

Piloting Music Therapy Support for Preterm Infant Non-Nutritive Suck and Caregiver

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Introduction

Premature infants cared for in neonatal intensive care units (NICUs) may experience simple and complex health issues that impact oral motor and suck-swallow coordination. Parent caregivers and NICU healthcare team members alike work hard and closely monitor infant weight gain oral feeding skills that ultimately improve weight gain needed for intact survival. Often delays in feeding are due to poor suck and swallow coordination. This delay may lead to slower weight gain and extended hospitalization. Investigating methods to improve preterm infant oral motor skills. Challenges with oral feeding and the many other medical complications that caregivers of premature infants' face can often place a tremendous strain on caregiver mental health and stress levels. According to previous research, 40% of NICU mothers experience postpartum depression (PPD), and NICU mothers are at much higher risk of developing PPD than mothers who have infants outside of the NICU (Tahirkheli, 2014). Studies also show that up to 60% of NICU fathers experience depressive symptoms at baseline. Up to one-quarter of mothers on the NICU may experience symptoms of PTSD (Lee, 2015).

Music Therapy, as a well-established evidence-based profession of credentialed clinical providers, develop therapeutic relationships to provide developmental, rehabilitative, psychosocial, emotional, and symptom management to support neonates and their families. Music therapists use developmentally appropriate music interventions. This study aims to evaluate the use of a non-pharmacological family-centered method of offering oral motor support to premature infants and psychosocial support to families and caregivers.

The Pacifier Activated Lullaby (PAL) is an FDA approved device (Standley, 2012). PAL provides developmentally appropriate lullaby music that includes the ability to use the caregiver's voices and personalized recorded lullabies as a positive reinforcement measure to entrain and reinforce a non-nutritive sucking response among infants in NICU (Standley, 2012). The PAL intervention, extensively studied nationwide, was identified for improving non-nutritive sucking endurance, increased infant weight gain, and decrease the length of hospitalization (REF & date). The aim of this study was to pilot a Music Therapist driven approach to utilizing the PAL in NICU with babies and their families to identify benefits to preterm infants and their caregiver parents.

Methods:

Study Design: This quality improvement (QI) project evaluated the introduction of PAL as a nutritive sucking tool within a hospital-based cohort of infants cared for in the UCLA Healthcare System at two NICUs, one was a Level 4 and the other a Level 3. This study aimed to serve as an introductory examination of the way in which the PAL could be implemented with the specific population on the UCLA Neonatal Intensive Care Units and to examine the caregiver (staff and parents) perceptions of Music Therapy services when the PAL was integrated into Music Therapy treatment plan. This study aimed to collect information that can be used to inform future investigations geared towards improving the quality of care and identifying areas of clinical need.

Before each PAL session, patients were approved by their RN. Our study examined 17 neonates and their parents over the course of 6 months in addition to examining the perceptions and satisfaction rates of 50 NICU staff members.

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Inclusion Criteria: All premature infants determined to be medically stable by the medical and nursing teams, and by occupational therapy (OT) and lactation specialist to be able to suck on a pacifier. **Exclusion criteria:** Neonates who required mechanical ventilation, intubation, vasopressors or otherwise considered unstable, or not eligible for the use of a pacifier by the medical team. **Recruitment:** Patients and families were identified by speaking with NICU healthcare physicians, nurses, lactation consults, and occupational therapists. Study participants included premature infants born between 32 to 36 weeks gestational age after their first week of life. Once approval was obtained from the multidisciplinary team members, the Music Therapy team obtained consent from interested parents prior to initiation of any study activity. A pre-study survey was reviewed with the parents prior to the introduction of the concept of the PAL and evaluation of its use. The lullaby writing process was described to the family prior to facilitating the writing and recording process (encouraging parents to sing on the recording). Prior to recording, each infants' baseline data for sucking endurance was collected by (who) on the PAL device for a duration of 5 minutes without music by using the PAL device. Following this pre-data collection, the lullaby recording was loaded onto the PAL for each infant participant to use five days per week for 5-15 minutes. During each session, data tracking included the number of sucks, duration, and vital signs. Additional data recorded included the percentage of intake the infant achieved by mouth over a 24 hour period. The PAL sessions repeated daily Monday through Friday before scheduled feeding times until discharge. The caregiver post-survey was collected prior to discharge.

Parental involvement with the regular PAL sessions was encouraged by inviting parents to offer their baby the pacifier, inviting parents to write down the number of sucks after each session, providing the opportunity for the parent to write the lullaby in music therapy sessions and to record their voices singing to be used with the PAL sessions. PAL sessions frequently took place in the midst of Music Therapy sessions and aligned with other clinical goals and interventions besides the PAL. For example, after completing a PAL session, the Music Therapist may have facilitated an

emotional release focused music improvisation or lyric analysis/ verbal processing with the family caregivers or a patient-focused developmentally appropriate touch intervention with live lullaby music to assist the patient in falling asleep.

Materials

The Pacifier Activated Lullaby (PAL) is a Federal Drug Agency (FDA) approved device for non-nutritive sucking support with premature infants. PAL has a developmentally appropriate speaker for infants to hear music lullabies recorded below a 65 decibel (dB) scale C range when triggered by an infant's sucking on a standard hospital pacifier. The PAL device comes with sensors (individually assigned to each patient). These attach to the standard hospital pacifiers. This device then cues the music to play through the speaker when infants suck the pacifier. The device contains only one small cord connecting the sensor and pacifier to the speaker and is otherwise battery operated. The PAL screen displays the number of sucks in live time. The volume level and contingency were adjustable with the selection of the specific lullaby used for the session. Before and after each session, each device was cleaned using medical-grade sanitizing wipes then rinsed off in hot water.

An iPad stopwatch app was used to time the duration of the PAL sessions. After writing the lullabies with caregivers, a "zoom" field recorder was used to record the lullabies with the caregivers' voice (or with the music therapist's voice featured if the parents declined singing for the recording). A digital music software called "Protocols" was then used after the lullaby recording was transferred onto a MacBook laptop. Protocols was used to adjust the sound levels of the lullaby in postproduction before transferring to the PAL device as we discovered that the lullaby recordings sounded muffled without post-production adjustments

A PAL Session Data Collection Form was used to record the patient's study code number, the session number, the number of sucks and duration of PAL session and the recorded percentage of PO feeds (feeds taken by mouth) that the infant had achieved that day. The PAL session Data Collection form also was used to record whether or not the caregivers' voice or the therapist's voice was used during the session on the PAL device.

Survey Forms administered throughout this study included seven questions developed with a Likert scale format which examined perceived stress levels, perceived involvement in infant's care, feelings of bonding and attachment and caregiver's perceived feelings of improvement in feeding abilities. Surveys remained anonymous and were geared towards gathering caregiver (parent and staff) initial reactions to the use of this device within the context of Music Therapy sessions. Surveys were not meant to extensively examine each component, rather provide a baseline introduction to caregiver's initial reactions and perceptions of the experience in order to help identify areas for further research in the following year.

Music Therapy interventions included a variety of individualized approaches.

Songwriting sessions involved brief reflection or meditation exercises facilitated by the music therapists to help facilitate the caregiver's creative thinking and help them connect to their feelings related to their baby. It then involved a brainstorming of adjectives to describe the baby (the caregiver's words), brainstorming of messages and wishes from the caregiver to the baby and any other meaningful words and concepts that the caregiver might like to include in the song. Next, the therapist would present two options of songwriting methods to the parents. The first option involved a lyric substitution approach in which the caregiver

would select a favorite lullaby song or meaningful song and then together the therapist and caregivers would replace the words of that song with the brainstormed adjectives and messages to the baby. The therapist role would be to help set the caregivers up for success by empowering them yet providing helpful musical guidance to ensure that the song was developmentally appropriate for a premature infant and also had soothing aesthetics, musicality, and flow. The second option involved creating the song "from scratch." In this songwriting method, the music therapist provided multiple chord progression options and melodic suggestions and collaborated with the caregivers in the creation of the original lullaby composition. The therapist maintained the same role with this method, facilitating further discussion, providing empowerment and helping to provide guidance on an individual basis as clinically appropriate while also helping to create a song that contained developmentally appropriate components.

Verbal processing involved: Music Therapy fellows engaged in verbal processing inspired by humanistic psychotherapy approaches to encourage and empower caregivers and to help establish trust and rapport within the therapeutic relationship. Intentions of Music Therapy were clearly explained, and Music Therapists provided active listening, validation, and affirmations to caregivers as they processed emotions regarding hospitalization. Verbal processing remained supportive, and caregivers were held with unconditional positive regard by the therapists. Music Therapists used verbal interns to continue emphasizing the importance of the caregivers' role in the infants care and to empower them in that role. After songwriting sessions and PAL sessions, caregivers oftentimes engaged in verbal processing to further express their concerns and emotions regarding the infant's hospitalization: their worries about the future; medical-related trauma and trauma related to their birthing stories; feelings regarding the medical state of their baby; thoughts and emotions regarding the transition of having baby in their lives; family dynamics; financial concerns; and also feelings of attachment and excitement about their baby and bonding with their baby. Verbal processing often served as an extension of emotional release where caregivers were able to share their stories within a safe, non-judgmental supportive therapeutic relationship.

Recording sessions were utilized in cases where the caregiv-



ers agreed to sing on the PAL lullaby recording for their baby. Recording sessions involved recording software, headphones, microphone, and laptop and were done in a quiet place off the unit. Recording sessions took about 30 minutes, and caregivers always received a copy of the lullaby recording via mp3 file after recording completion.

Lullaby assisted relaxation was offered to families when the infant was agitated or needed assistance falling asleep. Rather than proceeding with the PAL session, Music Therapists would adapt to the medical and developmental needs of the infant at the moment and also respond to the caregiver's emotional/mental state as well. It was not always clinically appropriate to offer the PAL. For example, if an infant had a procedure earlier that day and was fatigued/agitated, the Music Therapist facilitated relaxation focused music interventions rather than the more rehabilitative focused PAL intervention. Music Therapists followed a family-centered, humanistic approach to Music Therapy sessions always.

Caregiver education focused on providing information about the therapeutic use of developmentally appropriate music. Parents also were taught about the implementation of the Pacifier Activated Lullaby. Music Therapists provided caregivers with information regarding infants behavioral signs of overstimulation to music and also signs of a positive response to the music as stimuli. Music Therapists provided information regarding appropriate decibel levels for the infant throughout their stages of development along with providing a helpful framework for playing recording music and singing for each stage of infant development. Music Therapists provided verbal psychoeducation and also provided handouts with developmental information regarding the use of music with neonates when appropriate. Information provided was a culmination of information obtained from Jayne Standley's (Music Therapist) NICU Music Therapy research and information from UCLA's NICU developmental care committee. All recommendations were in alignment with the American Academy of Pediatrics most recent guidelines.

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NICU staff perception: of PAL, MT services, developmental impact & psychosocial care.

NICU staff members were provided with a pre and post-survey which was made in a Likert scale format with an optional space for qualitative comments and asked questions regarding staff's perceived feelings of Music Therapy's presence on the unit as a support service. Questions asked the staff about overall feelings of stress on the unit and with their patients, and any notable changes amongst caregiver behaviors as a result of Music Therapy sessions. Surveys were handed out at the beginning of the study and the end of data collection and remained anonymous.

Results

17 premature infants involved demonstrated an increase in endurance with their non-nutritive sucking abilities along with caregiver's reported increased feelings of bonding and empowerment. NICU

staff survey results also suggested high levels of satisfaction of Music Therapy services and the implementation of the Pacifier Activated Lullaby device as a developmental support intervention. Data suggests that 70 % of the infant participants demonstrated an increased average number of coordinated sucks during 5 minute long PAL sessions when the lullaby was used in comparison to when there was no music present to provide positive reinforcement and entrainment.

Of the 95% of the caregivers reported feeling their child had improved oral motor skills needed for feeding with the PAL Music Therapy sessions. Additionally, 98% reported stability and/or an increase in bonding with their baby during the study. All caregivers (100%) reported increases in music use in their daily routine with their infant and an increase in their involvement in their infant's care. An increase in hopefulness was reported by 98% by the end of their participation in the study.

NICU Staff Surveys were collected from 50 NICU staff members and demonstrated that 100% of staff members rated their experience working with Music Therapy as a 5/5. 100% of staff also rated Music Therapy a 5/5 as an effective modality for relaxation and agitation management for their patients and NICU staff also reported that they felt Music Therapy was a level 5/5 as an effective empowerment offering for caregivers. 99% of Staff reported that they would recommend Music Therapy services and the use of the PAL device to their qualifying and appropriate patients and families.

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Staff Survey Comments	Parent Survey Comments
<ul style="list-style-type: none"> ● <i>“Music Therapy is a key component of providing relaxation as well as interactive stimulation for our babies. I’ve taken care of agitated babies that calmed down with the help of our Music Therapy staff. This is a service I’d highly recommend for any family/baby in the NICU.”</i> ● <i>“It is amazing seeing the bonding effect of Music Therapy. It is so incredible seeing how empowered parents appear and how much they seem to bond with their babies during the music therapy sessions.”</i> ● <i>“Parents have commented that they love music therapy and wish that they could have it more frequently, every day if possible.”</i> ● <i>“The Music Therapy service has been an added bonus involving our parents in the care of their infants. It is a warm addition to parents who experience an infant loss, and the music therapists record the infant's heartbeat and help the parents create a heartbeat song as a memory for the parents to keep. Our infants also always appear more calm content and less agitated when Music Therapy visits.”</i> ● <i>“Music Therapy has been a very significant modality that can be used to calm/soothe babies. It gives parents a way to be more involved in their babies care and is a form of comfort to them, learning how to alleviate any signs of discomfort or pain that their baby is experiences.”</i> ● <i>“We NEED Music Therapy. We would be devastated if we ever lost this service. It is so good for our patients, and observing the PAL study has been absolutely incredible. Not only are the</i> 	<ul style="list-style-type: none"> ● <i>“It's been a long journey and a really difficult time, but I can see that music really helps him in many ways, especially in calming him down when his heart rate is high. I am really grateful to have experience Music Therapy while he's here.</i> ● <i>“Thank you so much for the BEAUTIFUL song, it has meant a lot to me, especially in the space that I have been separated from my baby for the last week while I have been hospitalized. My husband gave me your note the other day that you came by to sing to my baby, and we are so thankful for that sweet time you provide to him. I especially felt comforted to know that my voice was being used as a way to support my baby through the PAL even when I wasn't there.”</i> ● <i>“Being involved in the PAL study was so inspiring for me. It gave me a way to support my baby in feeding while waiting for my breast milk to drop. I loved the process of writing and recording the song, and I really enjoyed watching him improve each session and last longer on the PAL more and more with each session.”</i> ● <i>“Every parent should receive Music Therapy as a support during their time on the NICU. It is relaxing for parents, but it also helps give us hope and feels like a light at the end of the tunnel.”</i> ● <i>“Every time I see my baby's number of sucks increasing, I feel like its a little gold star on his chart. It is really empowering and inspiring to be involved in his care in this way.”</i> ● <i>“It's amazing watching how much better our little boy is able to feed when he is receiving music.”</i>

infants sucking with more endurance when receiving music, the parent's entire demeanor changes and they seem more hopeful and encouraged during feeding times as a result."

- *"The NICU is very stressful environment. Alarms galore. Moms are trying to remain calm so that they can produce breast milk for their babies, but stress can affect a mom's ability to pump. Music Therapy not only relaxes the baby and helps the baby sleep and feed, but it also helps with development and relieves the mother's stress/inspires her. Relieving this stress allows the mothers to pump more effectively. The breast milk serves as a form of medication to the infant and helps their immune systems. Music Therapy also makes skin to skin more enjoyable for the infant and the parents. I have recently traveled internationally across the world; Australia, United Kingdom, New Zealand, Canada, and they all use Music Therapy in their NICU settings. We should strive to be the best in the west and enhance our family integrated care with the continued expansion of our Music Therapy program and research."*
- *"I have experienced Music Therapy during palliative encounters, and they are professional, courteous, and kind, and often times I feel the energy of the unit becoming calmer as the music begins. The volume of their voices serves as a great model for us all to keep appropriate decibel levels with our own. The families and babies respond well to the music, and it helps their heart rates and respiratory rates to regulate."*
- *"The Music Therapy program has been a wonderful experience for our families. Being on the NICU can be a pathological insults to our parents which makes them*

- *"It's amazing watching how much better our little boy is able to feed when he is receiving music."*
- *"I love that you can use my actual voice on the PAL recording even when I can't be there at bedside because I am with my other children at home."*

anxious and can cause them to lose confidence. The music therapists show parents how to interact and engage with their babies in a meaningful calm manner. The parents have very positive interactions with their babies during Music Therapy, and the MT helps them to normalize their experience on the NICU.”

Table 1: Staff survey and parent survey comments.

Qualitative Responses on Surveys

Pre and post surveys allowed for room for optional qualitative anonymous comments for both parents and staff members. Staff and parents self-reported that Music Therapy helped to ease stress and help them to feel more comfortable on the unit. Qualitative comments from parents suggest that the use of the PAL within Music Therapy sessions may hold promising psychosocial benefit for the parents in addition to the developmental support it provides for the infant.

Discussion

Study variables include the additional health complications which extend beyond the need for weight gain. Additional medical complications and varied diagnoses may impact study data. Our unit, a level four NICU often treating complex cases differing from the “feeder and grower” population that seems to be more frequently involved with the use of the PAL may call for modified goals of the PAL. For example, rather than the aim of the PAL use to be solely focused on NNS, perhaps shifting the primary focus of its function with certain patients to be aimed at assisting in bonding and caregiver mental health support along with promoting infant self-soothing behaviors and potentially pain management even when nonnutritive sucking practice is not needed as a means to transition to oral feed (for example for infants who are already feeding orally or for infants who will remain fed by G-tube). Parents regularly verbally reported feeling an ease in stress levels during sessions in regards to Music Therapy sessions involving the PAL which piqued the researcher’s interest in potentially further investigating stress levels in future studies with an official standardized and evidenced-based measure in the next term. The survey forms used were not standardized therefore may be lacking in reliability and have the potential to be influenced by bias in the wording of the questions which would need to be adapted and more formalized by any researchers who intend to investigate further any of the psychosocial components introduced in this study. Other variables included infant sleep schedules, procedure times, changes in medical stability, rounding from medical teams or the infants being seen by other specialists during PAL session attempts and a lack of consistency in the lullaby recordings due to the nature of the creative process and different voices of caregivers. Out of the 17 families, only nine families agreed to use their voices. 55% of

the participants who had lullaby featuring their caregivers’ voice demonstrated an increase in non-nutritive sucking abilities. Our team also noticed that at times, having visitors at the bedside or other distracting noises on the unit impacted the infant’s ability to suck the pacifier at their usual performance rate. It has also become apparent when reviewing the data collected that any further investigation of the study would have to be much more refined for example, deciding whether or not the parent’s voice must be used in lullaby or not rather than having two separate groups, deciding whether parent stress/involvement be examined, or the infant’s NNS be examined or deciding to examine a correlation between the two rather than examining them separately in one study effort. Future research efforts might also include refining which caregiver group to focus on (staff, parents, family). This pilot project has served us in helping to begin the process of identifying areas most in need of further investigation and has helped to inform clinical areas of need that pique the most interest amongst staff and families both as a result of the questionnaires and verbal discussion surrounding the introduction of the PAL device at the bedside.

Our most significant hurdle throughout the beginning stages of this pilot study was the technical difficulties we experience when working with the PAL device. When using caregiver focused lullabies which featured the caregiver voices, the volume was incredible low (even lower than 60dB at times) and extremely muffled and of poor quality. After collaboration with audio engineers, we discovered how to adjust the recording formats to ensure clarity of recordings. However, the initial caregiver data may have been impacted by the poor sound quality of recordings (we hypothesize that the percentage of increased NNS endurance for the infants that received PAL with caregiver voices would be much higher if the recordings were of better quality and clarity.

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PAL Study Pre and Post Caregiver survey

1. My baby is having challenges with oral feed.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

2. I experience feelings of helplessness surrounding my baby's oral feeding abilities and medical care.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

3. I feel bonded with my baby.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

4. I use music as a part of my baby's current routine.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

5. I feel very involved in my baby's care and recovery.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

6. I feel that I personally help improve and support my baby's oral skills.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

7. I have feelings of sadness and frustration regarding my baby's current medical state.

Strongly Agree	Agree	Neutral
Disagree	Strongly Disagree	

Figure 1: PAL Study Pre and Post Caregiver survey

Potential improvements for this study could include a control group which uses recorded lullaby (without the caregivers' voice) versus an experimental group which does use the caregiver's voice. This group would help us further determine the impact of the caregivers' voice with the use of this device. To increase parental involvement, designing this study to require parents to be at bedside during PAL sessions and more consistently assigning parents a role such as recording the number of sucks or offering the PAL pacifier to their baby during each PAL session may also impact the caregivers sense of autonomy and further validate the importance of their presence.

Other improvements might include intervening with the PAL at a consistent gestational age to promote more consistency within the study and reduce variables. There were challenges in piloting the ideal timing of implementing this device. We aimed to present the PAL after infants had been introduced to the breast but during the transition to bottle feeds and if they were having additional challenges with breastfeeding. Our team worked closely with lactation consultants and occupational therapists, and in collaboration, it was decided to wait until after the breast has been introduced to the infant and to offer sessions about 20 minutes before scheduled feeding times in order to get the muscles engaged and prepared for feedings. However, at times this posed a risk of causing fatigue before the feeding (which would be counterproductive). However, at times, we would offer the device after feedings, and the infant would be tired, and the results were not an accurate representation of the patient's abilities. Finding an appropriate time for PAL sessions in between feedings throughout the day also presented with some challenges such as the infant being seen by other specialists throughout the day, potential effects of medications altering the data, or the patient sleeping. It would also be counterproductive to wake the infant during a sleep cycle as sleep is crucial to the infant's development. However, due to these variables and challenges our consistency within the study regarding the gestational age the PAL was offered, and the timing of PAL sessions were at times broad and inconsistent. For further exploration of this device, it may be of benefit to narrow down the inclusion criteria and protocol (such as the PAL session times).

Another challenge we faced during the implementation of the PAL device was that many of the infants had feeding times scheduled at the same time (meaning with one PAL device available and only two grant-funded research assistants) we were not always able to provide the PAL session during the most ideal time. For example, if five infants had a feeding time scheduled for 11:00 am, it was not always a guarantee that all of the infants would be ready and available for the PAL session between 10:30 and 11:00 and it was not always possible for the therapists to complete all 5 PAL sessions on time.

Additional areas for future exploration include; training other medical professionals on the PAL in order to increase patient impact and study size along with potentially decreasing some of the variables in missed session times or non-ideal session times. Training additional staff members and purchasing additional PAL devices would, in some ways, create consistency and accountability in session times.

Future considerations to examine within our population at UCLA might be the correlation between weight gain and PAL training, the impact of the PAL on the duration of hospital stay and any potential impact the PAL could have on infant pain and agitation levels, all of which have been previously studied at other institutions by Jayne Standley. Additional efforts may also explore and/or investigating the longer-term implications of bonding and development through caregiver's voice. Separating the interventions during data collection by requesting surveys after the songwriting and initial Music Therapy sessions and then collecting a separate

survey after the actual use of the PAL device may also help to determine whether or not the results of patient satisfaction, anxiety and stress reduction and the decreased feelings of hopelessness should be attributed to the PAL sessions exclusively or to the experience with the songwriting and the Music Therapy as a whole.

Exploration of parent support groups to focus on stress reduction particularly for breastfeeding mothers might also be another area of study to examine along with beginning the introduction of the Music Therapy process and the idea of planning for PAL sessions sooner (for example within the first week of admission to the NICU or during bed rest/antepartum).

Continuing to explore the impact of Music Therapy and the PAL on maternal mental health/overall stress levels seems to be an area of calling according to this pilot project as the results for caregiver stress management, especially in the form of qualitative comments on the surveys were incredibly promising. Continuing to explore ways in which parents can be provided with autonomy and emotional support with the involvement of this device would benefit future protocol development for a more formalized and refined research study. For example, studying the impact of having parents record the number of sucks with the therapist after each PAL session or assist in providing the pacifier on the caregivers' feelings of involvement or reduction in stress.

Lastly, exploring the use of the PAL as a comfort measure in addition to being a developmental aid may also provide some interesting insights for clinicians and caregivers, especially in level IV NICUs. For example, after an infant has achieved their oral feeding goals yet still must remain on the NICU for other medical reasons, examining the benefit of the PAL for agitation management and comfort as an adjusted clinical goal once they have achieved their oral feed goals.

Conclusions

Results from this study indicate that the PAL device paired with Music Therapy services could improve the endurance of non-nutritive sucks amongst medically stable neonates along with promoting bonding and decreased feelings of helplessness amongst caregivers while simultaneously boosting staff morale. Based



Average Number of Non-Nutritive Sucks without Lullaby vs. with Lullaby (within 5 minutes)

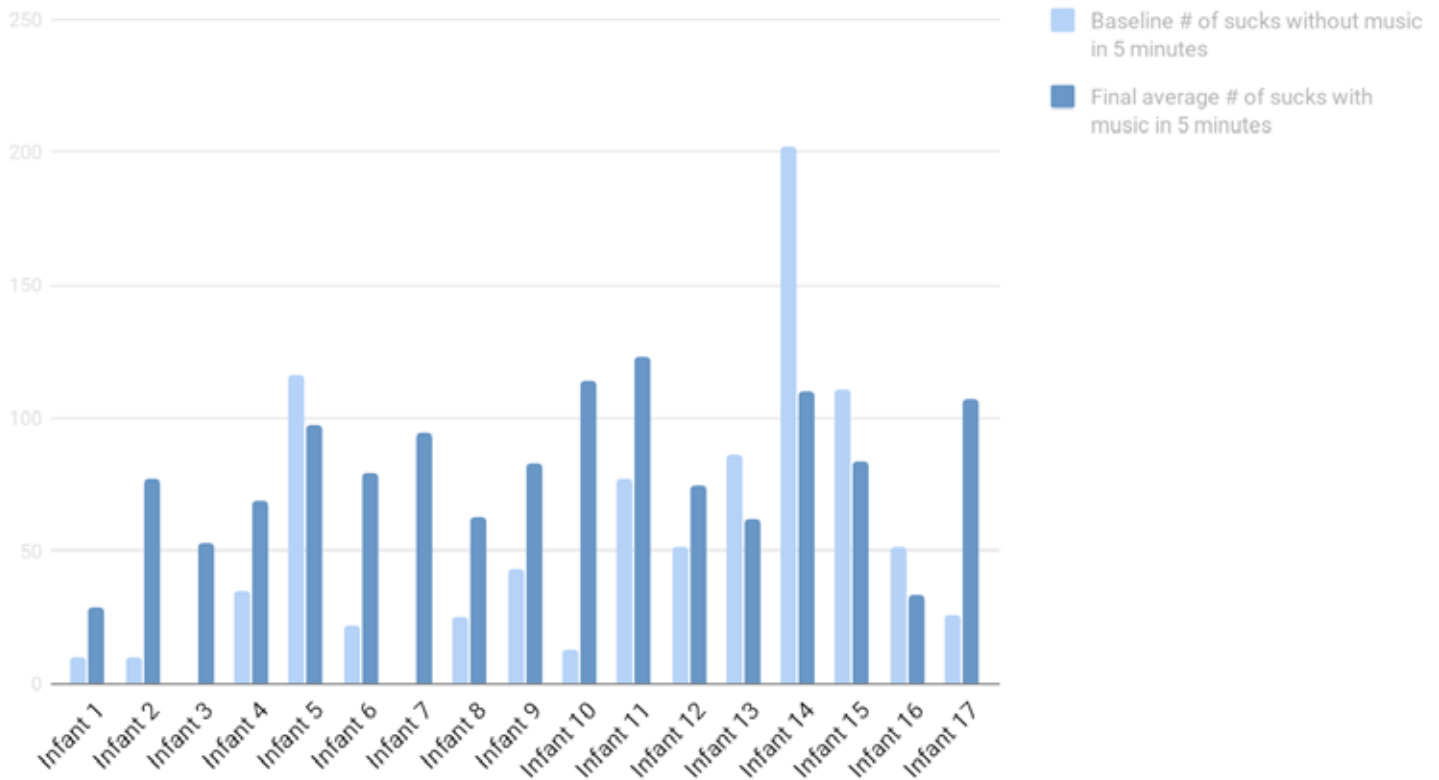


Figure 2: Average Number of Non-Nutritive Sucks without Lullaby vs. with Lullaby (within 5 minutes)

upon this small pilot project, the involvement of Music Therapy, more specifically the process of creating parent-written and parent-performed recorded lullaby with the PAL device could improve the quality of care provided in the NICU both from a psychosocial standpoint and also in terms of developmental care. As our study results have found a 100% rate of parents reporting to feel more involved in the care of their infant due to the PAL process and 98% of caregivers reported an increase in feelings of hopefulness this study suggests that including involvement with the PAL and Music Therapy services as part of the neonates routine care would be of benefit to caregiver mental health and patient satisfaction. This increase in hopefulness raises questions regarding the PAL (and Music Therapy's) ability to potentially decrease symptoms of "baby blues" and postpartum depression, Medical-related PTSD/ other mental health strains that caregivers may be experiencing when their infant is hospitalized in the NICU. The study results demonstrating 70% of increased sucking endurance within the first 5 minutes of using the PAL is promising. However, these findings require more refining of our PAL protocol and recording process and a closer look at the variables -- for example, perhaps refining the timing of the PAL introduction and the inclusion criteria or providing longer PAL sessions as clinically appropriate at more consistent opportune times. The results from this study have led us to our next cycle of research which will be funded by the Music Man Foundation beginning in June 2019 where we will more intensely examine the role of Music Therapy services as a stress reduction for caregivers on the NICU. Our next study cycle will also examine the relevance of mental health support through Music Therapy services earlier on during patient care for example, in antepartum while parents are on bed rest and on maternity/ labor and delivery units in tandem with continued Music Therapy

services in the NICU. We hope to continue improving our protocol with the PAL device for our unique patient population, order more PAL sensors and streamline ways in which to provide the PAL as part of routine care to premature infants in the NICU who are requiring assistance with their NNS endurance.

Funding and Approvals

This study was reviewed by the Institutional Review Board (IRB) and approved as a quality improvement study. All participants involved in this study opted to participate, signed consent forms and were informed that they would continue to receive the same quality of Music Therapy support regardless of whether or not they decided to participate in the optional and anonymous study.

This study was funded by the Music Man Foundation and the Peterson Family Foundation.

About The Music Man Foundation: The Music Man Foundation is named after the Tony-winning musical written by Meredith Willson. Meredith's widow, Rosemary, started the Foundation in 1998 as the Meredith and Rosemary Willson Charitable Foundation and substantially increased the Foundation's endowment upon her death in 2010. With a mission to empower people using the transformative energy of music to make positive changes in their own lives and the lives of others, the Foundation currently focuses its investments in two initiative areas: core-curriculum music education and music therapy. Besides "The Music Man," Meredith Willson wrote the musical, "The Unsinkable Molly Brown," and beloved songs "It's Beginning to Look a Lot Like Christmas" and the University of Iowa fight song.

About the Peterson Family Foundation:

The Peterson Family Foundation's main focus is sustaining and creating pediatric music therapy programs, as well as funding childhood leukemia research. Through an integrative approach to healthcare, we are bringing together music therapy and cancer research to support all aspects of treatment. Their primary mission is to seek out and support experts and institutions dedicated to enhancing and improving the lives of children and teens afflicted by life-threatening and life-long diseases.

The PFF believes in supporting the whole child and striving for an integrated approach to healthcare. The PFF supports medical research into childhood leukemia as well as music therapy programs to improve psychological and emotional well-being.

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References:

- Aagard, H.; Hall, E.O.C. Mothers' experiences of having a preterm infant in the neonatal care unit: A meta-synthesis. *J. Pediatric Nursing*. 2008, 23, 26-36.
- Ambra Palazzi, Camila Canani Nunes and Cesar Augusto Piccinini. Music therapy and musical stimulation in the context of prematurity: A narrative literature review from 2010–2015, *Journal of Clinical Nursing*, 27, 1-2, (e1-e20), (2017).
- Altimier & Phillips (2013). Neonatal Integrative Developmental Care Model: Seven Neuroprotective Core Measures for Family-Centered Developmental Care. *NAINR* (13) 9-22.
- Beck CT. The effects of postpartum depression on maternal-infant interaction: a meta-analysis. *Nurs Res*. 1995;44(5):298–304.
- Bicking C, Moore GA. Maternal perinatal depression in the neonatal intensive care unit: the role of the neonatal nurse. *Neonatal Netw*. 2012;31(5):295–304.
- Chorna, O., Slaughter, J., Wang, L., Stark, A. and Maitre, M. (2014). A Pacifier-Activated Music Player With Mother's Voice Improves Oral Feeding in Preterm Infants. *PEDIATRICS*, 133(3), pp. 462-468.
- G Chirico, R Cabano, G Villa, A Bigogno, M Ardesi and E Dioni. Randomised study showed that recorded maternal voices reduced pain in preterm infants undergoing heel lance procedures in a neonatal intensive care unit, *Acta Paediatrica*, 106, 10, (1564-1568), (2017).
- Harding C. An evaluation of the benefits of non-nutritive sucking for

- premature infants as described in the literature. *Archives of Disease in Childhood* 2009;94:636-640.
- Hiroko Uematsu and Ikuko Sobue. Effect of music (Brahms lullaby) and non-nutritive sucking on heel lance in preterm infants: A randomized controlled crossover trial, *Paediatrics & Child Health*, 10.1093/pch/pxy072, (2018).
- Hugill, K.; Letherby, G.; Reid, T.; Lavender, T. Experiences of fathers shortly after birth of their preterm infants. *J. Obstet. Gynecol. Neonatal. Nursing*. 2013, 42, 655-663.
- Jann P Foster, Kim Psaila and Tiffany Patterson. Non-nutritive sucking for increasing physiologic stability and nutrition in preterm infants, *Cochrane Database of Systematic Reviews*, (2016).
- Kamile Akca and Aynur Aytakin. Effect of Soothing Noise on Sucking Success of Newborns, *Breastfeeding Medicine*, 9, 10, (538), (2014).
- L.A. Papile. The effects of giving pacifiers to premature infants and making them listen to lullabies on their transition period for total oral feeding and sucking success, *Yearbook of Neonatal and Perinatal Medicine*, 2012, (318), (2012).
- Latisha Rhooms, Kimberly Dow, Cara Brandon, Grace Zhao and Sandra Fucile. Effect of Unimodal and Multimodal Sensorimotor Interventions on Oral Feeding Outcomes in Preterm Infants, *Advances in Neonatal Care*, 10.1097/ANC.0000000000000546, 19, 1, (E3-E20), (2019).
- Newport DJ, Hostetter A, Arnold A, Stowe ZN. The treatment of postpartum depression: minimizing infant exposures. *J Clin Psychiatry*. 2002;63(Suppl 7):31–44. [PubMed] [Google Scholar]
- Lefkowitz DS, Baxt C, Evans JR. Prevalence and correlates of post-traumatic stress and postpartum depression in parents of infants in the Neonatal Intensive Care Unit (NICU) *J Clin Psychol Med Settings*. 2010;17(3):230–237.
- Kim WJ, Lee E, Kim KR, et al. Progress of PTSD symptoms following birth: a prospective study in mothers of high-risk infants. *J Perinatol*. 2015 Apr 9 [Epub ahead of print]
- Pinelli J, Symington A. Non-nutritive sucking for promoting physiologic stability and nutrition in preterm infants. *Cochrane Database Syst Rev*. 2005;(4):CD001071. Crossref
- Standley, J. and Walworth, D. (2010). Music therapy with premature infants. Silver Springs, MD: American Music Therapy Association.
- Standley, JM, Cassidy J, Grant R, et al. The effects of music reinforcement for non-nutritive sucking on nipple feeding of premature infants. *Pediatric Nursing*. 2010; 36 (3): 138-146.
- Standley JM. The effect of music-reinforced non-nutritive sucking on feeding rate of premature infants. *Pediatric Nursing*. 2003; 18 (3): 169-173
- Standley J (2012) Music therapy research in the NICU: An updated meta-analysis. *Neonatal Netw* 31: 311–316. doi: 10.1891/0730-0832.31.5.311 [PubMed]
- Stefana, A.; Padovani, E.M.; Biban, P.; Lavelli, M. Experiences with their preterm babies admitted to neonatal intensive care unit: A multi-method study. *Journal of Advanced Nursing*. 2018, 74, 1090-1098.
- Vildan Kaya and Aynur Aytakin, Effects of pacifier use on transition to full breastfeeding and sucking skills in preterm infants: a randomised controlled trial, *Journal of Clinical Nursing*, 26, 13-14, (2055-2063), (2017).

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