

Full-Length Article

The Effects of a Music Therapy Intervention in PICU as Measured by the Comfort Behavior ScaleMaría Jesús del Olmo¹, Francisco Ruza Tarrío¹, Cintia Rodríguez Garrido¹, Pilar Carrasco Marina^{1,2}¹Faculty of Medicine, Autonomía University, Madrid, Spain²Mar Báltico Health Center, Madrid, Spain**Abstract**

This article describes the results of a study of 87 infants (aged 0 – 6 months) hospitalized in Pediatric Intensive Care Unit (PICU) who interacted with parents either with music or no music. A music therapist provided the live music condition consisting of music with specifically defined parameters: binary rhythm at a tempo of 80 b/min, ternary rhythm at 90 b/min. The use of both major and minor modes was utilized, but basically G, F, A, D, E major, and E, D, F, B and C minor were used. Each intervention began with two basic chords (I-IV). Intensity covered a range from pianissimo to forte, depending on the baby's presentation. Pre-and post-test measures were recorded using the COMFORT Behavior Scale. Results showed a significant difference after the interaction in the adult with music condition ($p = 0.038$). The score in the moments directly after the music is lower than the rest of the time.

Keywords: *Rhythm, Comfort, Music, High-Risk Infant.*multilingual abstract | mmd.iammonline.com**Introduction**

Babies are uniquely vulnerable beings, and as such, the Pediatric Intensive Care Unit (PICU) is not a place where they can develop optimally. High levels of technology and the use of endotracheal tubes and invasive procedures, can lead to discomfort [1,2].

It is important to take into account the child's stage of development in order to avoid, as much as is possible, the sequela of hospitalization. A young child's hospitalization usually entails a certain amount of anxiety that manifests itself in a variety of ways, inclusive but not limited to crying, muteness, distrust, lack of sleep, and so forth [3]. The separation from parents, relatives and friends, coupled with drastic changes in the environment, are situations that children and families are forced to adapt to. These circumstances can create stress and anxiety that may directly affect the recovery process. Treating the emotional, physical and psychological effects of hospitalized infants are identified needs that often can lead to referrals for Music Therapy in the

PICUs. The impact of hospitalization cuts across all the systems involved in a child's development, and as such requires interdisciplinary care and attention. When dealing with infants, the risk is even greater: with no former context for initial growth, no development resilience is assured [4].

Musical experiences can be incorporated into the experience of the PICU, providing an "aesthetic component that normalizes and gives coherence to their new situation" [5, p158]. Del Olmo and colleagues also noted that "Listening to music, the newborn is exposed to a coherent and organized multimodal stimulation involving both the senses and the emotions" [5, p158].

To assess the comfort of the baby in the (PICU) and the response to a live music intervention, we chose to use the Comfort Behavior Scale [1] based on the original Comfort Scale [6]. The original Comfort Scale was developed to measure the distress of children who are mechanically ventilated in PICU. It has high inter-rater reliability, and has been validated as a descriptor of distress in critically ill children under the age of 18, through physiological and behavioral variables [6,7]. The concept of comfort not only includes anxiety and agitation, but also the management of patients with mechanical ventilation, including pain and synchrony with the ventilator.

Further research determined that the Comfort scale is clinically useful in assessing whether a child is optimally sedated [8,9]. This tool is also considered a tool that is useful in assessment of pain, as it utilizes behavioral and physiological parameters typically associated with discomfort [1]. The Comfort scale consists of 2 physiological measures and 6 behavior measures. The patient is monitored for a period of two minutes. During that time, the data on five elements of behavior are collected: alertness, degree of

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María Jesús del Olmo, PhD, Autonomía University Madrid, Faculty of Medicine C/ Arzobispo Morcillo nº 4, Madrid 28029, E-mail: mjesus.delolmo@uam.es | COI statement: The authors declared that no financial support was given for the writing of this article. The authors have no conflict of interest to declare.

calmness or agitation, breathing response, movement and facial tension. At 6 points during the 2-minute data collection, physiological data may also be collected from the monitor including heart rate and mean arterial pressure. At the end of the period, the patient's muscle tone is assessed by extending and flexing a not instrumented limb (such as an elbow or knee, without an intravenous or arterial via).

Each section of the scale is rated on a scale of 1 to 5, with 1 being the highest non-response, and 5 the more uncomfortable level. The test score is the sum of the 8 items scores and ranges between 8 and 40.

As the physiological parameters measured in this test can be heavily influenced by the use of pharmacologic agents among other variables, and with a view to using the test in non-mechanically-ventilated children without invasive measurements of blood pressure (BP), Van Dijk and colleagues adapted the scale to eliminate the measurement of physiological parameters, and restricted its use to include observable behavior only, and as such is called the so-named "Comfort Behavior Scale." Their research indicated that it could render more accuracy in how a child's sedation level is assessed [10,11]. The same working group used the Comfort Behavior Scale, adding an item for crying to assess level of pain. Crying was measured instead of the breathing response in infants who were not on ventilators. For infants using mechanical ventilation the breathing response and not the crying was measured [1,12]. The Comfort Behavior Scale has also shown good reliability and validity as a measure of pain in infants with burns aged between 0 and 5 years [13].

In the present study, the population comprised infants with and without ventilator, and with and without invasive measurements of blood pressure, therefore we used the Comfort Behavior Scale adding the item for crying in patients without ventilator. We considered that a lower Comfort Behavior Scale score would indicate an improvement in the child's comfort because we would measure a decrease in anxiety, distress, pain and synchrony with the ventilator [11].

Method

Following the protocol of the previous study conducted by Del Olmo and collaborators [5], the group analyzed the responses of 87 infants aged 0 – 6 months during 100 interventions in the PICU. Using a within subject design, the Comfort Behavior Scale data were collected during 4 periods: before and after interaction with the parents without any music, and then, with the same subjects before and after interaction with the presence of live music.

The infants received live music therapy with an electric keyboard and guitar as the main harmonic support. The musical intervention took account of the singing voice of the parents accompanying the baby in the unit. Parents were not asked to sing or to make special use of their voices, however if any live voiced sound was made, the music therapist met it with simple harmonic accompaniment. Other parents chose not to sing to babies reportedly because the emotional stress of

the unit was too high. Every musical intervention lasted 10 minutes. The melodic range used in the musical interventions was established to be between G2 and E5 corresponding to 98.0 Hz and 1,318.8 Hz, respectively, in the tempered scale [5].

The tempo of the musical intervention (Figure 1) was established to be 80 beats per minute in the binary musical interventions and 90 beats per minute in the ternary musical interventions. The musical interventions took 3 different musical dynamics into account: low intensity (*mezzo pianissimo* or *mp*), medium intensity (*mezzo forte* or *mf*), and high intensity (*forte* or *f*). This parameter always considered (a) the intensity of the infants; (b) the postural-tonic adult-infant dialogue noted through the qualities of intensity of voice, caresses, whispers, and language; and (c) the level of environmental noise in the unit, recognizing and integrating as much as possible the sounds of alarms and monitors into the musical intervention [14-16].

BINARIO

The musical score is titled "BINARIO" and is in 4/4 time with a tempo of 70. It consists of four systems of music, each with a piano part and a guitar part. The first system starts with a piano part marked 'C' (Crescendo) and a guitar part marked 'F' (Forte). The second system starts with a piano part marked 'C' and a guitar part marked 'F'. The third system starts with a piano part marked 'C' and a guitar part marked 'C'. The fourth system starts with a piano part marked 'F' and a guitar part marked 'C'. The score ends with a double bar line.

Figure. 1 Music played at the beginning and end of the music therapy interventions

The melodies played on the keyboard were simple with small intervals, to encourage parents singing to their babies.

Melody is part of the emotional assessment, and therefore was not chosen before seeing the baby. The decision was based on the emotion in the moment and the observation of the baby’s musical actions and interaction with the parents. This is the most important aspect of the music therapist’s intervention, and after the session its description is always a unique part of the session summary. The music therapist documents these responses in the hospital chart, making careful notes related to the baby’s observable changes.

Study design

Both experimental and control groups included infants aged 0 – 6 months, and had parents present for interaction. The experimental group included music, while the control group did not have music.

Statistical method

To analyze changes (evolution) of Comfort Behavior Scale over 4 times between the 2 groups, we used an ANOVA 2-factor repeated measures within subjects: 1) presence of music (without / with) and 2) time (before and after). We studied both the main effects, such as interaction between the 2 factors (an interaction effect indicated significant difference. The significance level was set to the value of $P < 0.05$.

Results

Data were collected related to the characteristics of the study population: baby’s age, sex, length of stay in the PICU, the adult’s age and adult present in the studio (father, mother, etc.). The highest percentage of babies were 2 and 3 months old, with 28% of babies being 2 months and 29% 3 months old, with 55% percent of the babies were female.

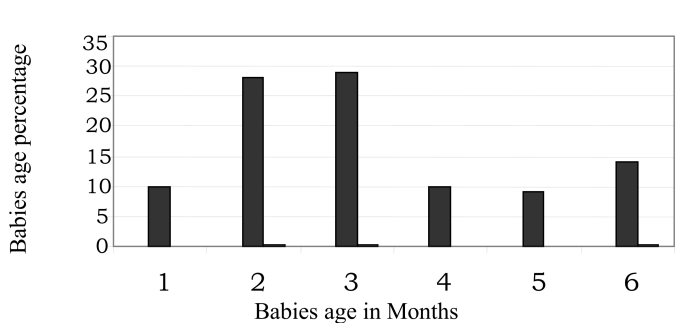


Figure 2. Age in months

The length of stay in the unit was 1 week in 48% of the cases (Figure 3). Adults involved in the interaction were predominantly mothers (82%), but also fathers (16%) and grandmothers (2%).

Stay in PICU

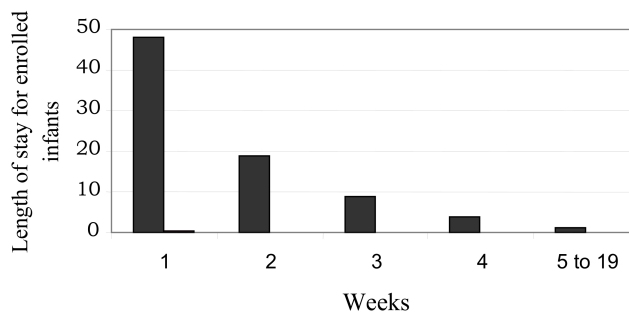


Figure 3. Length of stay for enrolled infants

Descriptive data is provided for the Comfort Behavior Scale before and after the 2 periods of study with and without music. The mean Comfort Behavior Scale score declined in the experimental group (Table 1).

	Without Music		With Music	
	before	after	before	after
Mean	11.92	11.08	11.02	9.29
SD	3.88	3.29	3.15	2.4
n	100	100	100	100

Table 1 Comfort Behavior Scale Test Results with an without Music; SD: standard deviation

Changes in the mean of the Comfort Behavior Scale (Figure 4) along the 4 times between the 2 groups are shown below.

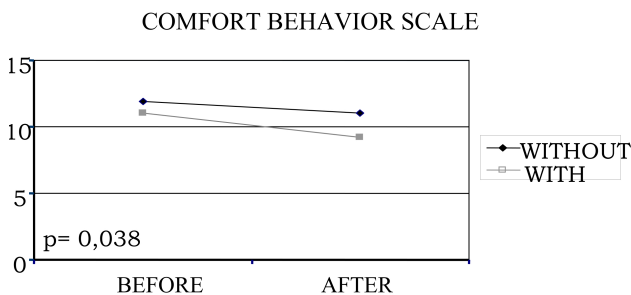


Figure 4. The Mean in the Comfort Behavior Scale Test

In the experimental group the Comfort Behavior Scale scores are significantly lower when music is used ($p = 0.038$). The score with music is lower than the rest of the times.

Discussion

The main aim of this study was to evaluate the level of comfort of babies 0-6 months of age hospitalized in PICU, who received a music therapy intervention. The use of music with therapeutic intention offered a musical space in which organization and coherence were features of the parent-infant interaction.

The organization that music offers to the babies is determined by the music therapists' selection of musical elements in the moment of carrying out the intervention. It is important to note the selection of musical features is not simply intuitive but is based upon refined observations of the baby and an understanding of how to match the musical components to the needs of the baby [5,17-19].

The musical elements present in human actions are illustrated in the many examples of rhythmic actions that often occur perfectly in synchrony with each other, organized in a musical form as structured and coherent as that of a symphony [18]. The heart rate, respiratory pace, brain rhythm, walking gait, are all rhythmic actions. From the point of view of developmental psychology, Piaget, quoted by Rodríguez [19] speaks of the relationship between biology and intelligence, and this linkage is given by the action, where rhythm is the organizing element.

In itself music is not necessary for survival, but its different modes of expression can be found in cultures throughout time. Authors such as Blacking [20] and Sloboda [21] noted this in their studies of musical performance (vocal, rhythm and movement) of all human social groups, pointing out that these musical forms serve clear communicative, therapeutic and social interaction functions. The ethnomusicologist Alan Merriam [22] classified the functions of music, among which are the following: sound-musical expression, aesthetic enjoyment, physical response, communication, entertainment, symbolic representation, strengthening the continuity and stability of culture, etc. There seems to be a consensus among ethnomusicologists on the functions and uses that humans have given to music throughout history, but not in terms of its biological origin or its formation as a communication system different from language [23]. What is clear is that music has always been present.

Limitations of the study

On entering an intensive care unit, there are many things that catch one's attention: a number of different smells, sounds, textures, and above all a great noise, all of which undoubtedly has a negative impact both on the state of babies hospitalized there, as well as the caregivers and even for the various professionals who care for the babies.

Even so, PICU professionals work becomes a test of quality of care, especially for those who are concerned about the negative impact that a stay in PICU could cause in the infant's psychological and emotional development. And not just on the infants, but also on families and the PICU team itself.

One of the limitations we encountered when conducting the study was that in most cases the babies were sleeping, in a coma or under the effects of muscle paralyzing medication and, when they awaken, they develop a kind of neutral affect, rather indifferent, highly unusual for a healthy child in any other circumstance. Most babies remain silent, without interacting with the adult in any way. The "adjustment

disorder with depressed mood" is a predominant disturbance in 15% of patients observed while in the PICU and appears when babies of any age remain hospitalized for over a week [17].

Conclusions

Babies develop from multiple and complex interactions with adults, the environment and physical objects [18] - and these 3 factors can shift dramatically during an experience of hospitalization. A baby does not know the unfamiliar adults who interact with him and who will be their new caregivers; the physical environment and sounds are not usual but they certainly do not provide consistency. These new circumstances will, in turn, generate new answers, often inadequate, which will have immediate effects on the baby's development, in the short and possibly the long-term outcomes. In these situations, parents and family members are also often stressed and restless, and this is inadvertently transmitted to infants. Parents often do not know how to express and regulate their emotions appropriately, because circumstances have changed so much that they are simply fighting to adapt to the new situation.

In conclusion, the application of active music therapy for babies from 0 to 6 months of age, in both sexes, had a beneficial effect on their wellbeing taken in 2 stages: before, during and after the music therapy session: From 11.02 down before to 9.29 after the music therapy ($P=0,038$). The therapeutic use of music helps to find a path of emotional, nonverbal expression, which favors the interaction between the adult and the child in these situations. The rate of heartbeat, or breathing, the melody of speech intonation, the intensity of gestures and general movements are musical elements that are present at any stage of the development irrespective of the type of circumstances in which human beings find themselves.

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