Procedural-Support Music Therapy in the Healthcare Setting: A Cost–Effectiveness Analysis

Darcy DeLoach Walworth, MM, MT-BC

This comparative analysis examined the cost–effectiveness of music therapy as a procedural support in the pediatric healthcare setting. Many healthcare organizations are actively attempting to reduce the amount of sedation for pediatric patients undergoing various procedures. Patients receiving music therapy-assisted computerized tomography scans (n = 57), echocardiograms (n = 92), and other procedures (n = 17) were included in the analysis. Results of music therapy-assisted procedures indicate successful elimination of patient sedation, reduction in procedural times, and decrease in the number of staff members present for procedures. Implications for nurses and music therapists in the healthcare setting are discussed.

AN INCREASING AMOUNT of research is focusing on reducing pediatric anxiety and distress associated with inpatient and outpatient medical settings. Some medical treatments generally elicit many negative and noncompliant behaviors such as screaming, crying, verbal resistance, and physical avoidance from pediatric patients. To eliminate these behaviors, many medical settings sedate pediatric patients to successfully complete invasive and noninvasive procedures. In addition, role playing and different distraction techniques including humor, visual art, recorded music, and live music have been used in attempts to improve varying aspects of the pediatric patient experience (Blount, Sturges, & Powers, 1990; Malone, 1996; Varni, Blount, Waldron, & Smith, 1995).

PEDIATRIC ANXIETY AND COPING STRATEGIES

Ryan-Wenger, Sharrer, and Wynd (2000) note that as medicine advances, children can experience more possible stressors in the medical setting, specifically those involving frightening diagnostic tests and treatments. It is reported that children with an acute or a chronic illness or those who are experiencing painful medical stressors most commonly use a support system for coping (Ryan-Wenger, 1996). The appropriateness of a child's coping strategy can determine his or her vulnerability or resiliency to current and future stressors (Ryan-Wenger et al., 2000).

Most medical stressors in young children (preschoolers and those in the early elementary years) arise from pain and anxiety associated with invasive procedures such as lumbar punctures, bone marrow aspirations, intravenous cannulations, and immunizations with needle sticks. During bone marrow aspirations, studies suggest that anxiety produces preprocedural distress and that actual pain produces procedural distress that steadily rises until after procedure completion when distress returns to preprocedure levels (Katz, Kellerman, & Siegel, 1980; Lebaron & Zeltzer, 1984). Therefore, children's reactions can be lengthy in duration with steadily rising intensity.

When faced with these kinds of anxiety-producing medical stimuli, children demonstrate different types of coping mechanisms through information-seeking or information-avoidance behaviors (Peterson, 1989; Siegel, 1981; Varni, 1995). With acute and complex stressors such as hospitalization and needle sticks, children eliciting more information-avoidance coping behaviors do not cope as well as those who display informa-

From the Tallahassee Memorial Healthcare, The Florida State University, Tallahassee, FL.

Address correspondence and reprint requests to Darcy DeLoach Walworth, MM, MT-BC, Tallahassee Memorial Healthcare, The Florida State University, 1033 High Meadow Dr, Tallahassee, FL 32311.

0882-5963/$ - see front matter

doi:10.1016/j.pedn.2005.02.016

tion-seeking coping styles (Blount, Davis, Powers, & Roberts, 1991; Blount, Smith, & Frank, 1999).

More interesting research about children's coping abilities indicate that children who do not have adult involvement either through coaching or prompting most commonly display distress behaviors in painful situations (Dahlquist et al.,1986; Jay, Elliot, Katz, & Siegel, 1987). Parent and staff interactions with children receiving a medical treatment have a direct impact on the amount of distress behaviors that these children display. Adult behaviors, whether positive or negative, usually elicit similar behaviors from other adults in the room; parental anxiety, staff giving the child control, apologies, and criticism all increase children's distress behaviors during procedures (Blount, Davis et al., 1991; Frank, Blount, Smith, Manimala, & Martin, 1995). Parental and staff coping-promoting and distress-promoting behaviors can predict 55% of the variance in child distress and 38% of the variance in child coping behaviors elicited during distressful procedures (Frank et al., 1995). Blount, Landolf-Fritsche, Powers, and Sturges (1991) found that parents with high and low coping abilities demonstrated equal amounts of distress-prompting behaviors, which equally resulted in a child's distress response.

DISTRACTION TECHNIQUES

Distraction techniques have been proven to be successful in reducing pediatric patient anxiety and distress behaviors while increasing coping for painful and preoperative procedures. It is recommended that these should be a standard component of every clinical program (Blount, Davis et al., 1991; Robb, Nichols, Rutan, Bishop, & Parker, 1995; Scheve, 2002; Standley & Hanser, 1995). Varni et al. (1995) provide an extensive review of literature supporting various cognitive–behavioral distraction techniques resulting in decreased anxiety and distress and increased coping for pediatric oncology patients. These include desensitization, hypnosis, relaxation, deep breathing, using a bubble blower, filmed modeling, and training in coping skills. Blount, Sturges, and Powers (1990) used distraction techniques such as nonprocedural talking, humming, humor, and deep breathing during painful procedures for children. These children still emitted distress behaviors of crying, screaming, and verbal resistance but did so at a lowered amount.

Distraction from procedural anxiety is primarily provided by nurses in pediatric oncology centers and bone marrow transplant units; the most common methods used include providing information before the procedure and positive reinforcement after the procedure (McCarthy, Cool, Peterson, & Bruene, 1996). Kleiber and Harper (1999) performed a meta-analysis of 16 studies and found distraction techniques to be successful in reducing children's distress behaviors during medical procedures.

Nurse coaching has been proven to be a successful distraction technique. Using cartoons paired with nurse coaching to distract pediatric patients from procedural anxiety and distress during immunizations has been proven to be successful for reducing not only patient distress but also parent and nurse distress (Cohen, Blount, & Panopoulos, 1997). Another study compared a local anesthetic, movie/nurse coaching distraction, and control conditions for children receiving immunizations and found that the movie/nurse coaching group showed significantly more coping skills and significantly fewer distress behaviors. The subjects also experienced less distress and pain than anticipated as compared with subjects from the other groups (Cohen, Blount, Cohen, Schaen, & Zaff, 1999). Both studies identified distraction as an economical alternative for patient and nurse anxiety reduction.

Jay, Elliot, Woody, and Siegel (1991) researched a cognitive–behavioral therapy program consisting of filmed modeling, imagery/distraction, breathing exercises, behavioral rehearsal, an incentive, and coaching by the therapist for children receiving bone marrow aspirations and lumbar punctures. Results showed a decrease in distress behaviors, heart rate, and pain perception for both the cognitive–behavioral-only group and the cognitive–behavior paired with valium group with no significant differences between the two groups. This finding indicates no reason for children to be given medication for procedures when receiving the cognitive–behavioral treatment package.

Megel, Houser, and Gleaves (1998) found recorded lullabies to be an effective distraction for reducing overall distress scores in children receiving routine immunizations. Malone (1996) found a significant decrease in behavioral distress for children younger than 7 years receiving needle sticks paired with live age-appropriate music versus children receiving no music. Standley (1986) also conducted a meta-analysis of 30 studies involving music interventions in medical/dental settings and found that 54 of the 55 variables enhanced the

medical objective. Robb et al. (1995) found that music-assisted relaxation significantly reduced preoperative anxiety behaviors in pediatric burn patients receiving reconstructive surgery. Scheve (2002) also found that live music significantly reduced pediatric patients' preoperative anxiety when compared with the anxiety levels of patients not receiving music interventions.

Because of the effect of memories on expectations, children who have a previous negative medical experience are likely to anticipate a negative interaction in the future (Ornstein, Manning, & Pelphrey, 1999). Memories of procedural distress can impact distress behaviors when a child is faced with a similar medical intervention (Zeltzer & Feldman, 1999). Even as adults, childhood memories of negative medical experiences impact decisions to receive treatment and increase fears associated with medical procedures (Pate, Blount, Cohen, & Smith, 1996). Cohen et al. (2001) collected data 6 months postvaccination of Grade 4 pupils and found that children who received distraction during injections recalled significantly less distress than did children in the control group. These results show the implication of positive memory recall for children receiving some kind of distraction during a medical procedure.

SEDATING PEDIATRIC PATIENTS

Pediatric patients' fears and anxiety associated with medical procedures are well documented. It is noted that children younger than 6 years and those with developmental delays often require sedation to complete medical procedures, even those that are noninvasive (American Academy of Pediatrics Committee on Drugs [AAP COD], 2002). A sedation treatment results in a continuum of responses with varying effects on different individuals. For example, some patients can slip into a deeper sedative state than intended, resulting in loss of protective reflexes or going from light sedation to obtundation or complete unresponsiveness (AAP COD, 2002). Risks for serious adverse reactions to sedation exist regardless of medication or delivery method used (Cote, Karl, Notterman, Weinberg, & McCloskey, 2000).

For many physicians, the sedation drug of choice for pediatric patients requiring conscious sedation is chloral hydrate (Reynolds, 1996). Conscious sedation (moderate sedation) is defined as:

> A medically controlled state of depressed consciousness that 1) allows protective reflexes to be maintained; 2) retains the patient's ability to maintain a patent airway independently and continuously; and 3) permits appropriate response by the patient to physical stimulation or verbal command. (AAP COD, 1992, Definition of terms section)

The most common side effects of chloral hydrate are nausea, vomiting, stomach pain, mild respiratory depression, and hyperactivity (Greenberg, Faerber, Aspinall, & Adams, 1993; Sifton, 1998).

Although guidelines exist for using conscious sedation, adverse outcomes still occur in multiple venues with different medications and for various reasons (Cote, Alderfer, Notterman, & Fanta, 1995). Adverse outcomes include seizures, respiratory failure requiring bag ventilation, laryngospasm, significant increases in middle ear pressure, oxygen desaturation/hypoxemia, sinus arrhythmia, and/or death (Abdul-Baqi, 1991; Biban, Baraldi, Pettenazzo, Filippone, & Zacchello, 1993; Cote et al., 1995; Munoz et al., 1997; Polaner et al., 2001; Sing, Erickson, Amitai, & Hryhorczuk, 1996). One study reported that two children were given light levels of sedation (chloral hydrate or midazolam) by their parents at home before the procedure as per the usual procedure, placed in the car seat, and found dead upon arrival at the medical office (Cote, 2002). In these cases, the causes of death were unknown. Known causes of adverse outcomes include early discharge, inadequate monitoring during or after a procedure, drug overdose, and administration error (Cote et al., 1995).

Eliminating the need for sedation in pediatric patients receiving noninvasive procedures is not only a cost–effective measure for healthcare organizations but also greatly benefits patients and family members by increasing a child's safety and decreasing the patient's, family members', and nurses' anxiety. In addition, reduced distress could avoid long-term anxiety for medical treatment. The current comparison analysis looked into the effectiveness of music therapy in eliminating the need for sedation and reducing distress in pediatric patients receiving inpatient and outpatient noninvasive procedures. The cost–effectiveness of music therapy as procedural support was also analyzed.

METHOD

Importance of Patient-Preferred Live Music

Finding and playing each patient's preferred music genre or song are an important component of every music therapy interaction. The formation of music preference is an involved process. In

children and adults, factors that influence music preference include increased repetition or exposure, degree of liking, and cultural environment (Hargreaves, 1984; Morrison, 1998; Morrison & Yeh, 1999; Siebenaler, 1999; Stratton & Zalanowski, 1984; Thaut & Davis, 1993). LeBlanc (1982) developed an in-depth model of music preference formation explaining the changes people experience in their music preference over time. Walworth (2003) found that playing an individual's preferred genre or artist is as effective in reducing anxiety as playing a specific song indicated as relaxing by the person when compared with the anxiety levels of a person receiving no music. Therefore, it is assumed that music therapists can achieve the same results playing songs from preferred genres as playing a specific song with which a patient has a previous positive association.

Procedure

All music therapy-assisted pediatric echocardiograms (ECG; n = 92), computerized tomography (CT) scans (n = 57), and other noninvasive and invasive procedures (n = 17) at a general medical hospital over a 1-year period were evaluated in this comparative analysis to determine the success rate of completing each procedure without the need for sedation. Institutional review board approval was not required for this analysis of accounting records related to procedures because no contact with patients was any different. All music therapy procedures used age-appropriate, patient-preferred live music selections and genres. Songs ranged from traditional children's songs such as "Twinkle, Twinkle" to religious and folk music. Music therapists used classical guitar, rhythm instruments, and interactive visual aids to accompany their live singing in all sessions.

Echocardiogram

Patients receiving music therapy for an inpatient or outpatient ECG procedure (n = 92) had a mean age of 2.09 years, an *SD* of 1.17 years, and a range of 6 months to 7 years. Patients included in the analysis were 48 boys and 44 girls. Every patient who received music therapy for an ECG was included in the analysis. For outpatient procedures, hospital staff members notified the music therapist when the patient had arrived and completed hospital registration. For inpatient procedures, hospital staff notified the music therapist in advance of the time the procedure was scheduled.

Caregivers were instructed to bring infants to the procedure with an empty stomach in case they required sedation to complete the procedure. Because of hunger, some infants displayed signs of increased anxiety before the beginning of the music therapy interaction. If initially infants did not fully respond to music therapy, parents were given the option to feed their child and continue with music therapy or sedate them. All parents chose to feed their infant and continue with music therapy.

To reduce patient environmental anxiety and establish rapport before the procedure, all music therapy interactions began in the waiting area. Each patient's music preference was determined at this time by questioning him or her and/or his or her family (see later section for importance of patient-preferred music). To establish trust and rapport with a patient, the music therapist sang songs and played instruments in the waiting area until the patient appeared comfortable. The music therapist then escorted the patient down the hall to the procedure room. Once in the procedure room, the music therapist engaged the patient in any live music interaction that successfully distracted him/her from the procedure and medical instruments. Guitar, rhythm instruments, and puppets were all used until the procedure was successfully completed. Because of young children's short attention spans, songs, instruments, and activities were often rapidly changed. It was not unusual for some patients to require a stimulus change every few seconds. At the end of the procedure, outpatients were discharged home and inpatients were taken back to their rooms.

Computerized Tomography Scan

Hospital staff notified the music therapist in advance when an outpatient or inpatient pediatric CT scan was scheduled (n = 57). The mean age of children included in the analysis was 1.96 years, the *SD* equaled 1.66 years, and the range was 1 month to 9 years; there were 28 boys and 29 girls. Before the procedure, parents or caregivers were instructed by hospital staff to deprive the patient of sleep by waking the child up a few hours earlier than normal on the day of the procedure. This is designed to help the child fall asleep for the CT scan. The goal of the music therapy intervention was to induce sleep before the CT scan and sustain sleep for the duration of the procedure without sedating the patient. After completing registration, the music therapist questioned the patient and/or his

or her family to determine the patient's preferred music. The patient and his or her family were then taken to a radiology waiting room to begin the music therapy session. The isoprinciple technique of matching the live music to a patient's current anxiety or behavioral state and then changing the music to yield a different patient behavior was used with every patient. The isoprinciple was proposed by Altschuler in 1948 and has been used therapeutically to alter each patient's mood states and/or physiological reactions to stimuli (Bradt, 2001). Once a patient's anxiety or behavioral state was matched by the live music, the music tempo and/or volume gradually decreased until the patient fell asleep. The guitar was the accompaniment instrument used by the music therapist. Many sessions began with the patient playing rhythm instruments and/or singing along. Over a 10- to 20-min period, the live music slowly decreased in intensity and volume, the lights were dimmed or turned out, and the patient was wrapped in a warmed blanket and most often held and rocked by a caregiver to facilitate sleep inducement. When the patient had been asleep for at least 5 min, the CT scan staff was notified and the CT scan procedure began as soon as the room was available. If the patient awoke and or cried in the scan room, the isoprinciple technique of matching current patient state with live music was continuously used until the patient returned to a sleeping state. A benefit of using live music (music therapist playing guitar and singing) is the ability of the music therapist to immediately change the music tempo, song selection, and/or volume to match the patient's current behavioral state. After the procedure was completed, outpatients were discharged home and inpatients were taken back to their rooms.

Caregivers were instructed to bring infants to the procedure with an empty stomach in case they required sedation to complete the procedure. Because of hunger, some infants displayed signs of increased anxiety before the beginning of the music therapy interaction. If initially infants did not fully respond to music therapy, parents were given the option to feed their child and continue with music therapy or sedate them. Most parents chose to feed their infant and continue with music therapy.

Other Procedures

Other music therapy-assisted pediatric procedures (n = 17) included intravenous (IV) starts (n = 11), X-rays (n = 2), ventilator extubation (n = 1), and electroencephalograms (EEGs) (n = 3). All procedures used the isoprinciple technique of matching the current patient behavioral or anxiety state with music then changing the music intensity, tempo, and volume in the desired direction of decreased anxiety and calming behaviors. Seven boys and four girls received music therapy-assisted IV starts and had a mean age of 5.57 years, an *SD* of 3.17 years, and a range of 18 months to 11 years. During IV starts, the music therapist began interaction before the painful stimulus of the needle insertion. Live guitar playing and singing paired with puppets and books were used to distract each patient from anxiety-producing stimuli before, during, and after the needle insertion.

Two patients displaying increased anxiety concerning an x-ray procedure were referred for music therapy procedural support. Both patients receiving music therapy-assisted x-rays were girls aged 3 and 4 years. The music therapist began interaction in the waiting room and then followed each patient back to the treatment room. Once in the room, the music therapist continued the live music, usually by guitar playing and singing, throughout the procedure.

The music therapy department received one referral to assist with a ventilator extubation of a 13-year-old female patient who had failed two previous attempts. The music therapist received information about the patient's music preference from her family members and established rapport by conducting two sessions with the patient before the procedure. On the day of the procedure, the music therapist began live guitar playing and singing before the procedure began, continued throughout the extubation, and played after the procedure until the patient fell asleep. This is another example of using the isoprinciple, matching the music to the current patient behavioral state and changing to yield the desired outcome. When the patient exhibited anxiety behaviors of increased breathing and heart rate, the music tempo and intensity increased to match such states then slowly decreased until the patient was asleep. Had the extubation trial failed again, the patient would have required a tracheostomy.

The primary goal during EEGs (n = 3) was to have each patient sleeping with reduced amounts of sedation. All three EEG patients were girls aged 3 to 5 years. The music therapy department received referrals for patients exhibiting noncompliant behaviors (screaming, crying, or verbal resistance) and patients not physically responding

to sedation. The isoprinciple discussed earlier was used successfully with these patients as well. The music was matched to the patients' current anxiety state and was gradually decreased in tempo, intensity, and/or volume until they were asleep.

Results

Results of the analysis show a 100% success rate of eliminating the need for sedation for pediatric patients receiving ECGs (see Figure 1), an 80.7% success rate for pediatric CT scan completion without sedation, and a 94.1% success rate for all other procedures. An intervention was considered successful if the behaviors elicited by a patient did not interfere with the procedure and if the procedure was completed without sedation. No registered nurses (RNs) were required for successful interventions. Music therapy-assisted CT scans that were unsuccessful revealed that the patients involved (n = 6; 10.51%) were not sleep deprived (received a full night's sleep before the procedure). Of these patients, two also received IV sticks and one had no family support system. In addition, three patients (5.26%) received multiple needle sticks in attempts for an IV start, one patient (1.75%) experienced a lengthy procedure delay, and one patient (1.75%) had a catheter in the chest area and received needle sticks during the CT scan (see Figure 2). For the other procedures, 1 of the 17 patients (5.9%) experienced a 3-hr procedure delay and was unsuccessful at completing the procedure without significant behavioral distress responses. Music therapy was facilitated by sleep deprivation in the children and was highly successful except during multiple IV sticks and extended delays.

Cost analysis of the records indicates that music therapy-assisted procedures save money, time, and staff/equipment resources for pediatric areas. The most compelling area of data analysis is the ECG laboratory (see Table 1). Based on the data collected, 92 patients completed ECGs without sedation, with each music therapy-assisted procedure taking an average of 20 min. The cost savings for this number of patients at the hospital performing the procedures equaled $7,005.80, resulting in $76.15 worth of savings per patient. Reasons for this cost reduction are as follows: the RN was not required to assist eliminating $55.00 per procedure, the sedation cost of $9.45 per dose (S. Jirau, personal communication, December 11, 2003) was eliminated, the sonographer time was reduced from 1 hr to 20 min, decreasing the cost of the sonographer from $23.00 to $5.75 per procedure, and the cost of the music therapist averaged $5.55 per procedure. With an average of 20 min per procedure, the equipment and staff could be scheduled for three times as many procedures as previously, and space in recovery rooms was increased. There is a nationwide shortage of RNs, who are severely overworked. This project resulted in 184 RN-hours saved for other duties.

Table 1. Cost Analysis for Echocardiograms (N = 92)

	Staff Time per Procedure (hr)	Cost per Procedure	Total Cost per Patient
Without music therapy			
RN	2	$55.00	
Sonographer	1	$23.00	
Medication		$9.45	
			$87.45
With music therapy			
RN	0	0	
Sonographer	1/3	$7.66	
Music therapist	1/3	$5.55	
Medication		0	
			$13.21
Net savings			$74.24

Note: Savings per patient = $74.20; total savings for 92 patients = $6,830.00; total RN hours saved for other duties = 184 hr at $27.50/hr = $5,060.00; total sonographer hours saved = 62 hr at $23.00/hr = $1,426.00.

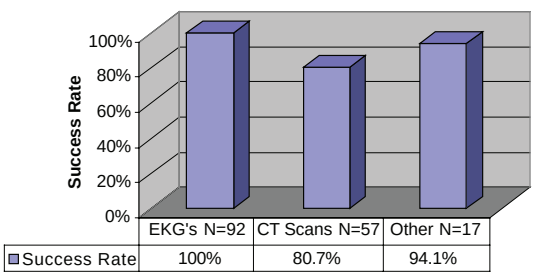

Figure 1. Music therapy-assisted procedures.

Discussion

Eliminating the need for sedation required patients to be asleep during a CT scan. Patients had to be eliciting minimal or no distress behaviors for an ECG, x-ray, or ventilator extubation to be considered successful. As discussed in the literature, patients who have previous negative associations with medical procedures are more likely to develop fears and show distress responses when faced with a medical procedure again. Having these patients

successfully complete a medical procedure with little to no distress behaviors could prevent or reduce future negative associations. Parents actively participated in the music therapy sessions and made many positive comments about the use of music to eliminate sedation. The elimination or reduction of parental anxiety appeared to benefit parents, patients, and staff members.

Adverse reactions and risks associated with sedating a pediatric patient were eliminated with the use of music therapy during the procedures. This benefits not only patients but also families and healthcare organizations. A secondary benefit is more available time and resources for nursing staff, use of equipment, and availability of recovery rooms. Many hospitals are experiencing nursing shortages, so decreasing the nursing demand was welcomed and appreciated by the staff participating in patient interactions compared for this analysis.

The savings identified with music therapy-assisted pediatric procedures could have a large impact on a pediatric hospital where large numbers of procedures are done yearly. The Children's Hospital of Pittsburgh reports conducting an average of 6,000 ECG pediatric (birth, 21 years old) procedures annually (A. Scheve, personal communication, May 15, 2003). With the data collected from this analysis, if even half of the reported cases received music therapy assistance and eliminated the need for sedation and subsequent RN supervision, roughly $228,450.00 could potentially be saved annually.

A rapidly emerging clinical area, medical music therapy programs have been established nationwide in children's hospitals, cancer settings, and general medical facilities. The American Music Therapy Association [AMTA] (2002) reports that 10% of music therapists provide services in medical/surgical settings (AMTA, 2002). The AMTA maintains a record of qualified music therapists by geographic locations. The most beneficial use of a music therapist in a medical setting is that with a full-time employee serving a variety of units and able to be on call for procedural support needs. Clinical music therapy services are provided in response to medical referrals on the following inpatient units: newborn intensive care unit, pediatrics/pediatric intensive care unit, pediatric rehabilitation, oncology, heart and vascular institute, geriatric inpatients, extended care/long-term care, and labor and delivery (Standley & Walworth, 2003). Clinical music therapy services are provided in the following outpatient programs: neuroscience center Parkinson's voice program, neurorehabilitation, pediatric rehabilitation, cardiac outpatient, and adult day care (Standley & Walworth, 2003). Robb (2003) compiled best-practice methods and research supporting the use of music therapy in the pediatric healthcare setting. The practice of music therapy is growing and its use in both pediatric and general medical settings is receiving attention.

Limitations and Suggestions for Future Research

Music therapy began assisting procedures in 2002, shortly after the new sedation standards were initiated by the Joint Commission on Accreditation of Healthcare Organizations. Because of the small number of pediatric ECGs administered at the general hospital where this analysis was conducted, the music therapy department had the ability to assist with every case. In the interest of providing optimal patient care and not sedating patients, a randomized controlled study evaluating patients receiving music therapy versus a control group was not conducted. Had there been a higher number of patients receiving these procedures than the music therapy department could serve, a randomized study with control subjects would have been initiated. Future studies at a large pediatric hospital would be able to gather more controlled randomized data concerning distress/anxiety behaviors from patients, family members, and staff, sedated and nonsedated patients, length of procedure, and staff resources used.

ACKNOWLEDGMENTS

The author would like to thank Deborah Merritt for her invaluable assistance and advocacy in creating music therapy procedural support and Dr. Jayne Standley for her continued guidance and support.

REFERENCES

Abdul-Baqi, K. J. (1991). Chloral hydrate and middle ear pressure. *Journal of Laryngol Otolaryngology, 105,* 421–423.

American Academy of Pediatrics Committee on Drugs. (1992). Guidelines for monitoring and management of pediatric

patients during and after sedation for diagnostic and therapeutic procedures. *Pediatrics, 89,* 1110–1115.

American Academy of Pediatrics Committee on Drugs. (2002). Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: Addendum. *Pediatrics, 110,* 836–838.

American Music Therapy Association. (2002). *AMTA member sourcebook 2002*. Silver Spring, MD: AMTA.

Biban, P., Baraldi, E., Pettenazzo, A., Filippone, M., & Zacchello, F. (1993). Adverse effect of chloral hydrate in two young children with obstructive sleep apnea. *Pediatrics, 92,* 461–463.

Blount, R. L., Davis, N. J., Powers, S. W., & Roberts, M. C. (1991). The influence of environmental factors and coping style on children's coping and distress. *Clinical Psychology Review, 11,* 93–116.

Blount, R. L., Landolf-Fritsche, B., Powers, S. W., & Sturges, J. W. (1991). Differences between high and low coping children and between parent and staff behaviors during painful medical procedures. *Journal of Pediatric Psychology, 16,* 795–809.

Blount, R. L., Smith, A., & Frank, N. (1999). Preparation to undergo medical procedures. In A. J. Goreczny, & M. Hersen (Eds.), *Handbook of pediatric and adolescent health psychology* (pp. 305–326). Needham Heights, MA: Allyn and Bacon.

Blount, R. L., Sturges, J. W., & Powers, S. W. (1990). Analysis of child and adult behavioral variations by phase of medical procedure. *Behavior Therapy, 21,* 33–48.

Bradt, J. (2001). The effects of music entrainment on postoperative pain perception in pediatric patients. (*Unpublished doctoral dissertation*) Philadelphia Temple University.

Cohen, L. L., Blount, R. L., Cohen, R. J., Ball, C. M., McClellan, C. B., & Bernard, R. S. (2001). Children's expectations and memories of acute distress: Short- and long-term efficacy of pain management interventions. *Journal of Pediatric Psychology, 26,* 367–374.

Cohen, L. L., Blount, R. L., Cohen, R. J., Schaen, E. R., & Zaff, J. F. (1999). Comparative study of distraction versus topical anesthesia for pediatric pain management during immunizations. *Health Psychology, 18,* 591–598.

Cohen, L. L., Blount, R. L., & Panopoulos, G. (1997). Nurse coaching and cartoon distraction: An effective and practical intervention to reduce child, parent, and nurse distress during immunizations. *Journal of Pediatric Psychology, 22,* 355–370.

Cote, C. J. (2002). Pediatric, dental communities concerned about safe sedation for kids. *American Academy of Pediatrics News, 21,* 11–12.

Cote, C. J., Alderfer, R. J., Notterman, D. A., & Fanta, K. B. (1995). Sedation disasters: Adverse drug reports in pediatrics—FDA, USP, and others. *Anesthesiology, 83,* 1183.

Cote, C. J., Karl, H. W., Notterman, D. A., Weinberg, J. A., & McCloskey, C. (2000). Adverse sedation events in pediatrics: Analysis of medications used for sedation. *Pediatrics, 106,* 633–644.

Dahlquist L. M., Gil, K. M., Armstrong, D., DeLawyer, D. D., Greene, P., & Wuori, D. (1986). Preparing children for medical examination: The importance of previous medical experience. *Health Psychology, 5,* 249–259.

Frank, N. C., Blount, R. L., Smith, A. J., Manimala, M. R., & Martin, J. K. (1995). Parent and staff behavior, previous child medical experience, and maternal anxiety as they relate to child procedural distress and coping. *Journal of Pediatric Psychology, 20,* 277–290.

Greenberg, S. B., Faerber, E. N., Aspinall, C. L., & Adams, R. C. (1993). High-dose chloral hydrate sedation for children undergoing MR imaging: Safety and efficacy in relation to age. *AJR American Journal of Roentgenology, 161,* 639–641.

Hargreaves, D. J. (1984). The effects of repetition on liking of music. *Journal of Research in Music Education, 32,* 35–47.

Jay, S. M., Elliot, C. K., Katz, E., & Siegel, S. E. (1987). Cognitive–behavioral and pharmacologic interventions for children's distress during painful medical procedures. *Journal of Consulting and Clinical Psychology, 55,* 860–865.

Jay, S. M., Elliot, C. H., Woody, P. D., & Siegel, S. (1991). An investigation of cognitive–behavior therapy combined with oral valium for children undergoing painful medical procedures. *Health Psychology, 10,* 317–322.

Katz, E. R., Kellerman, J., & Siegel, S. E. (1980). Distress behavior in children with cancer undergoing medical procedures: Developmental considerations. *Journal of Consulting and Clinical Psychology, 48,* 356–365.

Kleiber, C., & Harper, D. C. (1999). Effects of distraction on children's pain and distress during medical procedures: A meta-analysis. *Nursing Research, 48,* 44–49.

Lebaron, S., & Zeltzer, L. (1984). Assessment of acute pain and anxiety in children and adolescents by self-reports, observer reports, and a behavioral checklist. *Journal of Consulting and Clinical Psychology, 52,* 729–738.

LeBlanc, A. (1982). An interactive theory of music preference. *Journal of Music Therapy, 19,* 28–45.

Malone, A. B. (1996). The effects of live music on the distress of pediatric patients receiving intravenous starts, venipunctures, injections, and heel sticks. *Journal of Music Therapy, 33,* 19–33.

McCarthy, A. M., Cool, V. A., Peterson, M., & Bruene, D. A. (1996). Cognitive behavioral pain and anxiety interventions in pediatric oncology centers and bone marrow transplant units. *Journal of Pediatric Oncology, 13,* 3–12.

Megel, M. E., Houser, C. W., & Gleaves, L. S. (1998). Children's responses to immunizations: Lullabies as a distraction. *Issues in Comprehensive Pediatric Nursing, 21,* 129–145.

Morrison, S. J. (1998). A comparison of preference responses of White and African-American students to musical/visual stimuli. *Journal of Research in Music Education, 46,* 208–222.

Morrison, S. J., & Yeh, C. S. (1999). Preference responses and use of written descriptors among music and nonmusic majors in the United States, Hong Kong, and the People's Republic of China. *Journal of Research in Music Education, 47,* 5–17.

Munoz, M., Gomez, A., Soult, J. A., Marquez, C., Lopez-Castilla, J. D., & Cervera, A. (1997). Seizures caused by chloral hydrate sedative doses [letter]. *Journal of Pediatrics, 131,* 787–788.

Ornstein, P. A., Manning, E. L., & Pelphrey, K. A. (1999). Children's memory for pain. *Developmental and Behavioral Pediatrics, 20,* 262–277.

Pate, J. T., Blount, R. L., Cohen, L. L., & Smith, A. J. (1996). Childhood medical experience and temperament as predictors of adult functioning in medical situations. *Children's Health Care, 25,* 281–298.

Peterson, L. (1989). Coping by children undergoing stressful medical procedures: Some conceptual, methodological, and therapeutic issues. *Journal of Consulting and Clinical Psychology, 57,* 380–387.

Polaner, D. M., Houck, C. S., Rockoff, M. A., Mancuso, T. J., Finley, G. A., Maxwell, L. G, et al. (2001). Sedation, risk, and safety: Do we really have data at last? *Pediatrics, 108,* 1006–1008.

Reynolds, J. E. F., (Ed.) *The extra pharmacopoeia.* 31st ed. London, UK: Pharmaceutical Press.

Robb, S. L., (Ed.) *Music therapy in pediatric healthcare: Research and evidence-based practice*. Silver Spring, MD: American Music Therapy Association Inc.

Robb, S. L., Nichols, S. J., Rutan, R. L., Bishop, B. L., & Parker, J. C. (1995). The effects of music assisted relaxation on preoperative anxiety. *Journal of Music Therapy, 32,* 2–21.

Ryan-Wenger, N. A. (1996). Children, coping, and the stress of illness: A synthesis of research. *Journal of the Society of Pediatric Nurses, 1,* 126–138.

Ryan-Wenger, N. A., Sharrer, V. W., & Wynd, C. A. (2000). Stress, coping, and health in children. In V. H. Rice (Ed.), *Handbook of stress, coping, and health: Implications for nursing research, theory, and practice* (pp. 265–293). Thousand Oaks, CA: Sage.

Scheve, A. (2002). The effect of music therapy intervention on pre-operative anxiety of pediatric patients as measured by self-report. (Unpublished master's thesis): The Florida State University.

Siebenaler, D. J. (1999). Student song preference in the elementary music class. *Journal of Research in Music Education, 47,* 213–223.

Siegel, L. J. (1981). Naturalistic coping strategies in children facing medical procedures. Paper presented at the meeting of the Southeastern Psychological Association, Atlanta, GA.

Sifton, D. W. (Ed.) (1998). *PDR® Generics™*. Montvale, NJ: Medical Economics Company.

Sing, K., Erickson, T., Amitai, Y., & Hryhorczuk, D. (1996). Chloral hydrate toxicity from oral and intravenous administration. *Clinical Toxicology, 34,* 101–106.

Standley, J. M. (1986). Music research in medical/dental treatment: A meta-analysis and clinical applications. *Journal of Music Therapy, 23,* 56–122.

Standley, J. M., & Hanser, S. B. (1995). Music therapy research and applications in pediatric oncology treatment. *Journal of Pediatric Oncology Nursing, 12,* 3–10.

Standley, J. M., & Walworth, D. D. (2003). A cost/benefit analysis of a comprehensive medical music therapy program with arts in medicine component. Research paper presented at AMTA National Conference, Minneapolis, November.

Stratton, V. N., & Zalanowski, A. H. (1984). The relationship between music, degree of liking, and self reported relaxation. *Journal of Music Therapy, 21,* 184–192.

Thaut, M. H., & Davis, W. B. (1993). The influences of subject-selected versus experimenter-chosen music on affect, anxiety, and relaxation. *Journal of Music Therapy, 30,* 210–223.

Varni, J. W. (1995). Pediatric pain: A decade of biobehavioral perspective. *Behavior Therapist, 18,* 65–70.

Varni, J. W., Blount, R. L., Waldron, S. A., & Smith, A. J. (1995). Management of pain and distress. In M. C. Roberts (Ed.), *Handbook of pediatric psychology,* (2nd ed., pp. 105–123). New York: Guilford.

Walworth, D. D. (2003). The effect of preferred music genre selection versus preferred song selection on experimentally induced anxiety levels. *The Journal of Music Therapy, 40,* 2–14.

Zeltzer, L., & Feldman, S. (1999). Soothing and chronic pain. In M. Lewis, & D. Ramsey (Ed.), *Soothing and stress* (pp. 195–277). Mahwah, NJ: Lawrence Erlbaum.