

Jayne Standley, PhD, MT-BC, NICU-MT  
Research Benefits of Music Therapy for  
Premature Infants: Developing an  
Evidence-Based Clinical Program

**Viewing Time**

The program will take up to one hour to complete.

**Target Audience**

This program is designed for primary care physicians.

Other health care professionals working with patients and their families may also find this program of interest.

**Faculty Disclosure**

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**Faculty Disclosure**

**Jayne Standley, PhD, MT-BC, NICU-MT,** has disclosed no actual or potential conflict of interest in relation to this educational activity.

During this educational activity **Dr. Standley** will not be discussing the use of any commercial or investigational product not approved for any purpose by the FDA.

**Research Benefits of Music Therapy  
for Premature Infants: Developing an  
Evidence-Based Clinical Program**

**Jayne Standley, PhD, MT-BC, NICU-MT**  
Robert O. Lawton Distinguished Professor, The  
Florida State University, College of Music,  
Tallahassee, Florida

**Research Benefits of Music Therapy  
for Premature Infants: Developing an  
Evidence-Based Clinical Program**

*A lecture about music therapy and its  
benefits for premature infants.*

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### Program Objectives

*Upon completion of this program, participants should be able to:*

- Identify evidence-based benefits of music therapy for premature infants
- Develop evidence-based clinical music therapy programs in collaboration with a Board-Certified MT specializing in NICU MT
- Refer premature infants for evidence-based clinical MT treatment with reimbursement

### Disclaimer

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### Accreditation

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### Receiving CME Credit

To receive CME credit you must view the entire program and complete the evaluation form at the end.



### NICU Music Therapy: Research and Clinical Practice

Jayne M. Standley, Ph.D., MT-BC, NICU-MT  
Robert O. Lawton Distinguished Professor  
College of Music, College of Medicine  
The Florida State University

### Problems of Premature Birth

- More and longer hospitalizations, increased medical costs
- At-risk for developmental disabilities, increased need for special education, especially for CP, AD/HD, SLD
- Development is impaired by overstimulation, pain, ototoxic drugs, prolonged use of oxygen or ventilator

### Neurologic Maturation

- Faster habituation to stimuli equates to greater maturation
- Premies are hypersensitive; all stimuli are cumulative
- Over-stimulation disrupts neurologic development
- When older, severely premature infants can have 1/3 less brain volume and/or damaged cell networks resulting in constant hyper-alert state

### Evidence-Based NICU-MT Procedures

- Music listening
- Multimodal stimulation
- Pacifier activated music reinforcement for feeding
- Pacifier activated music reinforcement for calming after painful medical procedure
- Music activities to teach developmental milestones after discharge

### Recorded lullaby music in the infant's incubator:



- **improves oxygen saturation levels**
- **increases weight gain**
- **shortens the duration of hospital stay by up to 2 wks.**

### The earliest language discriminations are:

- **vowel sounds**
- **rising and falling phrase inflections**
- **the recognition of soothing sounds in the voice**

All these elements are components of lullabies of all cultures.

### Least Alerting Music

- **1 instrument, unchanging accompaniment style**
- **light rhythmic emphasis**
- **major key, no modulations, 3 or fewer chord changes**
- **constant rhythm (not syncopated)**
- **constant volume**
- **melodies in the higher vocal ranges which infants hear best**
- **fetuses hear in the womb and develop a preference for women's voices so female vocalists are highly recommended**

### Music Listening Protocol

- Referral at 28 weeks or later
- Music no greater than one 4 hr. period/day. Alternating ½ hr. periods of music and rest has also been successful
- dB level between 65-75 Scale C
- Use least alerting music until infant is 34 aga or until feeder/grower status
- Record oxygen-saturation, vital signs, length of stay
- Note: Females will probably respond better than males

### Live Singing and Multimodal Stimulation Shorten Hospital Stay:

- for female infants by an average of 11.1 days
- for male infants by an average of 1.5 days



### Multimodal MT Protocol

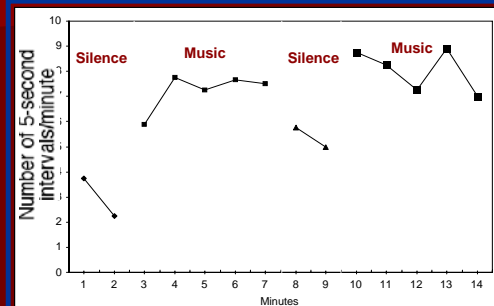
- Refer infant at 30-32 aga
- Check with primary caregiver prior to procedure to determine suitability (i.e, no traumatizing medical treatments or assessments on that day)
- Begin humming to pacify infant (30-60 sec.)
- Continue humming & massage cephalocaudally proximodistally while observing for signs of overstimulation – cease for 15 sec. in response to mild overstim, cease for the day in response to "halt hand" or multiple signs of overstim. -15'
- If infant tolerates complete massage, repeat with singing, massage, and rocking -15'
- Record physical extent tolerance, social responses

Parents can be taught to use the  
Multimodal Stimulation  
Program to reduce over-stimulation  
and they will spend more time  
visiting their child

The PAL (Pacifier-  
Activated Lullaby)  
System reinforces non-  
nutritive sucking of  
infants who have poor  
sucking motivation or  
endurance



### Pacifier Sucking Rates for Music vs. Silence



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Mean Feeding Rates in cc/minute

Group	Pre Feeding Rate	Post* Feeding Rate
Experimental (n=14)	2.25	3.03
Control (n=14)	2.43	1.93

\*indicates sig. difference between groups,  $\alpha = .05$

**PAL – Patented and Licensed**

- Has federal approval to teach feeding skills to premature infants
- Currently seeking approval for reduction of stress following painful medical procedures

**PAL Protocol - Feeding**

- Referred at 34 weeks ago
- Provide daily PAL opportunity approx. ½ hour before nipple feeding opportunity (usually 3 days)
- Record days to independent nipple feeding: avg.=3.3 days, (control group 10.4 days)

**PAL Protocol for Calming: Pre/during/post Painful Procedure**

- Refer from 32 weeks ago
- Begin PAL opportunity approximately 3 minutes prior to painful stimulus and continue for 3 minutes after up to a max. of 15 min.
- Observe behavior state and vital signs

**MT for NICU Infants**

- Improves oxygen saturation
- Stabilizes heart rate & respiration rate
- Shortens hospital stay an average of 5 days
- Increases weight gain
- Increases tolerance for stimulation
- Improves feeding
- Reduces stress after pain

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Meta-Analysis: Premature Infants

Cohen's  $d = .83$

- All effects were positive and not mediated by birth weight, gestational age at study, type of music delivery.
- Effects were not differentiated among physiological, behavioral, or developmental measures

Music for Development of  
 Premature Infants after Discharge:  
 "Little Ones"

- Weekly videotapes for 3 years by age groups: 6 months, 12 months, 18 months.
- Q1: Does music attendance promote developmental skills



Skill Scores by Group

Group Mean	N	Score
Experimental	11	12.05*
Contact Control	11	6.86

\* indicates significant  $p < .02$

Q2: What is the difference between young infants and older infants in their attentiveness and responses to music activities ?

Rank of Response Categories and % Time by Age & Proximity Status

	8 months		16 months	
	Rank	% Time	Rank	% Time
<b>In Contact with Parent</b>				
Music Therapist	1	34.1	1	23.6
Peers	2	18.4	2	13.1
Music Instruments	3	14.3	4	8.7*
Toys (non-auditory)	4	12.7	3	8.9
Parent	5	10.4	6	4.2*
Other (off-task)	6	6.8	5	7.7
<b>Contact Total</b>		<b>96.5</b>		<b>66.3</b>
<b>Independent of Parent</b>				
Peers	1	.9	3	6.6*
Toys (non-auditory)	2	.8	2	6.8*
Music Therapist	3	.6	1	9.5*
Other (off-task)	4	.4	4	6.5*
Parent	5	.3	6	1.3*
Music instruments	6	0	5	3.0*
<b>Independent Total</b>		<b>2.91</b>		<b>33.59*</b>

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**% Time Spent Attending to Peers  
 During Music vs. Non-Music Moments**

Age	During Music	No Music
8 months	6.4	3.2
16 months	7.4	2.3
In contact with parent	11.0*	4.5
Independent	2.7*	1.0

\* Indicates significant difference from no music moments,  $\alpha < .05$

**Estimated Annual Revenue for a 1/2 time  
 NICU-MT in a 40 bed Level III NICU**

NICU-MT	Treatments/Yr.	Cost/Treatment	Annual Charges	Annual Revenue @ Current rate
Multimodal Stimulation (billed using code 97533)	500 (167 infants each seen 3 times)	\$85	\$42,500	38% reimbursement for 26% of treatment = \$4,199
PAL (billed using code 92526)	750 (250 infants each seen 3 times)	\$170/treatment	\$127,500	42.6% reimbursement for 37% of treatment = \$20,096
<b>Total</b>			<b>\$450,930</b>	<b>\$24,295</b>

**NICU Length of Stay: 1 Yr Analysis**

	Gestational Age @ Birth	Birth Weight	Length of Ventilation	Length of O <sub>2</sub> Use
<b>NICU MT</b>	31.2 weeks	1.61kg @ 3 lb 9 oz	2.18 <1 week	2.23 <33 wk ga
44 M 39 F Total=83				
<b>NO NICU MT</b>	32.5 weeks	1.79kg @ 3 lb 15 oz	1.76 <1 week	2.32 <33 wk ga
51 M 71 F Total=125				

**Length of Stay Data**

	Critical Treatment And Serious Diagnoses	Length of Stay	Weight Gain per Day
<b>NICU MT</b>	1.61 Approx. .5 diagnoses	32.1 days	.018kg (.6349 ounces)
44 M 39 F Total=83			
<b>NO NICU MT</b>	1.36 Approx. .5 diagnoses	22.2 days	.011kg (.388 ounces)
51 M 71 F Total=125			

**Mean Length of Stay  
 by Birthweight Category**

Birthweight Category	NICU-MT		No NICU-MT	
	Mean days	S.D.	Mean days	S.D.
<1000g	69.4	33.3	79.0	20.5
1000-1499g	38.9	12.8	38.2	15.6
1500-2499g	21.3	10.6	14.1	7.8

**FSU Institute for Infant and Child  
 Medical MT**



Improving hospital services to infants and children by demonstrating music therapy techniques for medical treatment without trauma and for increasing neurological and developmental gains

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International Institute for Infant  
and Child Medical MT  
Florida State University

- Train NICU personnel – nurses, neonatologists, occupational and physical therapists
- Specialized training for MT-BCs in NICU-MT. We award certificate and NICU-MT credential
- Train medical personnel and MTs from other countries – Spain, England, Japan, Australia, Canada, Argentina, Venezuela,

Walt Disney Pavilion at Florida  
Children's Hospital Partnership

- 5 year business plan for an MT position on every floor to implement innovative evidence-based clinical MT
- 2 research projects/year at their hospital
- Support for graduate student and faculty research
- Member of the Florida State University College of Medicine Research Network

Comments  
and  
Questions

*Thanks for viewing  
this presentation!*



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the CME Eval button below  
and complete the form.*

- 1  **NICU Music Therapy: Research and Clinical Practice**  
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 Robert O. Lawton Distinguished Professor  
 College of Music, College of Medicine  
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- 2  **Problems of Premature Birth**
  - More and longer hospitalizations, increased medical costs
  - At-risk for developmental disabilities, increased need for special education, especially for CP, AD/HD, SLD
  - Development is impaired by overstimulation, pain, ototoxic drugs, prolonged use of oxygen or ventilator
- 3  **Neurologic Maturation**
  - Faster habituation to stimuli equates to greater maturation
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  - improves oxygen saturation levels
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- 6  **The earliest language discriminations are:**
  - vowel sounds
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  - 1 instrument, unchanging accompaniment style
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9  **Live Singing and Multimodal Stimulation Shorten Hospital Stay:**

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10  **Singing / massage**

11  **Multimodal MT Protocol**

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12  **Parents can be taught to use the Multimodal Stimulation Program to reduce over-stimulation and they will spend more time visiting their child**

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16  **Mean Feeding Rates in cc/minute**

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- 21  **Meta-Analysis: Premature Infants**  
**Cohen's d = .83**
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- 22  **Music for Development of Premature Infants after Discharge: "Little Ones"**
- Weekly videotapes for 3 years by age groups: 6 months, 12 months, 18 months.
  - Q1: Does music attendance promote developmental skills

- 24  **Skill Scores by Group**
- | Group           | N  | Score Mean |
|-----------------|----|------------|
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- 25  **Q2: What is the difference between young infants and older infants in their attentiveness and responses to music activities ?**

- 27  **% Time Spent Attending to Peers**  
**During Music vs. Non-Music Moments**

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**College of Music, College of Medicine, Florida State University**  
**Grand Rounds, Children's Hospitals and Clinics of Minnesota**

**RESEARCH RESULTS: MUSIC & PREMATURE INFANTS**

**Meta-Analysis Criteria:**

- 1) Quantitative studies using group or individual subject experimental designs
- 2) Subjects who were premature and low birth-weight infants receiving treatment in a NICU
- 3) Music as an independent variable
- 4) Research report (in English) meeting criteria for replication and data analysis.

**Effect Size Results by Study and Type of Dependent Variable**

Study	Study n	Dependent Variable	Effect Size Cohen's d
Caine (1991)	52	Days in hospital	.5045
		Weight gain	.8375
		Behavior state	.7283
Cassidy & Standley (1995)	20	Oxygen saturation	1.1885
Coleman, Pratt, Stoddard, Gerstmann, & Abel (1997)	66	Heart rate	.9190
		Oxygen saturation	.8636
		Behavior state	1.9528
		Days in hospital	.4915
Collins & Kuck (1991)	17	Weight gain	.4915
		Oxygen saturation	.6971
		Behavior state	1.2559
		Heart rate	.4555
Flowers et al. (1999)	9	Oxygen saturation	1.0503
		Behavior state	.8809
Moore, Gladstone, & Standley (1994)	22	Oxygen saturation	1.2887
Standley (1998)	40	Days in hospital	.5489
		Weight gain	.8102
Standley (2000)	12	Non-nutritive sucking rate	.7334
Standley (2003)	32	Feeding rate	.8726
Standley & Moore (1995)	20	Oxygen saturation	1.0280

**Results:**

- (1) all effect sizes were in a positive direction for the effects of music, ranging from .4915 to 1.9528
- (2) overall  $d = .83$ , the difference between the music and non-music results in standard deviation units, which is statistically significant
- (3) the Q-value was not significant ( $p = .1752$ ) which means that the effect sizes of music studies in the NICU were consistent and adequately explained by the single, mean effect size. Effects were not mediated by infants' gestational age at the time of study, birth-weight, or type of music delivery nor by physiological, behavioral, or developmental measures of benefit.

### **Studies Included in Meta-Analysis**

Caine, J. (1991). The effects of music on the selected stress behaviors, weight, caloric and formula intake, and length of hospital stay of premature and low birth weight neonates in a newborn intensive care unit. *Journal of Music Therapy*, 28(4), 180-192.

Cassidy, J. W., & Standley, J. M. (1995). The effect of music listening on physiological responses of premature infants in the NICU. *Journal of Music Therapy*, 32(4), 208-227.

Coleman, J. M., Pratt, R. R., Stoddard, R. A., Gerstmann, D. R., & Abel, H. H. (1997). The effects of the male and female singing and speaking voices on selected physiological and behavioral measures of premature infants in the intensive care unit. *International Journal of Arts Medicine*, 5(2), 4-11.

Collins, S., & Kuck, K. (1991). Music therapy in the neonatal intensive care unit. *Neonatal Network*, 9(6), 23-26.

Flowers, A. L., McCain, A. P., & Hilker, K. A. (1999). *The effects of music listening on premature infants*. Paper presented at the Biennial Meeting, Society for Research in Child Development, April 15-18, Albuquerque, New Mexico.

Moore, R., Gladstone, I., & Standley, J. (1994). *Effects of music, maternal voice, intrauterine sounds and white noise on the oxygen saturation levels of premature infants*. Unpublished paper presented at the National Conference, National Association for Music Therapy, Inc., November, Orlando, Florida.

Standley, J. M. (1998). The effect of music and multimodal stimulation on physiological and developmental responses of premature infants in neonatal intensive care. *Pediatric Nursing*, 24(6), 532-539.

Standley, J. M. (2000). The effect of contingent music to increase non-nutritive sucking of premature infants. *Pediatric Nursing*, 26(5), 493-499.

Standley, J. M., & Moore, R. S. (1995). Therapeutic effects of music and mother's voice on premature infants. *Pediatric Nursing*, 21(6), 509-512, 574.

Standley, J.M. (2003). The effect of music-reinforced non-nutritive sucking on feeding rate of premature infants. *Journal of Pediatric Nursing*, 18(3), 169-173.

### **Additionally**

Baily, K. & Katak, A. (2005) Music therapy in the neonatal intensive care unit, a multi-site study; a randomized control blind study of music therapy with high risk neonates cared for in Neonatal ICU. Presented at Music Therapy in the NICU: A symposium on research and applications of music therapy in the neonatal intensive care unit. Cleveland, Ohio, Sept.

Whipple, J. (2008). The effect of music-reinforced nonnutritive sucking on state of preterm, low birthweight infants experiencing heelstick. *Journal of Music Therapy*, 45(3), 227-272.