

The Neurosequential Model

A developmentally-sensitive, neuroscience-informed approach to clinical problem solving

Bruce D. Perry, M.D., Ph.D.

For:

The Handbook of Therapeutic Child Care: Evidence-Informed Approaches to Working with Traumatized Children in Foster, Relative and Adoptive Care

(Edited by Janise Mitchell, Joe Tucci and Ed Tronick)
Jessica Kingsley, London

Correspondence:

Bruce D. Perry, M.D., Ph.D.
Senior Fellow
The ChildTrauma Academy
Houston, TX

Professor (Adjunct)
Department of Psychiatry and Behavioral Sciences
Feinberg School of Medicine
Northwestern University
Chicago, IL

Professor (Adjunct)
School of Allied Health, College of Science, Health and Engineering
La Trobe University
Melbourne, VC Australia

BDPerry@ChildTrauma.org
832.472.9951
www.ChildTrauma.org

Origins of the Neurosequential Model

The Neurosequential Model[®] (NM) is the umbrella for three inter-related programs; the Neurosequential Model of Therapeutics[®] (NMT), the Neurosequential Model in Education[®] (NME) and the Neurosequential Model in Caregiving[®] (NMC). The NM originated as the clinically-focused NMT but has evolved over the last ten years to provide a set of parallel and complementary program elements for various target populations and settings.

The most fully-developed element of the NM is the NMT. The NMT is both an evidence-based and 'evidence-generating' approach that has shown effectiveness with a wide range of clinical populations in multiple settings including early childhood (Barfield et al. 2011; Ryan, Lane & Powers, 2017), outpatient mental health (Zarnegar et al., 2016), foster care (Grove, T. 2012; Wang et al., 2015), special education (Australian Council for Education Research, 2015), education (Anich & King, 2013; Whyde & Boldman-Buzard, 2017), juvenile justice and residential treatment (Hambrick et al., 2018) and inpatient psychiatric settings (De Nooyer & Lindgard, 2016). The NMT was designated an "promising practice" by the National Quality Improvement Center for Adoption & Guardian Support and Preservation (QIC-AG.org) in 2015. The NM has been incorporated into the practice framework for many organizations including Casey Family Programs and government systems, including Alberta Human Services.

The origins of the NM trace back to the work of an interdisciplinary clinical research group studying the effects of stress and trauma on neurodevelopment based at the University of Chicago (The Center for the Study of Child Trauma & the Laboratory of Developmental Neurosciences). When Dr. Perry moved to Baylor College Medicine in 1992, the Center became the CIVITAS ChildTrauma Programs, and in 1995 was re-named the ChildTrauma Academy (CTA). In 2001, the CTA became a free-standing non-profit organization functioning as a *Community of Practice* (Wenger, 1988). The CTA's Neurosequential Model Network is currently comprised of more than 2000 affiliated organizations and individual clinicians engaged in research, program development, direct service and training related child trauma, maltreatment, education, child welfare, juvenile justice and a host of related areas.

The NMT draws on research from multiple disciplines (e.g., the neurosciences, anthropology, sociology, developmental psychology, public health) to create a semi-structured, practical way for an interdisciplinary clinical team to quantify elements of the client's developmental history and current functioning. The NMT includes a set of 'metrics', the NMT Clinical Practice Tools, developed to help the clinician practice in an evidence-based, developmentally sensitive, and trauma-informed manner (Brandt et al., 2012). The goal of this semi-structured process is to ensure that the clinician/clinical team systematically considers key developmental factors that may contribute to the client's current functioning (see Figure 1). The NMT assessment elements are meant to complement and not replace other metrics or assessment elements; each organizations and clinical team has developed some assessment process and the NMT is designed to provide a neurodevelopmental framework for the data

obtained in these various assessments. The functional data for a client gathered in either quantitative (e.g., Wechsler Intelligence Scale for Children, Wide Range Achievement Test, Child & Adolescent Functional Assessment Scale, Child and Adolescent Needs and Strengths, Child Behavior Checklist, Trauma Symptom Checklist for Children, Parent Stress Index) or qualitative ways is organized into a neuroscience-focused “map.” This heuristic “brain map” provides the clinical team with an approximation of current functional organization of the client’s brain (see Figure 2)

Development of the NMT

A primary focus of the NM from the outset was integrating fundamental principles of neuroscience into an understanding of the child, youth and adult. This neurodevelopmental ‘bias’ is not intended to replace other theoretical perspectives on human behavior, rather it seeks to complement and enrich other perspectives. The recognition that the NM is an evolving ‘model’ – and that all models are wrong or incomplete in some way (see George E. P. Box as quoted in Draper, 1987) - drives the ‘growth mindset’ of the community of NM practitioners and developers. The creation of the NMT was in response to the frustrating awareness that a more traditional clinic-based, medical model was ineffective in working with children and youth impacted by severe neglect and trauma who presented with a host of developmental challenges including profound attachment problems (see Perry, 2017). By 2000, the CTA was beginning to use an alternative method for assessment and intervention, called the Neurosequential Model of Therapeutics (NMT), which evolved from the research and clinical experiences of the CTA team (Perry, 2006; Perry, 2009). Detailed theoretical background and rationale for the NMT have been reported previously (Perry, 2006; Kleim & Jones, 2008; Perry, 2009; Ludy-Dobson & Perry, 2010).

A multi-year process of beta-testing various versions of the NMT took place within the clinical settings of the ChildTrauma Academy in Houston, TX. The NMT was used in multiple clinical populations across the full developmental spectrum (infants to adults) including maltreated children and youth (e.g., Barfield et al., 2011; Hambrick et al, 2018). Approximately 1000 clients were evaluated in the CTA Clinics using the NMT Clinical Practice Tools (i.e., the NMT metrics). Based upon these experiences, modifications were made to the assessment to make it more practical, affordable and exportable. The intention was to provide a useful set of capacity building, assessment and implementation capabilities for other clinicians and clinical sites.

By 2008, inter-rater reliability and face validity of the Clinical Practice Tools (the web-based “NMT Metrics”: see below) had been established to a sufficient degree that the CTA felt comfortable sharing this approach using a certification process and the NMT approach was ‘manualized’ for export (see Perry & Szalavitz, 2017). In 2010 the NMT Metrics were converted to a web-based program with certified individuals used a web-based interface to enter, score and create reports. This stimulated significant growth of the NMT-certified community (see Figure 3).

Considering the typically 'slow' nature of the dissemination of new clinical innovations, the growth of the NMT is relatively rapid. Few translational medicine efforts see "the light of day"; only 14% of the practices developed in clinical research actually reach clinical 'practice' (Balas & Boren, 2000). Further, it takes, on average, 17 years for these innovations to go from clinical investigation to standard of practice (see Morris, Wooding & Grant, 2011). The growth of the NMT is ahead of the typical rate of dissemination as it has evolved over the last ten years from science-based practice to promising practice to an evidence-based practice (see Figure 3). Much of this growth is due to the general enthusiastic (sometimes over-enthusiastic) word of mouth from program to program, clinician to clinician. Since 2008, more than 2500 clinicians and 200 organizations or programs in 24 countries have become certified. The manualized and web-based training elements developed for the NMT certification process continue to be updated and revised as the field grows. To ensure the systematic, high-fidelity dissemination of the core concepts, mastery of the NMT Clinical Practice Tools (see below), and NMT-guided treatment planning process, ongoing access to the web-based NMT Metrics requires participation in an ongoing biannual NMT Fidelity exercise for all NMT Metric users. Over 85% of certified users routinely obtain high or acceptable inter-rater reliability. In one recent study, Cronbach's α was .95 for Part C (CNS Functioning), and was .84 for Part D (Current Relational Health) (Hambrick, Brawner & Perry, 2018).

The NMT Clinical Practice Tools

The NMT Clinical Practice Tools (aka, NMT Metrics) help provide a structured assessment of the developmental history of adverse experiences and relational health, as well as *current* brain-mediated functioning and relational health (connectedness). These NMT Metrics are designed to complement, not replace, existing assessment tools (e.g., CANS, CAFAS) and psychometrics (e.g., CBCL, IES, WISC, WRAT). They are designed to allow use across multiple systems using multiple assessment packages. The primary goal of the NMT Metrics and assessment is to ensure that the clinical team is organizing the client and family's data (and planning) in a developmentally sensitive and neurobiology-informed manner.

The NMT "mapping" process helps identify systems (areas) in the brain that appear to have functional or developmental problems; in turn, this helps guide the selection and sequencing of developmentally-appropriate (and age-acceptable) interventions. These interventions are designed to replicate the normal sequence of development beginning with the lowest, most abnormally functioning systems of the brain (e.g., those originating in the brainstem) and moving sequentially up the brain as improvement is seen. The NMT is grounded in an awareness of the sequential development of the brain and sequential, bottom-up processing of all incoming experience (i.e., sensory input). Cortical organization and functioning depend upon previous healthy organization and functioning of lower neural networks originating in the brainstem and diencephalon. Therefore, a dysregulated individual (child, youth or adult) will have a difficult time benefiting from educational,

caregiving and therapeutic efforts targeted at, or requiring, “higher” cortical networks. This sequential approach is respectful of the normal developmental sequence of both brain development and functional development. Healthy development depends upon a sequential mastery of functions; and a dysregulated individual will be inefficient in mastering any task that requires relational abilities (cortico-limbic) and will have a difficult time engaging in more verbal/insight oriented (cortical) therapeutic and educational efforts.

Table 1: Key Elements of the NMT Web-based Clinical Practice Tools (NMT Metrics)

1. **Demographics**
2. **History – Developmental**
 - a. Genetic
 - b. Epigenetic
 - c. Part A. Adverse Events measure
 - d. Part B. Relational Health measure
3. **Current Status**
 - a. Part C. Central Nervous System (CNS) Functional Status Measure
 - i. Brainstem
 - ii. Diencephalon/CBL
 - iii. Limbic
 - iv. Cortex/Frontal Cortex
 - b. Part D. Relational Health measure
4. **Recommendations**
 - a. Therapeutic Web
 - b. Family
 - c. Client
 - i. Sensory Integration
 - ii. Self Regulation
 - iii. Relational
 - iv. Cognitive
5. **Caregiving Challenge Estimator**
 - a. Caregiving resources
 - i. Internal resources/demands
 - ii. External resources/demands
 - b. Caregiving demand
 - i. Children (number)
 - ii. Children (challenge)
 - c. Caregiving reserve

This clinical approach helps professionals determine the strengths and vulnerabilities of the child and create an individualized intervention, enrichment and educational plan matched to his/her unique needs. The goal is to find a set of therapeutic activities that meet the child's current needs in various domains of functioning (i.e., social, emotional, cognitive and physical). An individual demonstrating significant problems in brainstem and diencephalic functions may end up with recommended activities that are primarily rhythmic, repetitive and somatosensory in nature such as music, dance, yoga, drumming, various sports, therapeutic massage or more traditional play therapy, sand tray or other art therapies. Later in the treatment process, with improved somatosensory processing and self-regulation, the "therapeutic front" shifts to more complex, higher networks in the brain. The treatment recommendations would shift (to more relational and cognitive-behavioral focused interventions including a range of EBTs such as PCIT or TF-CBT. Over the course of any client's NMT-guided treatment, then, a set of EBTs may be used depending upon the nature and timing of the client's needs.

A. The NMT Clinical Practice Tools (NMT Metrics). The NMT Metrics (see Table 1) are divided into four main parts and some supplemental tools: The four main components of the NMT Metrics are Part A (Developmental Adversity), Part B (Relational Health), Part C (Central Nervous System (CNS) Functioning: Current), and Part D (Current Relational Health).

In Part A (Adversity), clinicians score a range of potentially traumatic and/or adverse experiences during the following periods of life: Perinatal (birth to two months), Infancy (2 months to 12 months), Early Childhood (13 months to 4 years), and Childhood (4 years to 11 years). The six experiences assessed per developmental period are quality of primary caregiving, caregiver drug/alcohol use, neglect, domestic violence, transitions/chaos and "other trauma." Clinicians rate the severity of each experience from 1 – 12, ranging from None/Minimal (1-3), Mild (4-6), Moderate (7-9), to Severe (10-12). Although the metrics are only completed by clinicians, clinicians use information from any available source including clinical interviews, child welfare case files, observations of child/family, medical records, psychosocial assessments, etc. When clinicians are uncertain about a child's specific adverse experiences (or relational health: see below), the scoring rules instruct the clinician to provide a neutral score and, when partial information is available, score in a manner that will, if anything, underestimate developmental risk.

In Part B (Relational Health), clinicians score a series of questions focused on the child's "connectedness" across the same developmental periods. The six experiences assessed per developmental period are primary caregiver safety, primary caregiver attunement, consistency in primary caregiving, paternal (or partner) support, kinship support, and community support on a scale of 1-12 from Poor (1-3), Episodic (4-6), Adequate (7-9), to Positive (10-12).

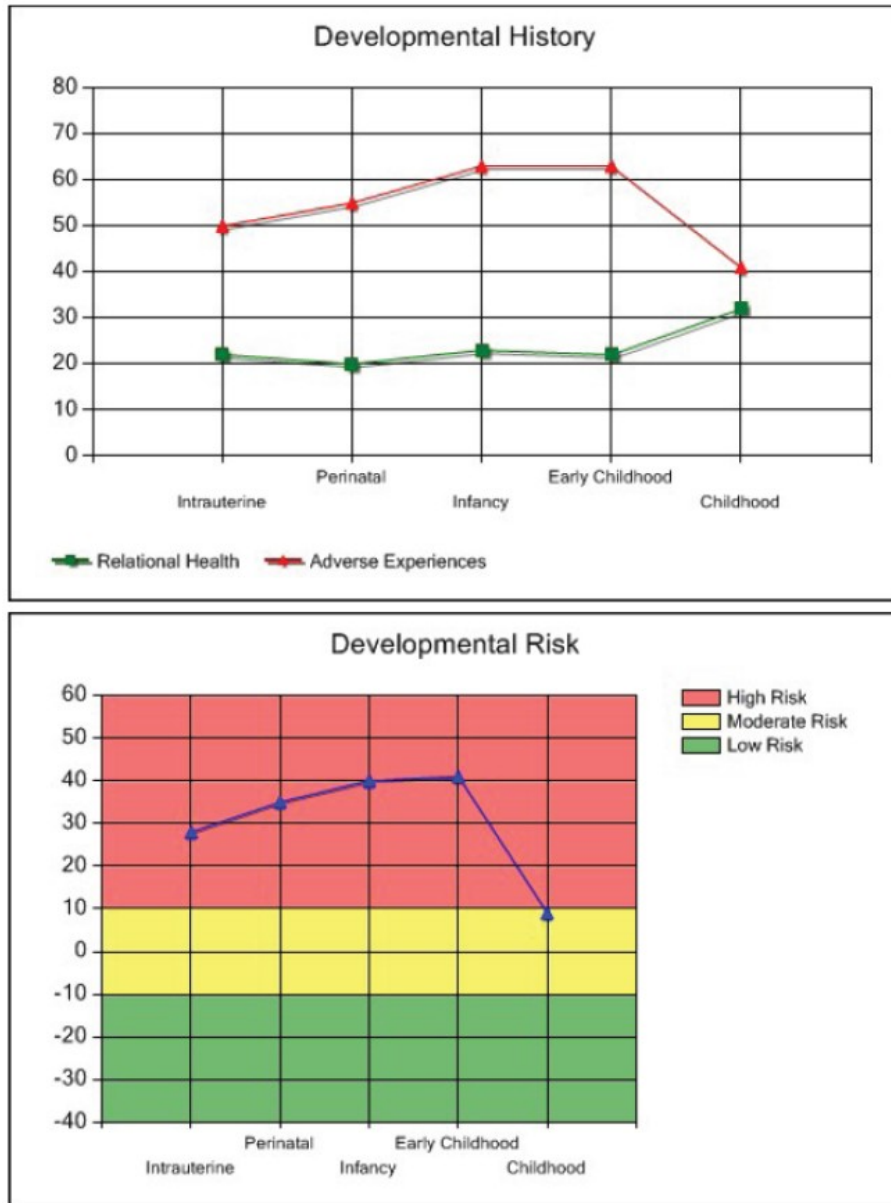


Figure 1. Graphic representation of NMT Clinical Practice Tools (Part A & B): The NMT assessment process examines both past and current experience and functioning. A review of the history of adverse experiences and relational health factors helps create an estimate of the timing and severity of developmental risk that may have influenced brain development (see graph). In the sample graph, both the timing and severity of risk and resilience factors are plotted (top graph) to generate an overall developmental risk estimate (bottom graph). In this case this individual was at high risk for developmental disruptions – with potential significant functional consequences – during the entire first five years of life.

In Part C (CNS Functioning: Current) the clinician rates a set of brain-mediated functions spanning from basic autonomic regulation, such as cardiovascular regulation (heart rate), to sleep, feeding/appetite, fine motor skills, affect regulation, relational skills, arousal, ability to modulate reactivity/inhibit impulsivity, and abstract/reflective thinking skills. Clinicians rate whether a child's capabilities are "age typical" or whether they fall above or below age typical on the 32 items that make up the CNS Functioning checklist on a scale of 1-12, where 1-3 = Severe Dysfunction, 4-6 = Moderate Dysfunction, 7-9 = Mild Dysfunction, and 10-12 = Normal Range.

In Part D (Current Relational Health) the clinician scores of the quality of a child's current relational health ("connectedness") across nine different domains, including primary caregivers, siblings, extended family, school, peers, and community. Clinicians rate the quality of the child's current relational experiences on a scale from 1-12 from Poor (1-3), Episodic (4-6), Adequate (7-9) to Positive (10-12).

The Caregiving Challenge Estimator, a supplement to the NMT Clinical Practice Tools, was added to the web-based application in 2017. The Caregiving Challenge Estimator (CCE) is intended to provide a rough estimate of the 'caregiving burden' facing a primary caregiver(s) at a given moment in time. It provides a set of potential resources to 'rate'. These are categorized into "Internal Resources" (e.g., physical health, education, caregiving experience, mental health) and "External Resources" (e.g., extended family, connection to community & culture, social network) which help provide some estimate of the strengths (or vulnerabilities) of the caregiving environment of a home. The challenge posed by the children is weighed against the resources of the caregiving setting to determine a caregiving "Reserve" score. The scores can be used in psychoeducation for caregivers about the need for respite, in home supports, self-care plans and so forth. In turn these scores can be helpful to agencies considering questions of placement (e.g., adding more foster children to a home or approving an additional adoptive child) and allocation of limited resources such as home visiting supports.

B. The NMT Metric Report and Treatment Planning: The resulting report provides a three-page, graphic representation of the child's developmental history (see Figure 1) and a heuristic of their brain's current functional status relative to same-age peers (Figure 2). This report also uses the data from Part C to create an estimate of the client's executive functioning, the 'cortical modulation ratio', as well as the relative functional status in four major domains: sensory integration, self-regulation, relational and cognitive functioning. These results are used to select and sequence enrichment, educational and therapeutic activities that can plausibly influence the targeted neural networks (e.g., motor, relational) with adequate nature, pattern and frequency of experience to effect positive change. The core principles of neuroplasticity help guide this treatment planning process (see Kleim & Jones, 2008) and multiple examples of a detailed therapeutic process using the NMT Metrics to guide treatment selection and sequencing have been described elsewhere (Perry & Dobson, 2013; Perry, 2014; Gaskill & Perry, 2017, Perry & Szalavitz, 2017; Steinkopf, Bræin, & Nordanger, D., 2017).

Client (14 years, 3 months)

Report Date: 12/4/2010

4	8	7	2	2	9
11	10	7	2	6	10
3	3	8	1	8	8
	10	5	2	3	
	11	6	4	3	
		4	4		
		8	10		
		9	6		

Age Typical - 14 to 16

10	10	10	10	10	10
12	12	12	10	10	11
11	11	12	11	10	12
	11	11	11	12	
	12	12	12	11	
		12	12		
		12	12		
		12	12		

Figure 2. CNS Functional Status Measure ("Brain Map"): Above is an example of a functional brain "map" produced by the web-based NMT Clinical Practice Tools application. The top image (with the red squares) corresponds to a client (each box corresponds to brain functions mediated by a region/system in the brain). The map is color coded with red indicating significant problems; yellow indicates moderate compromise and green, fully organized and functionally capable). The bottom map is a comparative map for a "typical" same-aged child. The graphic representations allow a clinician, teacher, or parent to quickly visualize important aspects of a child's history and current status. The information is key in designing developmentally appropriate educational, enrichment and therapeutic experiences to help the child.

Central to NMT recommendations is the recognition of the importance of the therapeutic, educational and enrichment opportunities provided in the broader community, especially the home and school. The power of relationships and the mediation of therapeutic experiences in culturally respectful relational interactions are core elements of the NMT recommendations (Ludy-Dobson & Perry, 2010). While not a formal wraparound, the NMT recommendation process starts with a focus on the *Therapeutic Web* – the collective of healthy invested adults and peers who provide the relational milieu of the child; the quality and permanence of this relational milieu is one of the most essential elements of successful outcomes (see Mears, Yaffe & Harris, 2010; Bruns et al., 2010). Ideally this is where the Neurosequential Model in Education (NME) can be a component of the intervention (see below). The school personnel often need support and psychoeducation to better understand the child, create realistic expectations and services to “meet” a client where he or she is developmentally. In clinical situations where the school is “trauma-informed” and the client’s teachers understand the effects of trauma, attachment disruptions, neglect and related adversities (e.g., food and housing insecurity, a more seamless treatment process can create therapeutic opportunities throughout the school day.

The next set of recommendations focuses on the family, often the key to the therapeutic approach. In many cases, the parent’s history will mirror the child’s developmental history of chaos, threat, trauma or neglect. When this is the case, the NMT will include the parents and provide recommendations to help address their multiple needs in addition to those of their child. Transgenerational aspects of vulnerability and strength in a family play important roles in the child’s educational, enrichment and therapeutic experiences. When the caregivers and parents are healthy and strong, their capacity to be present, patient, positive and nurturing is enhanced. When the parents’ needs are unmet and their own mental health is compromised as a result, it is unrealistic to expect that they will have the energy or capacity to meet all of the therapeutic needs of challenging maltreated children. In other cases, caregivers (e.g., biological parents, foster parents or adoptive parents) may be experienced and nurturing but not very “trauma-informed”; maltreated children can present with complex and confusing problems that even a team of professionals do not understand. This is where a capacity-building and ongoing psychoeducational approach is essential to help them help their child: the Neurosequential Model in Caregiving (NMC) helps address this. As described later, the NMC can help build capacity, encourage self-care and increased connectedness for the family.

The final stage of treatment planning involves the client. Individual recommendations are based upon the client’s neurodevelopmental organization. The selection and timing of various enrichment, educational and therapeutic experiences are guided by the developmental capabilities and vulnerabilities of the child, as determined from the results of the NMT Metric assessment. The NMT Metric report suggests some, but not all, activities that can provide patterned, repetitive and rewarding experiences. The goal is to help create therapeutic experiences that are sensitive to developmental status in various domains and that are aware of the individual’s regulatory state: “Know the Stage (of development) and Watch the State (of regulation”.

C. Certification in the NMT: The NMT Certification process is 150 hours of didactic and case-based training designed to introduce the NMT assessment process, the NMT Clinical Practice Tools/Metrics, and the core concepts of neurodevelopment, neuroplasticity, attachment theory, traumatology, and child development that inform work with traumatized and maltreated children, youth and adults. The certification process consists of three phases.

Phase I is the introduction to the NMT and the key principles that underlie the clinical applications used with the model. The primary goals of Phase I are for clinicians to build comfort with, and experience in, organizing clinical information in a neurodevelopmentally-informed way and develop mastery in using the NMT metric package. Phase II/TTT provides training in advanced clinical concepts, and is intended for a Train-the-Trainer component of the model. Internal fidelity and sustainability is provided by a cohort of Trainers completing the Phase II/TTT phase. Post completion of NMT Phases I and II/TTT, the Maintenance Phase begins. The intention of this phase is to ensure that clinicians are provided ongoing access to any enhancements to the NMT Practice Tools and related improvements in the NMT process. This phase also provides the CTA opportunity to help assure fidelity to the NMT.

NMT Database, Outcomes and Research

As the NMT Metrics are web-based, all of the data (deidentified) is gathered on a central database. Therefore, the developmental experiences and current functioning of all of the clients (and a set of 'typical' individuals) are on a central database which can be used to better understand the impact of experience on development. There are approximately 1,700 providers throughout the world who have achieved acceptable reliability in using the NMT Metrics. The Metrics, as described above, provide a way of organizing information regarding a child's developmental experience and current functioning. This dataset is unique and growing, with roughly 20,000 cases provided by NMT users who have acceptable or high fidelity. To date several important observations regarding the timing of developmental trauma (i.e., adversity in the first two months of life are the major contributor to functional outcomes in youth) and the power of relational connectedness (the best predictor of current functioning in youth is current relational health, not history of adversity) have been reported (Hambrick, Brawner & Perry, 2018; Hambrick et al., in press). This large NM dataset will allow a much more nuanced and granulated examination of the relationships between developmental experiences, good and bad, and various functional outcomes in multiple domains.

Development of the Neurosequential Model in Education (NME) and NM for Caregivers (NMC)

The first use of the NMT outside of the CTA's clinic was in an early childhood setting in 2006. Dr. Rick Gaskill and colleagues brought the NMT to a preschool setting serving at risk children with high rates of dysregulation and various social and emotional delays. In this version of the NMT, the senior clinical consultant (RG) and staff with advanced clinical training (MSW or higher) carried out the assessments, implemented treatment plans and provided psychoeducational support to frontline staff and parents. The results were promising with the

children having parents who participated in the NMT-guided activities at the school experiencing the best outcomes (Barfield et al., 2012). It became clear, however, that if these children matriculated to a public-school setting where the staff and teachers were not 'developmentally-sensitive' or 'trauma-informed' (like the staff at the NMT-trained pre-school) the positive effects faded. These children were misunderstood, and punitive, marginalizing interventions were used to address behavioral problems. The positive impact of the NMT in that setting faded without ongoing 'developmentally-sensitive' educational practices. Two things were clear from this and related clinical experiences: 1) schools needed support to better understand maltreated and traumatized children and youth and 2) parents and families needed to be engaged and supported to optimize any benefits provided in the school or clinic.

This was a major impetus to create the Neurosequential Model[®] in Education (NME) and the Neurosequential Model[®] in Caregiving (NMC). A major component of the NMT is the 'capacity building' component which focuses on teaching the core concepts and heuristics intended to introduce basic neuroscience, neurodevelopment, attachment, trauma, neglect, resilience, epigenetics and host of other topics key to understanding and working with maltreated or traumatized children and their families. In 2010, elements of this 'psychoeducational' content was modified to create materials and process with a focus on the educational setting (NME). Beta versions of the NME were provided to selected schools with good success. An NME Trainers model (a modification of the NMT Train-the-Trainer program) was developed in 2012. By 2018, one thousand individuals with access to over 6000 schools in 34 states and 10 countries have become NME Trainers; and this NME community continues to grow. Preliminary outcome data from these schools has been very promising; many report fewer critical incidents, increased attendance, fewer teacher sick days and improved standardized test scores (Whyde & Boldman-Buzard, 2017; Australian Council for Education Research, 2015; McNally & Ewing, 2017).

For many years, a major focus of feedback from our NMT Community was the need for further translation of these NM concepts for non-professionals including parents, kinship carers, foster and adoptive parents. Several of the CTA's partners (e.g., Cal Farley's Boys & Girls Ranch in Texas and Mount St. Vincent Home in Denver) have created modifications of the core content of the NM to use with caregivers. In 2016 the CTA started a pilot of the Neurosequential Model in Caregiving (NMC) with a state-wide collaborative of child and family-serving organizations in Arizona led by the Arizona Council of Human Service Providers. A modification of the core concepts and teaching heuristics of the NMT provide the curricular framework and ongoing web-based case discussions of challenges facing foster, kinship and adoptive parents provide the context for capacity building. The feedback has been positive. Independent evaluation data (LT Partners for Change, 2018) demonstrate that the majority (92%) of participants agreed or strongly agreed when asked if their participation in the webinars helped them be a better caregiver to the children in their care. Almost 90% of respondents stated that their participation in the webinars positively changed their approach with their child and/or situations with their child. 96% of respondents said the information will improve their caregiving skills. An exportable version of the NMC will be available in 2019.

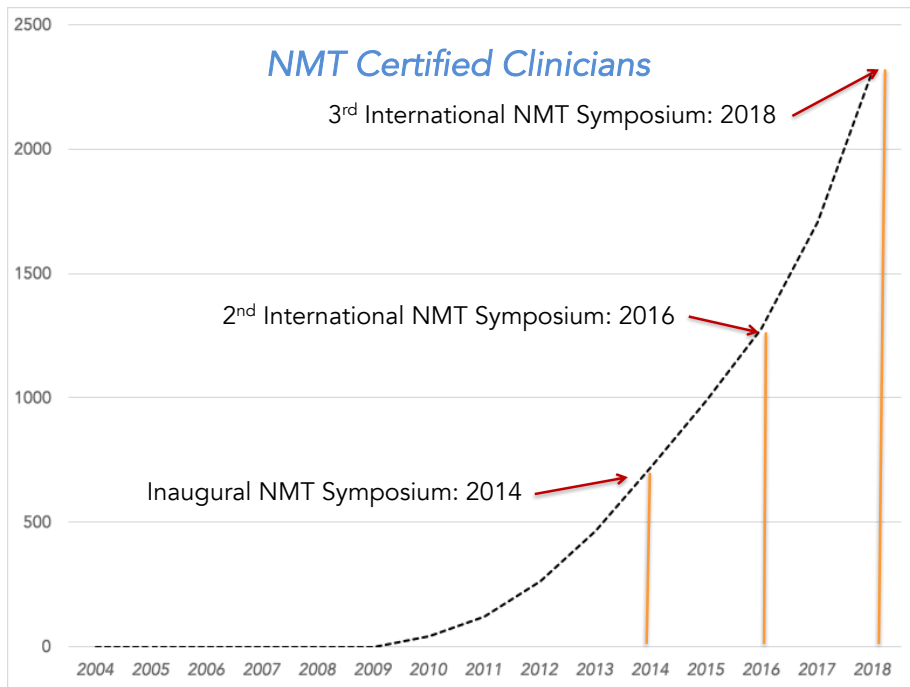
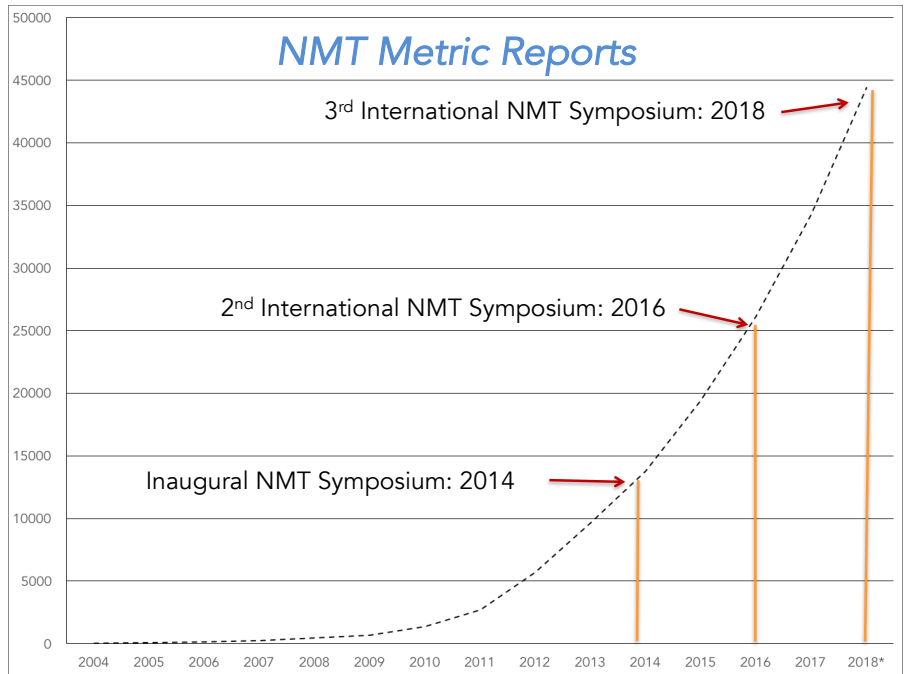


Figure 4. Growth of the NMT: These two graphs illustrate the growth of NMT-certified clinicians (bottom). Since the NMT Certification process was introduced the number of NMT-certified clinicians has grown from 0 in 2008 to over 2000 in 2018. The top graph illustrates the growth of NMT metric reports in the web-based dataset; projected to be over 60,000 by 2020.

Summary and Future Directions

The Neurosequential Model offers multiple cost effective ways to integrate core concepts of developmental psychology and neurobiology into clinical practice, education and the home. This approach has been used in public systems, thereby, allowing the systematic assessment of large numbers of complex children with relatively high fidelity. This is allowing better studies of the complex clinical phenomenology and neurobiology associated with maltreatment (e.g., Hambrick, Brawner & Perry, 2018). As with any approach there are shortcomings – primarily the time required to become trained to use the NMT metrics with fidelity and the challenge of having the resources and capacity to act on the NMT-derived recommendations. We believe these are outweighed by the capacity to track outcomes, ensure acceptable fidelity, and help create a developmentally sensitive, trauma informed lens through which to understand complex children and their families.

Ongoing studies of outcomes at several large clinical settings using the NMT will allow a more comprehensive evaluation of this approach in comparison with treatment as usual. Several key questions need to be addressed: which aspect of this multi-dimensional approach resulted in the positive outcome? Was it the “in-room” aide? The therapeutic massage or OT-directed activities? The psychoeducation for the foster family? Stopping the medications? The challenge of tracking outcomes and developing an “evidence base” and outcome studies for the clinical settings using the NMT will have to be dissected, to some degree, from the application of specific treatments (many of them evidence based treatments or EBTs) that end up being recommended by the NMT process.

NMT is still a “young” approach, only ten years have passed since the first systematic exporting of the model using a certification process. Despite this, the web-based nature of the NMT metrics allow collection of data at a very rapid pace. This dataset is now large enough to allow more detailed examination of important relationships between developmental experience (including the timing and nature of adversity, as well as resilience-related factors) and functional outcomes (e.g., Hambrick, Brawner & Perry, 2018). At present, we have more than 40,000 children, youth, and adults in the current data set. The projected number of NMT-assessed individuals will approach 60,000 in the 2020.

Current NM-related activities of the CTA include: 1) ongoing evaluation and modification of NMT Metrics (including modification of gender-related items & development of culturally-sensitive certification and training elements for; 2) development of data analysis packages and statistical models for research and site-related QI/QA evaluation; 3) development of university-based NMT/NME certification packages (an effort pioneered by Dr. Christie Mason of Loyola University, Chicago School of Social Work); 4) additional targeted versions of the Neurosequential Model including the NMT-Early Childhood Version and The Neurosequential Model in Sport (NM-S), 4) modification and revision of all NM-related multimedia content in collaboration with two Federally funded projects CORE Teen (<https://spaulding.org/professionals/spaulding-institute/core-critical-on-going-resource-family->

[education/](#)) and the NTDC (National Training and Development Curriculum for Foster/Adoptive Parents: <https://ntdcportal.org>); 5) development of advanced and proactive NM training opportunities (both advanced clinical workshops and NMT/NME boot camps) in collaboration with our new NM College. Collectively we are hopeful that we will continue to learn from our colleagues and clients and remain hopeful that a developmental and neuroscience-informed approach can help individuals and advance our field.

References

Australian Council for Education Research (2015) ACER Social-Emotional Wellbeing Survey. Summary School Report RADAR (Tasmania)

Anich, Z. & King, E. (2013) Trauma, neuroscience and SEBN: an evaluation of training. Presentation at: Annual Conference for Educational Psychologists in Scotland

Balas, E. A. & Boren, S.A. (2000) Managing clinical knowledge for health care improvement. *Yearbook Med Inform.* 2000; (1): 65–70

Barfield, S., Dobson, C., Gaskill, R., & Perry, B. D. (2012). Neurosequential model of therapeutics in a therapeutic preschool: Implications for work with children with complex neuropsychiatric problems. *International Journal of Play Therapy*, 21(1), 30-44.
<http://dx.doi.org/10.1037/a0025955>

Brandt, K., Diel, J., Feder, J. & Lillas, C. (2012) A problem in our field. *Journal of Zero to Three*; 32(4), 42-45

De Nooyer, K.M. and Lingard, M. (2016) Applying principles of the Neurosequential Model of Therapeutics across an adolescent day program and inpatient unit. *Australasian Psychiatry* 2016 Jul 12, pp 1-4, PMID: 27406931 DOI: 10.1177/1039856216658824

Draper, N.R. (1987). *Empirical Model-Building and Response Surfaces* p. 424, Wiley. New York ISBN 0471810339

Hambrick, E., Brawner, T., & Perry, B.D. (2018). Examining developmental adversity and connectedness in child welfare-involved children. *Children Australia*, 43(2), 105-115.
doi:10.1017/cha.2018.21

Hambrick, E., Brawner, T., Perry, B.D., Wang, E., et al. (2018) Restraint and critical incident reduction following introduction of the Neurosequential Model of Therapeutics (NMT). *Residential Treatment for Children & Youth*,
<http://www.tandfonline.com/doi/full/10.1080/0886571X.2018.1425651>

Hambrick, E., Brawner, T., Perry, B.D., Wang, E., Griffin, G., DeMarco, T., Capparelli, C., Grove, T., Maikoetter, M., O'Malley, D., Paxton, D., Freedle, L., Friedman, J., Mackenzie, J. Perry, K.M., Cudney, P., Hartman, J., Kuh, E., Morris, J., Polales, C. & Strother, M. (2018) Restraint and critical incident reduction following introduction of the Neurosequential Model of Therapeutics (NMT). *Residential Treatment for Children & Youth*,
<http://www.tandfonline.com/doi/full/10.1080/0886571X.2018.1425651>

Hambrick, E.P., Brawner, T., Perry, B.D., Brandt, K., Hofeister, C. & Collins, J. (in press) Beyond the ACE Score: Examining relationships between timing of developmental adversity, relational health and developmental outcomes in children. *Archives of Psychiatric Nursing*

Kleim, J.A. & Jones, T.A. (2008) Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *Journal of Speech, Language and Hearing Research* 51: S225-S239

LT Partners for Change (2018) Arizona's Neurosequential Model in Caregiving Project. Webinar Survey Results. The Arizona Council of Human Service Providers, Phoenix, AZ

Ludy-Dobson, C. & Perry, B.D (2010) The role of healthy relational interactions in buffering the impact of childhood trauma in Working with Children to Heal Interpersonal Trauma in (E. Gil, Ed.) The Guilford Press, New York pp 26-44

McNally, E. & Ewing, A. (2016) A journey to calm: utilizing a Neurosequential Model to effect school turn around. Presented at

Morris, Z.S., Wooding, S. & Grant, J. The answer is 17 years, what is the question: understanding time lags in translational research. *J R Soc Med* 2011: 104: 510–520. DOI 10.1258/jrsm.2011.110180

Perry, B.D. (2006) The Neurosequential Model of Therapeutics: Applying principles of neuroscience to clinical work with traumatized and maltreated children In: Working with Traumatized Youth in Child Welfare (Ed. Nancy Boyd Webb), The Guilford Press, New York, NY, pp. 27-52

Perry, B.D. (2009) Examining child maltreatment through a neurodevelopmental lens: clinical application of the Neurosequential Model of Therapeutics. *Journal of Loss and Trauma* 14: 240-255

Perry, B.D. (2014) The Neurosequential Model of Therapeutics in young children. In *Infant and Early Childhood Mental Health: Core Concepts and Clinical Practice*. (K. Brandt, B.D. Perry, S. Seligman & E. Tronick, Eds) American Psychiatric Press, Washington DC, pp. 21-54.

Perry, B.D. (2017) Trauma- and stress-related disorders in Textbook of Child and Adolescent Psychopathology: Third Edition in (Theodore P. Beauchaine and Stephen P. Hinshaw, Eds) Wiley, New York pp 683-705

Perry, B.D. & Dobson, C. (2013) Application of the Neurosequential Model (NMT) in maltreated children. In *Treating Complex Traumatic Stress Disorders in Children and Adolescents*, (J. Ford & C. Courtois, Eds) Guilford Press, New York, pp. 249-260.

Perry, Bruce D. and Maia Szalavitz *The Boy Who Was Raised As A Dog: And Other Stories from a Child Psychiatrist's Notebook: What Traumatized Children Can Teach Us About Life, Loss and Healing: Revised and Updated*. Basic Books, New York, 2017

Steinkopf, H., Bræin, M.K. & Nordanger, D. Ø. (2017) Kartlegging av barn med "The Neurosequential Model of Therapeutics" *Journal of the Norwegian Psychological Association (TIDSSKRIFT FOR NORSK PSYKOLOGFORENING 2017 S. 958–969 FAGFELLEVDERT)*

Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press. ISBN 978-0-521-66363-2.

Whyde, J. & Boldman-Buzard, J. (2017) *Building Better Lives: Promoting Healthy Children, Strong Families and Thriving Communities*. Franklin County Family and Children First Council. Columbus OH.

Zarnegar, Z., Hambrick, E., Perry, B.D., Azen, S. & Peterson, A. (2016) Clinical improvements in adopted children with Fetal Alcohol Spectrum Disorders through neurodevelopmentally-informed clinical interventions: a pilot study. *Clinical Child Psychology and Psychiatry* 1-17
DOI: 10.1177/1359104516636438

Biography

Dr. Perry is the Senior Fellow of [The ChildTrauma Academy](#), a not-for-profit organization based in Houston, TX and Professor (Adjunct) in the Departments of Psychiatry and Behavioral Sciences at the Feinberg School of Medicine at Northwestern University in Chicago and the School of Allied Health, La Trobe University in Melbourne. He is the author, with Maia Szalavitz, of [The Boy Who Was Raised As A Dog](#), a bestselling book based on his work with maltreated children and [Born For Love: Why Empathy is Essential and Endangered](#). Over the last thirty years, Dr. Perry has been an active teacher, clinician and researcher in children's mental health and the neurosciences holding a variety of academic positions. Dr. Perry is the author of over 500 journal articles, book chapters and scientific proceedings and is the recipient of numerous professional awards and honors, including the T. Berry Brazelton Infant Mental Health Advocacy Award, the Award for Leadership in Public Child Welfare, the Alberta Centennial Medal and the 2014 Kohl Education Prize. He serves on the Board of Directors of multiple organizations including Prevent Child Abuse America (PreventChildAbuse.org) and the Ana Grace Project (AnaGraceProject.org).