Treatment Intervention Advisory Committee Review and Determination

Date: July 12, 2019

To: Wisconsin Department of Health Services

From: Wisconsin Department of Health Services Treatment Intervention Advisory Committee: Shannon Stuart, Ph.D. (chairperson)

RE: Determination of Neurologic Music Therapy as a proven and effective treatment for children and adults

☒ This is an initial review

☐ This is a re-review. Previously reviewed (rated) on date (rating), date (rating) and date (rating).

☐ No new research located; determination from month, year stands (details below)

Section One: Overview and Determination

Please find below a statement of our determination as to whether or not the committee views Neurologic Music Therapy (NMT) as a proven and effective treatment. In subsequent sections you will find documentation of our review process including a description of the proposed treatment, a synopsis of review findings, the treatment review evidence checklist, and a listing of the literature considered. In reviewing treatments presented to us by the Department of Health Services, we implement a review process that carefully and fully considers all available information regarding a proposed treatment. Our determination is limited to a statement regarding how established a treatment is with regards to quality research. The committee does not make decisions regarding funding.

Description of proposed treatment

NMT is defined as the therapeutic application of music to cognitive, sensory, and motor dysfunctions due to neurologic disease of the human nervous system. Treatment techniques are based on the scientific knowledge of music perception and production and the effects of nonmusical brain and behavior functions. They are not population based, but focus on engaging the brain in specific musical exercises in order to influence functional outcomes related to speech and language, cognition, and sensorimotor performance.

NMT was researched and developed by the Academy of Neurologic Music Therapy in Fort Collins, Colorado. The first certification program of NMT was held in 1999.

NMT Summary

Neurologic Music Therapy is distinguished from Music Therapy by (a) theoretical foundations drawn from primarily medical and neuroscience research and practices that (b) have established 20 clinical techniques stressing sensorimotor training, speech/Language, and cognitive training. This orientation was summarized by Traut (2015) and is the lead statement on the Neurlogic Music Therapy website (https://nmtacademy.co/home/clinic/):

Neurologic Music Therapy (NMT) is a research-based system of 20 standardized clinical techniques for sensorimotor training, speech and language training, and cognitive training. It's [sic] treatment techniques are based on the scientific knowledge in music perception and production and the effects thereof on nonmusical brain and behavior functions. Populations served by Neurologic Music Therapists include, but are not limited to: stroke, traumatic brain injury, Parkinson's and Huntington's disease, cerebral palsy, Alzheimer's disease, autism, and other neurological diseases affecting cognition, movement, and communication (e.g., MS, Muscular Dystrophy, etc). NMT encompasses neurologic rehabilitation, neuropediatric, neuropsychiatric, neurogeriatric, and neurodevelopmental therapy. Therapeutic goals and interventions address rehabilitation, development, and maintenance of functional behaviors (Thaut,2015).
The 20 clinical procedures ae summarized here: https://nmtacademy.files.wordpress.com/2015/07/nmt-definitions.pdf). Generally speaking, these technique constitute a body of related procedures that collectively constitute a manual of what is and, to some extent, how to do, Neurologic Music Therapy. As the literature review forwarded to TIAC indicates, no small amount of clinical research is directed at medical conditions e.g., stroke, Parkinson's, voice control, gait training, attention control, mood and memory issues, to name only a few.
The literature focused on in this review deals with ASD and developmental disabilities. Over 25 pages of references were forwarded with no less than 25 per page plus and additionally over 12 pages of references under the category "Sensorimotor." I considered the titles of every citation to isolate those dealing specifically with ASD and developmental disabilities. A number of these were theses, pilot studies, uncontrolled studies, etc. and several could not be located through databases and resources at the University of Wisconsin-Madison. I reviewed 12 articles that, I believe represented the ASD/Developmental Disabilities literature meeting TIAC requirements. Such selections will, of course, never satisfy everyone and I would be pleased to entertain additional reviews.

Synopsis of current review (June 2019)
Committee members completing current review of research base: Brooke Winchell and Roger Bass

Please refer to the reference list (Section Four) which details the reviewed research.

Neurologic music therapy is a particular method of music therapy that was developed from neuroscience models of music perception and production (Thaut, 2005). NMT consists of 20 standardized music therapy techniques directed toward nonmusical therapeutic goals and its scientific theories are based on the clinical neuroscience of music perception, cognition, and production.Treatment in neurologic music therapy is focused on the use of rhythm and music stimuli to drive cortical plasticity. Traditionally, music therapy has been utilized to address social, communicative, and cognitive needs of children with ASD (e.g., Kern and Humpal, 2012).

There are no systematic studies investigating the use of neurologic music therapy for movement disturbances in autism, likely due to the focus of social and communication skills in the diagnostic criteria. However, based on the above findings of movement differences in autism and the use of rhythm for other gross motor deficits, rhythm may be an appropriate accommodation for motor skill acquisition in ASD. Evidence that rhythm can be used for motor gains in a person with cerebellar ataxia can be used as a theoretical basis for using rhythm and music for movement in ASD.

Three critical components need to be considered when using music in a therapeutic context.
First, the music exercises used in therapy need to be provided by a qualified and accredited professional who is trained to understand the music theory, history, and performance, as well as the sciences underlying the therapeutic and rehabilitative aspects of music-based intervention.
Second, music-based interventions must be determined based on a diagnostic therapeutic goal. Third, in order to use music as a therapeutic tool, a therapist must understand the scientific foundations of the influence of music on functional changes in non-musical brain and behavior functions (Thaut & Hoemberg, 2014). NMT interventions and therapeutic protocols follow the Transformation Design Model (TDM), which provides a systematic step-by-step approach to designing, implementing, and evaluating the treatment process (Thaut & Hoemberg, 2014). There are six steps:

1. Diagnostic and functional/clinical assessment of the patient.
2. Development of therapeutic goals and objectives.
3. Design of functional, non-musical therapeutic exercises.
4. Translation of non-musical exercises (step 3) into functional therapeutic music exercises. 5. Outcome reassessment.
6. Transfer of therapeutic learning to functional, non-musical, "daily life" activities.

There are defined NMT protocols that can be implemented according to the treatment target. Musical Speech Stimulation (MUSTIM), Rhythmic Speech Cueing (RSC), and Symbolic Communication Training Through Music (SYMCOM) are examples of NMT techniques designed to address speech and language functions, whereas Rhythmic Auditory Stimulation (RAS) and Patterned Sensory Enhancement (PSE) are focused on different aspects of motor rehabilitation (Thaut & Hoemberg, 2014). Neurologic Music Therapy treatment techniques are standardized in terminology and application but are adaptable to meet each patient's unique needs.

Further Synopsis of Literature Reviewed
The specific articles reviewed are provided in Section 4 of this report. And, this being a synopsis, I will not detail each article, that is available in the forms provided for that purpose. I will, instead, attempt to summarize key generalizations regarding the research.
#1. The neurologic foundation. The studies reviewed did not collect neurologic data and were only obliquely related to neurologic interpretations. As one reads the research summaries submitted with this report, the "dependent variable" is never physiological—it is instead a battery of tests, data collection of rates of stereotypy, notes played on a xylophone, number of words learned in an ABA-Verbal Behavior procedure in the presence of music-vs-not, matching sounds (sung, piano, etc.) matching pictures of sad, happy, etc. faces given a musical antecedent, etc. Typically those data are descriptive—ASD-vs-typically developing children, for example and how they each perform on a given task. Those differences are then given theoretical explanations drawn from neurological theory.
#2. Clinical-vs-Statistical significance. Often the data described above are statistically analyzed multiple ways and statistical significance is found, sometimes across subtests of a larger assessment device. Two points are relevant here:
(a) The absolute amount of behavior change is often not clinically significant. For example, these data are from Quintin, Bhatara, Poissant, Fombine (2011) indicating the number of pictures (emotional faces) correctly identified by ASD and typically developing individuals that, according to the authors, reflected the mood of music played:

Emotion	ASD	Typically Developing
Happy 3.77	3.85	
Sad 3.65	4.23	
Scared 4.38	4.69	
Peaceful	2.5	3.19

All of these differences are less than one picture across the ASD and typically developing participants. (b) The differences obtained are not clinically significant unless they are explained. The design of this research was matching to sample with no training regarding what the match is. The assumption was that ASD participants may have deficient emotionality and that would be reflected in these results. The question, of course, is "Why?" And that question requires a functional analysis of the variables that resulted in the individuals making their selections. Without that, neurologic interpretation is only speculation whose superior validity has to be demonstrated. That is not done in this or any of the research reviewed here.

#3. The relative efficacy of NMT. No study reviewed here made a head-to-head comparison of NMT with methods identified by TIAC as acceptable. The closest study to a comparison was Lim and Draper (2011) where ABA's Verbal Behavior approach was combined with music in one group, no music in another, and no training as a control group. The ABA-VB plus music was not significantly different than ABA-VB alone.

#4. The studies ended too soon. Here's an example of what this means: four conditions were created: developmentally music-vs- no music and passing musical-vs-nonmusical materials. Only one condition, (No Music/Passing musical materials) was statistically significant. Why? Finding the reason(s) for this inconsistent result would have greatly clarified the relationship between music and sustained attention toward peers (the focus of the study).

In summary, it is this reviewer's opinion that few procedural differences between Music Therapy and Neurologic Music Therapy were apparent in the literature reviewed here. Despite the prolific publication history of NMT, research design issues in the area of ASD and developmental disabilities, the lack of clear clinically significant effects, and the inconsistent data even within studies suggests that NMT should receive a rating of Level 4 – Insufficient Evidence (Experimental Treatment).

Committee's Determination: After reviewing the research and applying the criteria from the Treatment Review Evidence Checklist, it is the decision of the committee that Neurologic Music Therapy (NMT) receive an efficacy rating of Level 4- Insufficient Evidence.

Review history

Initial review - no review history

Section Two: Rationale for Focus on Research Specific to Comprehensive Treatment Packages (CTP) or Models

In the professional literature, there are two classifications of interventions for individuals with Autism Spectrum Disorder (National Research Council, 2001; Odom et al., 2003; Rogers & Vismara, 2008):

(a) **Focused intervention techniques** are individual practices or strategies (such as positive reinforcement) designed to produce a specific behavioral or developmental outcome, and

(b) **Comprehensive treatment models** are "packages" or programs that consist of a set of practices or multiple techniques designed to achieve a broader learning or developmental impact.

To determine whether a treatment package is proven and effective, the Treatment Intervention Advisory Committee (TIAC) will adopt the following perspective as recommended by Odom et al. (2010):

The individual, focused intervention techniques that make up a comprehensive treatment model may be evidence-based. The research supporting the effectiveness of separate, individual components, however, does *not* constitute an evaluation of the comprehensive treatment model or "package." The TIAC will consider and review only research that has evaluated the efficacy of implementing the comprehensive treatment *as a package*. Such packages are most often identifiable in the literature by a consistently used name or label.

National Research Council. (2001). *Educating children with autism.* Washington, DC: National Academy Press.

Odom, S. L., Brown, W. H., Frey, T., Karusu, N., Smith-Carter, L., & Strain, P. (2003) Evidence-based practices for young children with autism: Evidence from single-subject research design. *Focus on Autism and Other Developmental Disabilities, 18,* 176-181.

Odom, S. L., Boyd, B. A., Hall, L. J., & Hume, K. (2010). Evaluation of comprehensive treatment models for individuals with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 40,* 425-436.

Rogers, S., & Vismara, L. (2008). Evidence-based comprehensive treatments for early autism. *Journal of Clinical Child and Adolescent Psychology, 37,* 8-38.

Section Three: TIAC Treatment Review Evidence Checklist

Name of Treatment: Neurologic Music Therapy

Level 1- Well Established or Strong Evidence (DHS 107 - Proven & Effective Treatment)

- ☐ Other authoritative bodies that have conducted extensive literature reviews of related treatments (e.g., National Standards Project, National Professional Development Center) have approved of or rated the treatment package as having a strong evidence base; authorities are in agreement about the level of evidence.
- ☐ There exist ample high quality studies that demonstrate experimental control and favorable outcomes of treatment package.
  - ☐ Minimum of two group studies or five single subject studies or a combination of the two.
  - ☐ Studies were conducted across at least two independent research groups.
  - ☐ Studies were published in peer reviewed journals.
- ☐ There is a published procedures manual for the treatment, or treatment implementation is clearly defined (i.e., replicable) within the studies.
- ☐ Participants (i.e., N) are clearly identified as individuals with autism spectrum disorders or developmental disabilities.

Notes: At this level, include ages of participants and disabilities identified in body of research

Level 2 – Established or Moderate Evidence (DHS 107 - Proven & Effective Treatment)

- ☐ Other authoritative bodies that have conducted extensive literature reviews of related treatments (e.g., National Standards Project, NPDC) have approved of or rated the treatment package as having at least a minimal evidence base; authorities may not be in agreement about the level of evidence.
- ☐ There exist at least two high quality studies that demonstrate experimental control and favorable outcomes of treatment package.
  - ☐ Minimum of one group study or two single subject studies or a combination of the two.
  - ☐ Studies were conducted by someone other than the creator/provider of the treatment.
  - ☐ Studies were published in peer reviewed journals.
- ☐ Participants (i.e., N) are clearly identified as individuals with autism spectrum disorders or developmental disabilities.

Notes: At this level, include ages of participants and disabilities identified in body of research

Level 3 – Emerging Evidence (DHS 107 – Promising as a Proven & Effective Treatment)

☐ Other authoritative bodies that have conducted extensive literature reviews of related treatments (e.g., National Standards Project, NPDC) have recognized the treatment package as having an emerging evidence base; authorities may not be in agreement about the level of evidence.
☐ There exists at least one high quality study that demonstrates experimental control and favorable outcomes of treatment package.
  ☐ May be one group study or single subject study.
  ☐ Study was conducted by someone other than the creator/provider of the treatment.
  ☐ Study was published in peer reviewed journal.
☐ Participants (i.e., N) are clearly identified as individuals with autism spectrum disorders or developmental disabilities.

Notes: At this level, include ages of participants and disabilities identified in body of research

Level 4 – Insufficient Evidence (Experimental Treatment)

☒ Other authoritative bodies that have conducted extensive literature reviews of related treatments (e.g., National Standards Project, NPDC) have not recognized the treatment package as having an emerging evidence base; authorities are in agreement about the level of evidence.
☒ There is not at least one high quality study that demonstrates experimental control and favorable outcomes of treatment package.
  ☒ Study was conducted by the creator/provider of the treatment.
  ☐ Study was not published in a peer reviewed journal.
☐ Participants (i.e., N) are not clearly identified as individuals with autism spectrum disorders or developmental disabilities.

Notes:

Level 5 – Untested (Experimental Treatment) &/or Potentially Harmful

☐ Other authoritative bodies that have conducted extensive literature reviews of related treatments (e.g., National Standards Project, NPDC) have not recognized the treatment package as having an emerging evidence base; authorities are in agreement about the level of evidence.
☐ There are no published studies supporting the proposed treatment package.

☐ **There exists evidence that the treatment package is potentially harmful.**
  ☐ Authoritative bodies have expressed concern regarding safety/outcomes.
  ☐ Professional bodies (i.e., organizations or certifying bodies) have created statements regarding safety/outcomes.

Notes: At this level, please specify if the treatment is reported to be potentially harmful, providing documentation

References Supporting Identification of Evidence Levels:

Chambless, D.L., Hollon, S.D. (1998). Defining empirically supported therapies. *Journal of Consulting and Clinical Psychology, 66(1)* 7-18.

Chorpita, B.F. (2003). The frontier of evidence---based practice. In A.E. Kazdin & J.R. Weisz (Eds.). *Evidence-based psychotherapies for children and adolescents* (pp. 42---59). New York: The Guilford Press.

Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure, 54(4),* 275-282.

Section Four: Literature Review

Literature reviewed for current determination:

Janzen, T. B. & Thaut, M. H. (2018). Rethinking the role of music in the neurodevelopment of autism spectrum disorder. Music Sci. https://doi.org/10.1177/2059204318769639

Thaut, M.H. & Braun Janzen, T. (2019). Neurologic Music Therapy. In R. D. Rieske (ed.), Handbook of Interdisciplinary Treatments for Autism Spectrum Disorder, Autism and Child Psychopathology Series, https://doi.org/10.1007/978-3-030-13027-5_20

Hurt-Thaut, C.P. & Johnson, S.B. 2003. Neurologic music therapy with children: Scientific foundations and clinical applications. In S.L. Robb (Ed.), Music Therapy in Pediatric Healthcare: Research and Evidence-Based Practice (pp. 81-100). Silver Spring, MD: American Music Therapy Association, Inc.

Thaut, M. H., McIntosh, G. C., & Hoemberg, V. (2015). Neurobiological foundations of neurologic music therapy: Rhythmic entrainment and the motor system. Frontiers in Psychology, 6, 1–6. doi:10.3389/fpsyg.2015.0118

Boso, M, Emanuele, E., Minazzi, V., Abbamonte, M., and Politi, Pierluigi. (2007). Effect of Long-Term Interactive Music Therapy on Behavior Profile and Musical Skills in Young Adults with Severe Autism. The Journal of Alternative and Complementary Medicine, Volume 13, Number 7, pp. 709–712

DePape A-MR, Hall GBC, Tillmann B, Trainor LJ (2012) Auditory Processing in High-Functioning Adolescents with Autism Spectrum Disorder. PLoS One 7(9): e44084. doi:10.1371/journal.pone.0044084

Heaton,P.,Hermelin, B., Pring, L. (1999). Can children with autistic spectrum disorders perceive affect in music? An experimental investigation Psychological Medicine, 1999, 29, 1405–1410.

Lim, H.A. (2010).Effect of developmental speech and language training through music on speech production in children with autism spectrum disorders. Journal of Music Therapy, 47(1), 2-26.

Lim, H.A., Draper, E. (2011). The effects of music therapy incorporated with applied behavior analysis verbal behavior approach for children will autism spectrum disorders. Journal of Music Therapy, 48(4), 532-550.

Quintin, E., Bhatara, P., Poissant, H., Fombine, R. (2011). Emotion perception in music in high-functioning adolescents with autism spectrum disorders. Journal of Autism and Developmental Disorders, 41(9), 1240-1255
DOI 10.1007/s10803-010-1146-0

Saylor, S., Sidener, T.M., Reeve, S.A. (2012). Progar, P.. (2012). Effects of three types of noncontingent auditory stimuluation on vocal stereotypy in children with autism, Journal of Applied Behavior Analysis, 45 (1), 185–190.

Simpson, K., Keen, D., Lamb, J. (20130. The use of music to engage children with autism in a receptive labelling task. Research in Autism Spectrum Disorders, 7, 1489-1496. doi: org/10.1016/j.rasd.2013.08.013

Sussman, J.E. (2009). The effect of music on peer awareness of preschool age children with developmental disabilities. Journal of Music Therapy, 6, 53-68.

Thaut, M.H. (1988). Measuring Musical Responsiveness in Autistic Children: A Comparative Analysis of Improvised Musical Tone Sequences of Autistic, Normal, and Mentally Retarded Individuals. Journal of Autism and Developmental Disorders, Vol. 18, No. 4.

Literature reviewed for previous determinations:

Initial review - no previous references