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PATTERNS—A Model for Evaluating Trauma in NICU Music Therapy: Part 1—Theory and Design

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What is This?

PATTERNS—A Model for Evaluating Trauma in NICU Music Therapy: Part 1—Theory and Design

Kristen Stewart, MA, MT-BC, LCAT, SEP¹

While preterm infants are born with survival mechanisms intact, they lack the protective buffering system of the intrauterine environment. Dysmature neurological functioning and the absence of coping strategies further impede the preterm infant's capacity to manage the heightened states of arousal commonly linked to hospitalization in a neonatal intensive care unit (NICU). Music therapy offers a unique capacity to enhance healing across the spectrum of experience, and research in NICU music therapy has shown consistent benefit for infants, parents, and caregivers in this environment. Integrating current evidence across disciplines in developing new models of treatment is key to

Rationale: Identifying Critical Elements of a Trauma-Informed Model in NICU Music Therapy Practice

Experiences of overwhelm and intense fear commonly accompany hospitalization for children and adults alike.

Trauma is an internal straitjacket created when a devastating moment is frozen in time. It stifles the unfolding of being, strangling our attempts to move forward with our lives. It disconnects us from our selves, others, nature and spirit. When people are

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building fully informed and responsible practices. PAT-TERNS (Preventive Approach to Traumatic Experience by Resourcing the Nervous System) was developed to address this need both by identifying the broadranging potential for traumatic experience in the NICU and by utilizing this scope of potential exposure to trauma as a construct for the formation of a preventive music therapy treatment model that is based on latent human resiliency and trauma renegotiation principles.

Keywords: medical trauma; traumatic stress; familycentered care; medical music psychotherapy; NICU music therapy; procedural music therapy

overwhelmed by threat, we are frozen in fear. (Levine, 1997, p. 99)

Traumatic stress responses follow a somewhat predictable pattern of escalation when one is faced with overwhelming life circumstance. While the context of this pattern may vary, taking into account the type and duration of exposure, personal history, and individualized coping styles and strategies, humans are "hard-wired," as all other animal species, with distinct survival mechanisms—fight, flight, and freeze (Levine, 1997; Levine & Poole-Heller, 2002).

Although preterm infants are born with such survival mechanisms intact, they lack the protective buffering system of the intrauterine environment and are not yet equipped with coping strategies, which typically develop over time in response to life experience. Dysmature neurological functioning also impedes the preterm infant's capacity to manage heightened states of arousal, which occur automatically in response to life threat perceived through the sensory systems. During the course of an average neonatal intensive care unit (NICU) hospitalization, a preterm infant may face these acute states of

¹Vassar Brothers Medical Center, Poughkeepsie, New York

This article is the first installment of a two-part series. Whereas Part 1 lays the theoretical and design foundation for this model, Part 2 defines and describes essential treatment parameters to integrate the PATTERNS model into neonatal intensive care unit music therapy practice. Part 2 of this series can be found in the next issue of *Music and Medicine*.

Address correspondence to: Kristen Stewart, Vassar Brothers Medical Center, Music Therapy/NICU, 45 Reade Place, Poughkeepsie, NY 12601; e-mail: kstewart1@health-quest.org.

hyperarousal up to 60 to 100 times as part of routine procedural care. In cases of extreme prematurity, such as with infants born at less than 27 weeks gestation, the average number of procedures increases to 300, with one case recording as many as 488 procedures (Hyman, 2009).

Anand (2009) connects fetal pain, functional in the second trimester, to consciousness. According to Anand, pain in the preterm infant stimulates the brain in the highest sensory areas of the cortex. This implies a conscious perception of pain. While this perspective remains controversial, it is less critical when considering that responses to overwhelming experience and perceived life threat, hallmarks for the development of trauma symptomatology, are stored in the nervous system (Levine, 1997; Porges, 1995; Scaer, 2001; van der Kolk, 1994). Without support to manage these repeated experiences of acute hyperarousal, the preterm infant is vulnerable to long-term, globalized impact, due to the crucial stage of brain development coinciding with the timing of an NICU admission (Anand, Phil, & Carr, 1989; Fisher, 2009; Graven, 2009; Liu et al., 2007; McKenna, 2009; Scaer, 2001; van der Kolk, McFarlane, & Weisaeth, 1996).

Studies conducted with newborn rats, similar in developmental stage at birth to preterm infants, show that exposure to overwhelming stress at birth resulted in impaired development of the limbic system and delayed growth (Braun, 2009). Very little input is required to produce significant synaptic change, notes Braun, professor of zoology and developmental neurobiology and director of the Institute of Biology at Otto von Guericke University in Madgeburg, Germany. Results from one study designed to simulate medical treatment, investigating newborn rat response to one needle stick per day for 2 weeks, showed increased emotional and physiological stress responses and led Braun to conclude that preterm infants quickly learn to fear.

While this information alone appears to substantiate the high risk of traumatic stress for preterm infants, a steadily increasing number of literary references also identify the NICU acoustic environment as hazardous to preterm infant development (Blackburn, 1998; Dykema, 2006; Graven, 2009; McKenna, 2009; Porges, 2003; Scaer, 2005; Schore, 2001). Overwhelming reactions to the environment have been similarly noted in parents and caregivers involved in NICU infant care (Hyman, 2009; Maroney, 2003; Stewart & Schneider, 2000).

This knowledge becomes particularly significant when viewed in conjunction with growing evidence pointing to both the capacity and the necessity of interactive experience to promote healthy development for preterm infants (Als, 1995; Braun, 2009; Brazelton, 1992; Gardner, Garland, Merenstein, & Merenstein, 1986; Schore, 2001). Consistent emphasis is placed on the preterm infant's reliance on the environment (Schwartz, Ritchie, Sacks, & Phillips, 1998), particularly the significant figures of attachment in this environment (McKenna, 2009; Schore, 2001), for making sensory and emotional associations that contribute to learning (Abrams & Gerhardt, 2000; Braun, 2009; Graven, 2009). Viewing each of these factors in tandem serves to highlight the complexity of this systemic network of influences on healthy development and the potential risk for traumatic experience in the NICU (Stewart, in press).

Music therapy offers a unique capacity to enhance healing across the spectrum of experience (Bonny, 1973; Bruscia, 1989; Crowe & Scovel, 1996; Rugenstein, 1996; Stewart, 2002), and research in NICU music therapy has shown consistent benefit for infants, parents, and caregivers in this environment, such as improving physiologic stability and growth in preterm infants (Amon et al., 2006; Kaminsky & Hall, 1996; Standley, 1998); strengthening parent-infant bonding (Bolton, 2000; Nöcker-Ribaupierre, 2004; Whipple, 2000); enhancing interactions between staff, infants, and parents; improving the mood of staff and general attitudes of caregivers (Stewart & Schneider, 2000; Whipple, 2000); and decreasing noise levels in the NICU environment (Amon et al., 2006; Stewart & Schneider, 2000).

Music and rhythm continue to surface in references from scholars specializing in high-risk infant care and trauma (Braun, 2009; Levine, 1997; McKenna, 2009; Scaer, 2001; van der Kolk, 1994). Levine (2004) and van der Kolk (2007) have described trauma as a disruption of the rhythm of the self, and Schwartz et al. (1998) describe the potential importance of intrauterine sounds and rhythms on fetal brain development. Daniel Levitin (2006), neuroscientist, sound engineer, and director of the Laboratory for Musical Perception, Cognition, and Expertise at McGill University, illustrates the power of music from a neurological standpoint. According to Levitin, music engages regions throughout the brain and, more so than speech, activates emotional centers mediating reward and arousal. Levitin (2006) also notes that regions of the brain linked with memory are highly similar to those involved in perception. This seems to support the assumption that memory is linked with sensory perception.

Specific studies of the fetus and the uterine growth environment further substantiate the role of music, sound, and rhythm in fetal and infant development. Fetal breathing has been reported to entrain to the pulse of placental blood flow during the last trimester before birth (McKenna, 2009; Schwartz et al., 1998), while newborn exposure to breath sounds is shown to enhance bonding relationships in infants (Philbin, 2000). It is further understood that the fetus retains a memory of intrauterine auditory experience into early postnatal life, particularly the "prosodic features of speech" (Moon & Fifer, 2000, p. S37). "Not only has it been hypothesized that fetuses can perceive music, but also that they can differentiate among different types of music and demonstrate a musical preference" (Gerhardt & Abrams, 2000, p. S26).

Varying members of the academic community remain in disagreement, however, on the implications of these findings as a basis for clinical application in the NICU. One reason for this, according to Moon and Fifer (2000), is that "postnatal experience cannot be ruled out as a possible explanation for results . . . [of] research on newborn response to naturally occurring stimuli such as heartbeats, intrauterine recordings, pre- and postnatal versions of the maternal voice, father's voice, and unfamiliar voices" (p. S37).

Conversely, recommendations for preterm care continue to stress the importance of an approach that is developmentally based and includes integrative engagement of the somatosthetic, kinesthetic, proprioceptive, vestibular, chemosensory, auditory, and visual systems (Graven, 2009). Positive somatosensory stimulation provided postnatally may help to counter the understood negative impact of an NICU admission and restore impaired synaptic networks to normalize developmental progress (Braun, 2009).

About PATTERNS: Definition, Design, and Treatment Scope

The history of the studies of the effect of auditory stimulation on the developing organism suggests

that untapped opportunities are available in the integration of theory, lines of inquiry, and levels of analysis across various disciplines and in the absorption of existing knowledge into clinical practice. (Philbin, Lickliter, & Graven, 2000, p. S3)

PATTERNS—Preventive Approach to Traumatic Experience by Resourcing the Nervous System—is a multilayered treatment model designed to address the potential for traumatic experience across systems of development and levels of impact. PATTERNS in NICU music therapy integrates theory and best practices from NICU music therapy, trauma, high-risk infant development, and transpersonal psychology and is based on the use of trauma renegotiation and music therapy principles to develop, restore, or otherwise engage absent and/or latent human resiliency processes.

A comprehensive view of PATTERNS in NICU music therapy includes focused applications that range from an assessment of the unit's ecosystem to consideration of NICU architectural design and from individualized bedside intervention for infants and caregivers to the NICU healing environment at large. Each element of this NICU model is dictated by current NICU music therapy best practices (Loewy, 2000; Nöcker-Ribaupierre, 2004; Shoemark, 2004; Standley, 2003; Stewart, in press), standards of safety for the NICU acoustic environment, and developmentally based infant care (Fischer & Als, 2004; Graven, 2000; Morris, Philbin, & Bose, 2000; Philbin & Klaas, 2000; Philbin, Robertson, & Hall, 1999/2008). It is intended to be viewed as a dynamic model, designed to reflect the ongoing development of new treatment standards and driven by scientific and clinical research, as well as by subjective interview of patients, families, and staff.

The goal in developing this model is to offer a discriminating focus to treatment that may enhance medical music therapy interventions hospital-wide and across micro- and macrosystems of contact. Potential for extended applications of this treatment model into antepartum and labor and delivery care, as well as to outer community intervention relative to the health–wellness continuum, is also evident. Birth, as a point of entry into the external world, became the initial population focus for application, due to its unarguably profound potential for benefit across the spectrum of experience and also as an essential marker in the life–death cycle.



Figure 1. A comprehensive view of NICU treatment considerations.

PATTERNS in NICU Music Therapy: A Treatment Model

Due to the comprehensiveness and complexity of this model, it is understood that a detailed description of each element in the model is beyond the scope of this article. It is not the author's intention to give an exhaustive review of each element in the model but rather to present the model as a whole. This perspective may be likened to appreciating the broad sweep of the artist's brush, versus examining a detailed application of color. The focus from this point forward is to introduce a trauma-based model of treatment for the preterm infant while maintaining mindfulness of the complex and interrelated network of influences in this work (Figure 1).

As depicted in Figure 1, the primary treatment areas of the PATTERNS model are similar to those addressed in NICU music therapy best practices: the infant, parents or other primary caregivers, staff, and NICU environment. Each of these treatment areas is significant for the interactive role it plays and for its ultimate influence on the health and development of the preterm infant. Therefore, all treatment areas are to be considered when responding to a new referral in the NICU.

An evaluation across levels of influence should be equally applied to assess the potential for traumatic stress. Understanding how interactive sensory experience molds and shapes the developing fetus, preterm infant, and newborn infant is critical to the formation of any NICU treatment plan, as is considering the evidence to date that points to both the constructive and destructive potential outcomes for these infants and exploring the impact of quality, timing, and duration on interactive processes (Braun, 2009; Fischer & Als, 2004; Graven, 2000, 2009; Philbin et al., 1999/2008).

Given the high risk of exposure to acutely distressing experience that most preterm infants face during an NICU admission, it seems safe to assume that the average preterm infant who is referred for music therapy is coping with some degree of traumatic stress. The evaluation of overwhelming response to circumstances surrounding an NICU admission for parents and caregivers is understandably more diverse, given the difference in timing and duration of exposure, range of past life experience, and variety of coping styles and strategies. For the purpose of broad assessment of potential exposure to trauma across the spectrum of experience (Stewart, in press), the NICU environment can be viewed as a dynamic communal system as well as a physical structure. Consideration of the NICU environment as both a structure and a dynamic entity leads the therapist to pose distinctly different assessment questions while continuing to take into account aspects pertinent to the individuals who contribute to this dynamic.

Once a referral is received, it is the job of the music therapist to gather as much information as possible pertaining to the history of the infant through antenatal, intrapartum, and postpartum conditions and events, along with the background of parents or other primary caregivers. A thorough patient history includes medical, psychosocial, and trauma backgrounds, particularly relating to time frames surrounding the pregnancy and birth of the infant (Stewart, in press). This gathering will cue the therapist to the number and intensity of potential stress risk factors for the infant, as well as for caregivers (Appendix A), and should be combined with the parent/caregiver interview (Appendix B), communications with the interdisciplinary care team, clinical assessment of the infant (Appendix A), and consideration of the NICU care environment to determine primary needs and goals relative to the prevention of trauma outcomes.

PATTERNS incorporates a phase-oriented approach to trauma renegotiation and recovery, which has been adapted to meet the diverse range of potential exposure associated with an NICU experience. Phase-oriented treatment, first introduced by Judith Herman (1992), is the approach to trauma renegotiation that is generally accepted by trauma experts; it involves three major stages of treatment: (a) stabilization, (b) integration, and (c) postintegration self and relational development. While a traumatized individual may move through these stages of recovery progressively, it is more common that progress will be nonsequential and layered through repeated revisiting of each stage.

This said, it is important to approach each infant encounter with the goal to first enhance physiologic stability. Stabilization is widely emphasized as the first stage in phase-oriented trauma models, with the universal understanding that without the establishment of functional stability, pursuing other treatment goals is likely to be futile.

Several phase-oriented treatment models (Cook et al., 2005; Levine & Poole-Heller, 2002; Luxenberg, Spinazzola, & van der Kolk, 2001; Macy, Behar, Paulson, Delman, & Schmidt, 2004; van der Kolk, 2002) have been integrated into the PAT-TERNS model to suit the diverse needs on this unit. These phases include:

- 1. Stabilization
 - a. Enhance physiologic and/or emotional stability
 - b. Help to develop a context of internal and environmental safety
 - c. Identify arousal triggers and current access to regulatory resources
 - d. May include psychoeducation
- 2. Self-regulation: developing the capacity to modulate arousal from internal and external sources and to track patterns of regulation and dysregulation within each domain of experience
 - a. Somato-sensory
 - b. Affect
 - c. Behavior
 - d. Imagery
 - e. Meaning
- 3. Integration of experience/resolution of traumatic memories; deconditioning
- 4. Establishment of secure social connections: repair and/or development of effective attachment and reciprocity
- 5. Accumulation of restorative emotional experiences
- 6. Future planning: development of self-care plans and goals

These phases should conform to each treatment area in consistent and unique ways. For example, while a preterm infant is certainly unlikely to experience imagery or a connection to conscious meaning making, these may be highly significant process areas for a caregiver. Table 1 illustrates goals of treatment based on the phase-oriented approach utilized in the PATTERNS-NICU Music Therapy Model and helps to clarify variations and similarities among these phases across areas of treatment.

Treatment Phase 1. Stabilization	Treatment Goals								
	Infant	Parent/Primary Caregiver	Staff	Environment					
	 a. Stabilize infant physiologic and emotional states (entrainment, combined use of staccato and legato phrases, improvised passing tones to reflect empathic attunement b. Create, as much as possible, a predictable treatment environment (use of structure, simple patterns, familiar sounds, and music) c. Identify arousal triggers and regulatory resources through clinical and nonclinical observation and assessment with the infant individually and interrelationally with caregivers and staff in combination with staff and parent perspectives 	 a. Enhance feelings of internal and external control and identify somatic and emotional states b. Set and maintain a consistent treatment schedule c. Identify arousal triggers and regulatory resources through self-report, staff perspectives, and clinical and non- clinical observation and experience with caregivers individu- ally and interrela- tionally with infant, staff, and family d. Provide psychoeducation as indicated and desired Emphasize the importance of the role of the primary caregiver in supporting infant stabilization Work with the parents/ caregivers to develop awareness of infant arousal triggers and regulatory resources Increase awareness of resources assisting infant regulation 	 a. Enhance feelings of internal and external control and identify somatic and emotional states b. Establish and maintain a schedule for routine Caring- for-the-Caregiver groups c. Identify arousal triggers and regulatory resources through clinical and nonclinical observation and experience with staff individually and interrelationally with other staff and NICU families, in conjunction with staff survey and spontaneous self- report d. Provide psychoeducation as part of routine in-servicing Emphasize the role of staff in supporting infant and caregiver stabilization Work with the staff to develop awareness of infant arousal triggers and regulatory resources Increase awareness of resources assisting infant regulation 	 a. Stabilize and balance acoustic and dynamic environment b. Institute unit redesign and renovation wherever possible to promote feelings of internal and external safety of community members (i.e., enhancing sound aesthetic, increasing noise abatement, and influencing unit design, relative to acoustics, to promote a sense of privacy for families) c. Identify acoustic and dynamic arousal triggers that result in systemic disorganization, stress, and interpersonal reactivity and identify regulatory acoustic and dynamic resources 					
2. Self- regulation	Develop and sustain self- regulatory patterns within somato-sensory, affect and behavioral systems by enhancing access to and utilization of identified resources	Enhance self-regulatory patterns within all domains of experience individually and interre- lationally by developing access to and utilization of identified resources	Enhance self-regulatory patterns within all domains of experience individually and interre- lationally by developing access to and utilization of identified resources	Expand access to resources that enhance and main- tain a healing unit dynamic and improve an experience of the unit's aesthetics					
		Emphasize attunement to and facilitation of infant self-regulatory patterns	Emphasize attunement to and facilitation of infant self-regulatory patterns						

 Table 1. Phase-Oriented Treatment Goals in the PATTERNS-NICU Music Therapy Model

(continued)

	Treatment Goals							
Treatment Phase	Infant	Parent/Primary Caregiver	Staff	Environment				
3. Integration	Expand regulatory patterns across domains of experience	nd regulatory patterns Interventions are aimed to ross domains of expand regulatory pat- terns across domains of experience, incorporating applicable narrative		Interventions provide a sense of integration of the acoustic environme to enhance cohesion ar dynamic balance				
4. Attachment/ social engagement	Emphasize socially interactive processes in treatment	Emphasize interpersonal, interactive processes in both individual and caregiver/infant-focused treatment	Emphasize socially interactive processes in staff group and in community context	Emphasize socially interac- tive processes suited to various clinical and non- clinical areas in the unit				
5. Restorative experiences	Foster experiences of joy	Foster experiences of joy	Foster experiences of joy	Foster experiences of joy				
6. Future planning	Foster developing resiliency patterns and ongoing development	er developing resiliency Address ongoing self-care tterns and ongoing velopment caregiver—infant attach- ment relationships, and support of development		Advocate for unit renova- tion and new unit design to support the prevention of experiences of over- whelm for infants, care- givers, and staff				

 Table 1. (continued)

The goals described in Table 1 may be applied to treatment applications over the course of hospitalization as well as to interventions applied during single sessions, such as in procedural care. While complete relief from distress in response to painful procedures may be unrealistic, interventions applied during acute moments of distress are intended to reduce the intensity of arousal and to help expand the infant's *window of tolerance* (Ogden, Minton, & Pain, 2005), thus engaging existent regulatory patterns and supporting the development of resiliency. This is the essence of the PATTERNS model as a preventive approach to trauma.

Summary

Integrating current evidence across disciplines in developing new models of treatment is key to building fully informed and responsible practices. While there remains a continued need for additional research, evidence to date conveys the importance of moving forward to explore the potential benefit of the specialized application of music therapy in the NICU. PATTERNS was developed to address this need both by identifying the broad-ranging potential for traumatic experience in a hospital environment and by utilizing this scope of potential exposure to trauma as a construct for the formation of a preventive music therapy treatment model that is based on latent human resiliency and trauma renegotiation principles. "The synthesis of perspectives from multiple species, disciplines, and levels of analysis can provide a broader understanding of the processes of development" (Philbin et al., 2000, p. S3).

Declaration of Conflicting Interests

The author has declared that there are no conflicts of interests in the authorship and publication of this contribution.

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Kristen Stewart, MA, MT-BC, LCAT, SEP, is a music therapy coordinator at Vassar Brothers Medical Center in Poughkeepsie, New York.

Appendix A. NICU Music Therapy Assessment

Patient:	Referred by:							
D.O.B.: Reason(s) for referral:								
Patient Intake Summary:								
Average HR: Stre Average RR: Stre Average Q2 Sat.: Stre Supportive Equipment Used: Stre Additional Stressors: Stressors:	ss: ss: ss:	 () Bradycardic () Apneic () Desaturates 	() Tachycardic() Tachypneic() Intubated					
Feeding / Intake / Weight Gain / Voiding: Method of Feed: () Breast () Bottle Feeding noise:	e ()Gavage, specify:							
Reflux: () Yes () No Is the patient's suck in need of assistance? Is physical or occupational therapy involved	Other stressors: () Yes ? () Yes	() No () No						
Pain / Sedation: Describe physiological indicators, location, and perceived level of pain (1-10, with 10 being highest):								
Ongoing procedures which may benefit from	n music therapy assistance:							
Is the infant on a sedative? () Ye Medication(s):	s () No							
Crying / Irritability: Pitch: () HIGH () LOW Absence of cry: () Yes () Irritable: () Yes () Colic: () Yes () Irritable sleep: () Yes ()	() AVERAGE No No No No							
Development: Is the infant developing appropriate muscle Has the infant's hearing been evaluated: Outcome(s):	tone? () Yes () Yes	() No () No						
Is the infant organized in: Sound? () Yes (Touch? () Yes (Movement? () Yes () No) No) No							
Activity level factors (check all that apply): () Flaccid () Hypertonic () Hypotonic () Jittery () Lethargic () Tremors Does the infant like proprioceptive stimulus' Can the infant self-regulate?	? () Yes () Yes	() No () No						

Appendix A (continued)

Psychosocial Needs / Stress Risk Factors:

Antenatal:	Compromised or absent prenatal care Intrauterine exposure to drugs/alcohol Socioeconomic status Stressful work patterns Fetal surgery			Poor maternal health Traumatic injury High-risk pregnancy Past hospitalizations										
Other (define)	:													
Intrapartum:	Birth trauma Maternal stress			Anesthesia Poor				Poor	Apg	ars _		_		
Other (define)	:													
Postpartum:	ICU growth environmentAcuitHigh frequency of proceduresPremLimited or absent parental involvementGeneStimulation intoleranceCarePostpartum depressionCPS			uity of medical status ematurity enetic risk factors eregiver stress PS hold										
Other (define)	:													
Caregiver Stre Who:	ess Self-Evaluation: (with	n 10 being highest)	1 2	3	4	5	6	7	8	9	10			
Family's religi	ous preference / culture													
Defined stress	sors:													
Clinical Asse	ssment Summary:													
Instruments /	activity selection:													
Description of	the music:													
Significant iss	ues:													
Future plans:														
Music Thera	pist:								Dat	te: _				
Extension / F	ager:													

Source: Adapted from Loewy (2000).



Name: ______
Relationship to Infant:

_____ mother _____ father _____ sibling _____ foster parent _____ relative _____ friend

Rate your stress level from 0-10:



What is the most stressful part of having a baby in the NICU?

Are there any additional stressors at this time?

Describe the ways you notice this stress affects

Your body: Your mind: Your emotions: Your beliefs: Your behavior:

What helps you when you feel stressed?

Do you have family and/or friends available to support you at this time?

Is music a part of your daily life? If yes, how so?

What type of music do you use for yourself?

Did you use music during your pregnancy? In what capacity?

Favorite song/song of kin/lullaby?

To be evaluated by the music therapist: Vocal range/preferred key?

Source: Adapted from an unpublished survey by J. V. Loewy.