio-developmental framework informing the basic science of paediatrics. Led by advances in developmental neuroscience,

Healing environment	<ol style="list-style-type: none"> 1. The physical environment is a soothing, spacious, and aesthetically pleasing space that is conducive to rest, healing and establishing therapeutic relationships 2. The human environment emanates teamwork, mindfulness and caring 3. The organisational environment reflects a just culture committed to safety
Family collaborative care	<ol style="list-style-type: none"> 1. Parents are integral to the comprehensive care of their hospitalised infant(s) 2. Assessing and supporting the emotional well-being of parent(s) is an expressed priority 3. Competence and confidence in parenting skills is mentored, supported and validated over the hospital stay
Pain and stress	<ol style="list-style-type: none"> 1. Prevention of pain and stress is an expressed goal in the daily management of the hospitalised infant 2. Pain and/or stress is assessed, managed and reassessed before, during and after all procedures until the infant returns to his or her baseline level of comfort; interventions and infant responses to stress-relieving and pain-management interventions are documented 3. Family is involved, informed and participates in the pain and stress management of their hospitalised infant(s); all participation and observations are documented
Protected sleep	<ol style="list-style-type: none"> 1. Practices that protect sleep integrity and support circadian/diurnal rhythmicity are integrated into the culture of care 2. Care strategies that support infant sleep are implemented in partnership with the family 3. Staff role-model compliance with recommended back to sleep safety practices for eligible infants
Activities of daily living	<ol style="list-style-type: none"> 1. Age-appropriate postural alignment is consistently provided to ensure comfort, safety, physiologic stability and support optimal neuromotor development 2. Age-appropriate feeding experiences will be pain and stress free, individualised, infant driven, and nurturing 3. Age-appropriate skin care routines and skin protective measures preserve barrier function and tissue integrity

TABLE 2 Core measures for trauma-informed neuroprotective care (Coughlin 2016²⁸).

molecular biology, genomics, developmental psychology, epidemiology, sociology and economics, the AAP framework illustrates how early life experiences and the environment influence health and wellness across the lifespan.²¹ Succinctly stated, the ecology of the developing individual influences their biology, which then affects their development and lifelong health.

The challenge

NICU clinicians struggle to 'read' the cues of their tiny patients. These 'cues' are psychobehavioural tools used to communicate and express the infant's emotional state, or 'affect', and may be blunted by the infant's immaturity, severity of illness, or pharmacologic prescriptions.²² 'Affective

capabilities' emerge during the end of the second trimester in the developing fetus and create the dynamic scaffold for the neocortex (the largest and evolutionarily most recent portion of the cerebral cortex) to build upon.²² Neuroception – an individual's unconscious awareness of safety, danger or life threat – is mediated by the autonomic nervous system and linked to behavioural responses that communicate emotional state and affect to the outside world.^{18,23} These emotional distress states are modulated through mutual, synchronous and reciprocal dyadic relationships that convey a sense of safety, security and connectedness.¹⁸

The challenge for NICU clinicians is to look beyond the infant's clinical condition and see their biopsychosocial competencies

as fellow human beings, with rudimentary intentions and emotions trying to make meaning out of their life in relation to the world around them.¹⁷ Infants make meaning out of the world based on how the world makes them feel, often expressed through activation of their autonomic nervous system, limbic system and cerebellum.^{17,24} This can be difficult to fathom but investigators into neonatal psychology, consciousness and neuro-physiology reveal that, despite their pre-verbal status, infants are highly tuned in to the world around them and, more specifically, the people around them at an autonomic and subcortical level.²⁵⁻²⁷

Conclusion and call to action

Trauma for the hospitalised newborn and infant is the chronic disruption of a felt sense of safety, security and connectedness. This disruption is expressed through autonomic instability and perturbations that may not be recognised as signs and symptoms of trauma. In addition, parents are often traumatised or re-traumatised by their infant's life-threatening situation and may also experience alterations to their emotional state via autonomic perturbations expressed as withdrawal, hostility and/or suspicion. Adopting a trauma-informed paradigm for neonatal intensive care acknowledges the lived experience of the infant-family dyad in crisis.

Neonatal clinicians must integrate evidence-based best practice in age-appropriate, neuroprotective care to manage and mitigate the trauma and adversity associated with neonatal intensive care (TABLE 2).²⁸ Standardising trauma-informed neuroprotective care is at the heart of safe, patient-centred quality care in the NICU and a global health imperative:²⁸ “*Psychosocial deprivation within any caregiving environment during early life must be viewed with as much concern as any debilitating childhood disease.*”²⁹

The biological imperative of infant-parent connectedness is supported within a trauma-informed, neuroprotective paradigm that promotes parents as primary co-regulators of their babies.¹⁸

Clinicians must be engaged and empowered to create authentic healing relationships with patients and families grounded in healing intention. Self-awareness into one's own experience with suffering prepares the trauma-informed clinician to adopt a transpersonal approach to the caring-healing encounter and honour the clinicians' admonition: *First, do no harm.*

References

1. Franke H.A. Toxic stress: effects, prevention and treatment. *Children (Basel)* 2014;1:390-402.
2. Shonkoff J.P., Boyce W.T., McEwen B.S. Neuroscience, molecular biology, and the childhood roots of health disparities: building a new framework for health promotion and disease prevention. *JAMA* 2009;301:2252-59.
3. Felitti V.J., Anda R.F., Nordenberg D. et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experience (ACE) Study. *Am J Prev Med* 1998;14:245-58.
4. Montiroso R., Provenzi L. Implications of epigenetics and stress regulation on research and developmental care of preterm infants. *J Obstet Gynecol Neonatal Nurs* 2015;44:174-82.
5. Johnson S.B., Riley A.W., Granger D.A., Riis J. The science of early life toxic stress for pediatric practice and advocacy. *Pediatrics* 2013;131:319-27.
6. McEwen B.S. Stressed or stressed out: what is the difference? *J Psychiatry Neurosci* 2005;30:315-18.
7. National Scientific Council on the Developing Child. *Excessive Stress Disrupts the Architecture of the Developing Brain: Working Paper No. 3.* 2005/2014 [Online]. Available from www.developingchild.harvard.edu [Accessed 11 August 2017].
8. Kuhlman K.R., Chiang J.J., Horn S., Bower J.E. Developmental psychoneuroendocrine and psychoneuroimmune pathways from childhood adversity to disease. *Neurosci Biobehav Rev* 2017;80:166-84.
9. McEwen B.S. Protective and damaging effects of stress mediators: central role of the brain. *Dialogues Clin Neurosci* 2006;8:367-81.
10. Moore T.A., Berger A.M., Wilson M.E. A new way of thinking about complications of prematurity. *Biol Res Nurs* 2014;16:72-82.
11. Nusslock R., Miller G.E. Early-life adversity and physical and emotional health across the lifespan: a neuroimmune network hypothesis. *Biol Psychiatry* 2016;80:23-32.
12. Berens A.E., Jensen S.K.G., Nelson C.A. Biological embedding of childhood adversity: from physiological mechanisms to clinical implications. *BMC Med* 2017;15:135.
13. Cuesta J.M., Singer M. The stress response and critical illness: a review. *Crit Care Med* 2012;40:3283-89.
14. Smith G.C., Gutovich J., Smyser C. et al. Neonatal intensive care unit stress is associated with brain development in preterm infants. *Ann Neurol* 2011;70:541-49.
15. Provenzi L., Montiroso R. 'Epigenetics' in the neonatal intensive care unit: conveying complexity in health care for preterm children. *JAMA Pediatr* 2015;169:617-18.
16. National Scientific Council on the Developing Child. *Persistent Fear and Anxiety Can Affect Young Children's Learning and Development: Working Paper No. 9.* [Online]. Available from www.developingchild.harvard.edu [Accessed 11 August 2017].
17. Zmyj N., Witt S., Weitkamper A. et al. Social cognition in children born preterm: a perspective on future research directions. *Front Psychol* 2017;8:455.
18. Sanders M.R., Hall S.L. Trauma-informed care in the newborn intensive care unit: promoting safety, security and connectedness. *J Perinatol* 2017;doi: 10.1038/jp.2017.124.
19. D'Agata A.L., Young E.E., Cong X. et al. Infant medical trauma in the neonatal intensive care unit (IMTN): a proposed concept for science and practice. *Adv Neonatal Care* 2016;16: 289-97.
20. D'Agata A.L., Sanders M.R., Grasso D.J. et al. Unpacking the burden of care for infants in the NICU. *Infant Ment Health J* 2017;38:306-17.
21. Shonkoff J.P., Garner A.S. et al. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics* 2012;129:e232-46.
22. Panksepp J. How primary-process emotional systems guide child development. In: Narvaez D., Panksepp J., Schore A.N., Gleason T.R. (eds). *Evolution, Early Experience and Human Development.* New York: Oxford University Press; 2013 p88.
23. Porges S.W. Neuroception: a subconscious system for detecting threats and safety. *Zero to Three* 2014;24:19-24.
24. Tronick E., Beeghly M. Infants' meaning-making and the development of mental health problems. *Am Psychol* 2011;66:107-19.
25. Poulin-Dubois D., Brooker I., Chow V. The developmental origins of naïve psychology in infancy. *Adv Child Dev Behav* 2009;37:55-104.
26. Lagercrantz H., Changeux J-P. Basic consciousness of the newborn. *Semin Perinatol* 2010;34:201-06.
27. Porges S.W., Furman S.A. The early development of the autonomic nervous system provides a neural platform for social behavior: a polyvagal perspective. *Infant Child Dev* 2011;20:106-18.
28. Coughlin M. *Trauma-informed Care in the NICU: Evidence-Based Practice Guidelines for Neonatal Clinicians.* New York: Springer Publishing Co; 2016.
29. Johnson D.E., Gunnar M.R. Growth failure in institutionalized children. *Monogr Soc Res Child Dev* 2011;76:92-126.

infant Subscribe today!

www.infantgrapevine.co.uk