The Neurosequential Model of Therapeutics as Evidence-based Practice

The Neurosequential Model of Therapeutics (NMT) is a developmentally sensitive, neurobiology-informed approach to clinical problem solving. NMT is not a specific therapeutic technique or intervention. It is an approach that integrates core principles of neurodevelopment and traumatology to inform work with children, families and the communities in which they live. The Neurosequential Approach has three key components – training/capacity building, assessment and then, the specific recommendations for the selection and sequencing of therapeutic, educational and enrichment activities that match the needs and strengths of the individual.

As described by Brandt and colleagues (2012) – “The Neurosequential Model of Therapeutics (NMT) (Perry, 2006) provides an integrated understanding of the sequencing of neurodevelopment embedded in the experiences of the child, and supports biologically informed practices, programs, and policies. As a global evidence-based practice (EBP) and coupled with the NMT’s brain mapping matrix, the model supports providers in identifying specific areas for therapeutic work and in selecting appropriate therapies, including evidence-based therapies (EBTs), within a comprehensive therapeutic plan. Organized NMT-based intervention models, such as NMT therapeutic child care, can be EBTs.”

A more detailed overview of the NMT will help articulate why NMT is an EBP. 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.

A review of current functioning identifies problems and strengths in current functioning and helps generate a visual representation of the child’s estimated current
functioning organized into a neurobiological fashion; this generates a Functional Brain Map (see below). The NMT “mapping” process helps identify various areas in the brain that appear to have functional or developmental problems; in turn, this helps guide the selection and sequencing of developmentally sensitive interventions. These interventions are designed to replicate the normal sequence of development beginning with the lowest, most abnormally functioning parts of the brain (e.g., 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; 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 (limbic) and will have a difficult time engaging in more verbal/insight oriented (cortical) therapeutic and educational efforts.

The NMT Web-based Clinical Practice Tools (aka, NMT Metrics) help provide a structured assessment of developmental history of adverse experiences, relational health and current brain-mediated functioning. 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.
Above is an example of a functional brain "map" produced by the web-based NMT Clinical Practice 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.

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 treatment recommendations would shift to more relational and cognitive-behavioral focused interventions including a range of EBTs such as PCIT or TF-CBT.

NMT Training and Certification

The NMT training and capacity building component (NMT Certification) is a manualized yet flexible process that involves a minimum of 90 hours. Certification incorporates didactic teaching with web-based sessions using clinical cases presented by participating clinicians. It also incorporates multimedia and reading materials that focus on child development, neurobiology, traumatology, attachment theory and a host of related areas relevant to understanding the impact of maltreatment and other developmental insults on the developing child. The CTA has developed an NMT training certification process for individual clinicians and organizations. This training process provides the necessary exposure to the core concepts, practical application and use of the web-based NMT Metrics to establish and maintain fidelity required for examining clinical outcomes and conducting research using the NMT Metrics as part of the evaluation package. Certified clinicians from across the world demonstrate high fidelity and inter-rater reliability when "evaluating" and scoring the same client data.

The NMT is widely applicable to a variety of clinical and educational environments and has been integrated into a variety of settings across the full life cycle – infants through adults - including therapeutic preschools, early head start programs, infant mental health, ECI programs, residential treatment centers, schools and in numerous private and outpatient clinical practices working with young children, youth and adults. Several large public child protective services and child mental health settings have become certified and routinely use the NMT to help guide clinical decision-making.
Evidence-based Practice and the NMT

Over the past decade there has been a movement toward practice accountability from federal, state and foundation funding sources demanding proof of the effectiveness for specific interventions (Austin & Roberts, 2002). This increased interest in accountability has led toward more “evidence-based” work throughout various disciplines. Similarly, evidence-based medicine (EBM) refers to aspects of medical care in which the scientific method is applied to certain parts of medical practice. It seeks to assess the quality of evidence relevant to the risks and benefits of treatments (including lack of treatment). Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients (Sackett, 1996). The NMT adheres to these principles and as this relatively “young” approach to clinical work is disseminated, an impressive body of evidence is accumulating (see references below); some of this has been published, and much of it is in the process of being prepared for publication.

There are various levels of “evidence” which are to be considered when making the designation of “evidence-based.” For example, the U.S. Preventive Services Task Force uses the following to ranking evidence about the effectiveness of treatments:

Level I: Evidence obtained from at least one properly designed randomized controlled trial.
Level II-1: Evidence obtained from well-designed controlled trials without randomization.
Level II-2: Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.
Level II-3: Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.
Level III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

The Neurosequential Model of Therapeutics currently meets criteria for Level III, Level II-3, Level II-2 and Level II-1. Randomized controlled trials in several settings are underway.

The NMT has the following EBP elements:

1.) Multiple sites participating in NMT Training Certification gather data that is used to determine efficacy of the model. The NMT model in these sites is employed in therapeutic preschools, residential treatment facilities, out-patient clinical settings, and large state child welfare systems. There are several cross-validation projects underway to compare NMT Metrics with a variety of other common metrics (e.g., CAFAS, CBCL, TSC).

2.) There are several reports from independent groups using the NMT that have demonstrated positive outcomes.

3.) All NMT-certified sites have demonstrated improved outcomes (using both NMT and non-NMT metrics such as incident reports, restraints, changes in CAFAS). In cases where the data were collected in systematic fashion these outcomes are statistically significant when compared to previous “treatment as usual” at the same site or organization.

4.) NMT metrics have been shown to be valid (both face valid and cross-validity have been examined) and reliable. There is a network wide inter-rater reliability process and ongoing “ratings meeting” to allow ongoing correction and supervision.

5.) The Certification and training process are manualized with a robust fidelity model (including inter-rater reliability and case-auditing process).
In 2015 the Federally funded National Quality Improvement Center for Adoption/Guardianship Support and Preservation (QIC-AG: http://qic-ag.org) rated the NMT as LEVEL 3 Emerging Practice (see below). When a number of current “in preparation” and “in press” reports are published, the NMT will meet their criterion for LEVEL 2 Supported by Research Practice.

**QIC-AG Level of Evidence**

The interventions and programs were identified from multiple sources that use various scales and levels for rating the evidence. Given the variations among the existing scales, the QIC-AG developed a six-level Evidence Rating Scale or “crosswalk” that enabled the project to approximate the level of evidence for each intervention by using one or more of the following three methods: 1) a review conducted by one or more credible evidence-based review organizations, 2) information provided by the developer or purveyor of the intervention, or 3) additional information about the intervention that was obtained from searches conducted by QIC-AG staff.

The QIC-AG developed and adapted the following Evidence Scale to ensure consistency and utility for the QIC-AG.

- **LEVEL 6**: Failed to Prove Positive Effect. Interventions in this level have been tested in studies but have not established positive findings.
- **LEVEL 5**: Better Practice. Interventions in this level constitute guidelines or practices primarily driven by clinical wisdom, guild organizations, or other consensus approaches that do not include systematic research evidence.
- **LEVEL 4**: Promising Practice. Interventions in this level are recognized by professionals and organizations in the field to have demonstrated an impact. This level of includes promising practices and acceptable treatments that have some research evidence or a record of clinical experience from experts or other respected authorities. Rigor of evaluation is low. Interventions appear to produce desired results and have shown promise in improving client outcomes in studies using non-experimental design.
- **LEVEL 3**: Emerging Practice. Interventions in this level are supported and acceptable treatments with positive evidence from studies at the middle levels of the research hierarchy pyramid, including non-randomized studies, which are also referred to as quasi-experimental studies; observational studies; correlation studies; and comparative studies. Examples include panel studies, cohort studies, and case-control studies.
- **LEVEL 2**: Supported by Research. Interventions in this level are supported with positive evidence from two or more quasi-experimental studies or at least one randomized controlled trial. Evidence at this level indicates a strong likelihood that intervention produces the desired effects, but the evidence has not risen to the level of proving cause-and-effect.
- **LEVEL 1**: Effective and Proven by Research. Interventions in this level are well-supported with positive evidence from two or more randomized controlled trials (RCTs). RCTs are the “gold standard” in research, indicating a high level of evaluation rigor. However, given the high cost of conducting RCTs, fewer interventions have been evaluated using this design.


Summary of Selected Reports and Publications related to NMT as “EBP”

Rationale for a neurodevelopmental approach to maltreated children


Read, J., Perry, B.D., Moskowitz, A. & Connolly, J. (2001) The contribution of early traumatic events to schizophrenia in some patients: a traumagenic neurodevelopmental model. Psychiatry 64 (4) 319-345


Core elements of the Neurosequential Model of Therapeutics


Prasad, N. (2011) Using a neurodevelopmental lens when working with children who have experienced maltreatment: A review of the literature of Bruce Perry. Children, Young People and Families Research and Program Development, Social Justice Unit, UnitingCare, Paramatta, NSW, 1-17


Application and outcomes using the Neurosequential Model


Mackenzie, J. (2012) Using a trauma-based approach to promote the education of troubled adolescents. Presented at: 3rd International Conference on Violence in the Health Sector, Vancouver, BC *(frequency of restraints and floor holds significantly decreased following introduction of NMT related practices)*

Grove, T. (2012) Outcomes from a pilot project examining the NMT in a residential treatment center. Report to Shaw Foundation (NMT Grant to St. Aemelian-Lakeside), Milwaukee, WI *(Positive outcomes included higher percentage of responders to Tx and larger drops in CAFAS scores with NMT-guided intervention)*.

Hansen, L. & Lusk, R. Sensorimotor intervention for children who have experienced trauma: a pilot study. Pp. 1-64 Lambert Academic Publishing, (2012) *(The study incorporated the principles of NMT in interventions with children who experienced complex trauma. Following the intervention, significant results were found, including improvements in positive behavior and emotional regulation.)*


Anich, Z. & King, E. (2013) Trauma, neuroscience and SEBN: an evaluation of training. Presentation at:
Annual Conference for Educational Psychologists in Scotland (Overview of NMT training process and implementation in Sound Lanarkshire Council Psychological Service).


Perry, B.D. (2013) A conversation about trauma assessment and intervention Casey Practice Digest, 4: June 2013 pp. 5-8

Clark, D. & Palinkas, J. (2013) Comparing parent perceptions of two programs for young children exposed to domestic violence: Neurosequential Model of Therapeutics (NMT) and psycho-educational play therapy. Mount Royal University, Centre for Child Well-Being, Calgary (Both interventions resulted in improvements overall; Achenbach overall scores in NMT-informed groups demonstrated superior improvement in comparison to the psychoeducational play therapy groups.)


Clark, D. & Palinkas, J. (2014) Adaptive functioning of children exposed to domestic violence: parent perceptions of the Neurosequential Model of Therapeutics and a psychoeducational play therapy model. Executive Summary for YWCA Calgary, Mount Royal Centre for Child Well-Being, Calgary

Wang, E., Wilkes, T.C., Perry, B.D. & McMaster, F. (2015) Open trial of the Neurosequential Model of Therapeutics (NMT) approach in a clinical setting. 28th Annual Sebastian Littman Research Day, University of Calgary (CAFAS scores showed a significant reduction of 59% (t = 10.97, p < 0.001). Cortical Modulation Ratio showed a 45% increase (t = 8.510; p < 0.001). There was a negative correlation between baseline Cortical Modulation Ratio and Post CAFAS scores (r = 0.533, p = 0.031).)


Frederico, M., Jackson, A., Black, C. & Pawsey, R. (submitted: 2016) Take Two: Implementing a therapeutic service for children who have experienced abuse and neglect: beyond evidence-informed practice (The program’s practice framework and the subsequent contribution of the Neurosequential Model of Therapeutics (NMT) is described)


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 (Reduction of restraints (more than 60%, P<0.001) and critical incidents (50%, p< 0.005) following introduction of the NMT; 10 sites, 3 countries, avg. duration of observation was over 60 months, 2700 clients with estimated $1.5 million savings.)

Reports/Theses/Dissertations examining the NMT or Using NMT Core Dataset


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. (Report on the introduction of the Neurosequential Model into Franklin County schools and related systems. Outcome from sample elementary schools (e.g., decrease in suspensions from 149 to 12 per year following the introduction of the NME).

Albright, J.G. (2017) Art therapy as a bottom-up processing intervention in the contextual framework of the Neurosequential Model of Therapeutics. Dissertation: Doctorate in Art Therapy, Mount Mary University, Milwaukee, WI


Research Reports (Using NMT Core Dataset)


Evidence-based practice and the NMT


Southwell, J. (2014) Evaluation of Boys Town’s Expressive Therapies Intervention 2012-2014 (The conceptual framework based, in part, on the NMT. A substantial majority of preschool children entered therapy in the clinical or borderline clinical symptom ranges for internalising (67%) and externalising problems (70%) and at exit from therapy, just 13% remained in the clinical or borderline clinical ranges on either of these measures. www.Boystown.com.au)
**Practice, Program & Policy Implications**


Wilcox, K (2012) Kids and trauma recovery: practice reflections from the recent Bruce Perry tours. Issues in Good Practice 50:4-5. *Australian Domestic & Family Violence Clearinghouse, University of New South Wales, Sydney*


*(NMT listed as Evidence-based Practice or EBP)*

**Other Recognitions**

The Minister of Human Services and the Alberta government selected The Preadolescent Treatment Program at Hull Services in Calgary (an NMT Flagship Program) as one of three best practice sites in Alberta (2014).

The Center for the Study of Social Policy (CSSP), a national think tank based in Washington, D.C., has selected SaintA’s trauma informed care work (using the NMT as a core element) as one of 15 exemplary initiatives that are innovative in helping youth thrive. SaintA (an NMT Flagship Program based in Milwaukee, WI) was selected out of 136 applications submitted from across the nation. (2014)

Take Two of Berry Street ((an NMT Flagship Program in Melbourne, VIC, AU) was recommended for the exceptional rating of ‘extensive achievement’ (EA) regarding assessment during the 2015 biennial quality accreditation cycle in relation to national health standards (Australia). This rating was based upon the use of the NMT and in particular the NMT Fidelity process and cross-organization benchmarking allowed by the NMT fidelity exercises.

In 2015 the Federally funded National Quality Improvement Center for Adoption/Guardianship Support and Preservation (QIC-AG: [http://qic-ag.org](http://qic-ag.org)) rated the NMT as Level 3 Promising Practice (see above)
and in 2016 NMT was selected as the emerging best-practice framework to include in an RCT in one of the primary Phases of this five-year program project dedicated to the development of best practices in Child Welfare.

In 2016 the Ministry of Human Services in Alberta, Canada (Alberta Humans Services) formally announced that they would be using the Neurosequential Model of Therapeutics (NMT) as the practice framework to support therapeutic work with at-risk, maltreated and traumatized children and youth.


For more information: ChildTrauma.org