THE PSYCHOPHYSIOLOGICAL EFFECTS OF MUSIC THERAPY IN INTENSIVE CARE UNITS

Music therapy is inexpensive with significant physiological and psychological benefits, says Donna Austin

Summary

This article reviews the evidence for using music therapy with young people who are supported by mechanical ventilation. The author argues that music therapy is essential for developing a holistic approach focusing on the developmental level of a child or young person, as well as being an inexpensive, non-pharmacological, non-invasive therapy, with significant physiological and psychological benefits. She argues that more research is needed in this area to develop a sound evidence base on which guidelines to inform practice could be based.

Keywords
Intensive care, music therapy, patients: families

MECHANICAL VENTILATION is one of the most frequently used treatments in paediatric intensive care units (PICUs) for patients who are unable to maintain adequate ventilation and oxygenation (Lee et al 2005). Despite the lifesaving potential of endotracheal intubation and mechanical ventilation, they can cause major distress.

Patient distress from mechanical ventilation occurs from thirst, sleep deprivation, inability to communicate, fear, discomfort, agitation, immobility and confusion. A stress response results from the anxiety and distress associated with being mechanically ventilated (Chlan 2000). If stress is prolonged or unresolved, patients can experience long-term symptoms that may affect recovery, which is why it is essential to reduce anxiety and stress pharmacologically and non-pharmacologically among intubated children (Almerud and Petersson 2003).

To alleviate anxiety in ventilated young people nurses frequently administer pharmacological sedation. This can have a number of side effects, such as nausea, vomiting, respiratory depression, decreased gut motility, muscle weakness or atrophy, delayed weaning from mechanical ventilation, increased risk of infection, hypotension and altered mental state (Evans 2002).

In recent years there has been an increase in research on using non-pharmacological therapies, such as music therapy in intensive care units (ICUs).

This literature review aimed to:
- Identify the potential causes for stress and anxiety of intubated young people.
- Review the literature of music therapy use in intubated patients.
- Provide recommendations for the use of music as a non-pharmacological intervention to alleviate stress in young people.

Literature review

A literature review was undertaken to explore the use of music therapy with young people in PICU who are supported by mechanical ventilation. For the purpose of the review young people were considered to be between 11 and 18 years old. Most of the studies related to music therapy in intensive care units (ICUs) are conducted on adults which, although not ideal, is the best available evidence to date.
According to Tervo (2001) young people have enough developmental capacity to be considered similar in their thought patterns and physiological reactions to adults, despite their gross differences. The lack of children-specific research could be attributed to the fact that PICU is a young domain of research or that music therapy, although beneficial, is not viewed as life saving, so funding for research will be put into more essential interventions.

A literature search involving electronic databases, hand searches, internet searches and contacting experts in the field was conducted. Some children’s hospitals throughout the UK were approached. If the hospital had a music therapist or arts manager, they were contacted. This method of literature searching yielded the paper ‘Singing medicine’ from Birmingham Children’s Hospital and Ex Cathedra, as it had not been published at that point. Otherwise experts did not provide any new research papers.

Search terms included: music, music therapy, young people, adolescents, adults, children, paediatric intensive care, PICU, ICU, critical care, mechanical ventilation and artificial ventilation (Box 1). The electronic databases that were searched were the Allied and Complementary Medicine Database (AMED), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index (BNI), Cochrane Library, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Medline, Embase and Web of Knowledge from 1995 to 2007.

Manual searches of Paediatric Nursing, Intensive Care and Critical Care Nursing, American Journal of Critical Care and Australian Journal of Music Therapy were conducted. Incremental searches were executed to ensure that the review was comprehensive and representative of the evidence available. After extensively searching the literature, the best available evidence was used to judge whether music is a beneficial intervention in PICU.

Results
The literature searched suggested a multitude of beneficial effects. Music has great healing power; it can be used as an anxiolytic medium, a method of distraction and as a relaxant, and it can also promote sleep by creating a peaceful atmosphere (Wong et al 2001). Music affects the body via entrainment. This is a process whereby two objects vibrating at similar frequencies tend to synchronise with one another. It causes a reduction in sympathetic nervous control and therefore a reduction in heart and respiration rates, metabolism, oxygen consumption, muscle tension, gastric and sweat gland activity (Lee et al 2005). Reduced heart and respiration rates lead to less anxiety and can promote relaxation.

Only two of the studies yielded had data about paediatric, intubated and ventilated patients. These were a case study by Kennelly and Edwards (1997) and a paediatric cardiac ICU quantitative study by Hatem et al (2006). The literature primarily focuses on the adult population who are intubated and ventilated, which means that only passive music therapy could be applied as an intervention. Passive music therapy is described for the purpose of this review as the use of CD and portable music players, whereas active music therapy is defined as music being provided by an individual who adapts the music to the patient, their age, needs and responses to the music.

Kennelly and Edwards (1997) describe two case studies with children who receive active music therapy which is not directly comparable to the studies using passive music therapy; however, despite this, it does highlight similar findings.

Hatem’s (2006) study was in a PICU and it uses passive classical music therapy, which the literature suggests is not always beneficial for children (Kennelly and Edwards 1997) (Table 1).

Music therapy and children
It has been documented well that children are receptive to music that is familiar to them (Tervo 2001, Howell 2005). Consequently simply playing music that is deemed to be relaxing, such as classical music which is highlighted in the literature as having a positive psychophysiological response for adults (Chlan 1998, Wong et al 2001, Almerud and Petersson 2003), may not be relaxing for a child who is unfamiliar with such music. However,
### Table 1  Summary of reviewed studies

<table>
<thead>
<tr>
<th>Author and date</th>
<th>Method</th>
<th>Sample</th>
<th>Age range</th>
<th>Environment</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almerud and Petersson (2003)</td>
<td>Mixed method – observation and quantitative measurements while being ventilated and qualitative interviews on return to the ward.</td>
<td>20 patients who were receiving mechanical ventilation and sedation.</td>
<td>54-81 years</td>
<td>Intensive care unit (ICU) in a moderately large hospital in Sweden. Patients listened to classical music through headphones for 30 minutes.</td>
<td>Quantitative data showed a significant fall in systolic and diastolic blood pressure during the music therapy session and a corresponding rise after cessation of treatment. Qualitative findings showed that there was little recollection from the ICU time and little or no recollection of music therapy.</td>
</tr>
<tr>
<td>Chlan (1998) (Chlan 1995 was pilot study to this study)</td>
<td>Two-group, pretest, post-test experimental design with repeated measures. Subjects randomised to either a 30-minute music condition or a rest period.</td>
<td>54 ventilator-dependent participants who were non-sedated and alert. Convenience sampling</td>
<td>Mean age control group 56.8 years. Mean age experimental group 57.3 years.</td>
<td>Four ICUs in midwestern United States using headphones and classical music for 30 minutes.</td>
<td>Heart rate and respiratory rate decreased over time for those subjects in the music group when compared with the control group subjects.</td>
</tr>
<tr>
<td>Hatem et al (2006)</td>
<td>Physiological measurements and subjective pain assessment tool.</td>
<td>84 children who were in the first 24 hours of post-operative care following cardiac surgery. Randomly assigned to control or experimental group</td>
<td>One to 16 years.</td>
<td>Paediatric ICU (PICU) specific for cardiac conditions in a Portuguese hospital using classical music through headphones for 30 minutes.</td>
<td>Heart rate, respiratory rate and pain scales were reduced in the experimental group.</td>
</tr>
<tr>
<td>Kennelly and Edwards (1997)</td>
<td>Case study using observation, physiological measurements and interviews with parents.</td>
<td>Two children in PICU in Australia.</td>
<td>Five and seven years.</td>
<td>PICU in a moderately large hospital in Australia. Active/improvisational music therapy was used and adapted according to the children’s responses.</td>
<td>Observation revealed heightened movement and eye twitching to the music.</td>
</tr>
<tr>
<td>Lee et al (2005)</td>
<td>Chinese State Trait Anxiety Inventory Scale, physiological measurements.</td>
<td>64 subjects randomly assigned to control or experimental group.</td>
<td>ICU in a Chinese hospital using headphones and classical music.</td>
<td>Patients on mechanical ventilation who listened to a single 30-minute session of music appeared to show greater relaxation as manifested by a decrease in physiological indices and an increase in comfortable resting behaviours.</td>
<td></td>
</tr>
<tr>
<td>Wong et al (2001)</td>
<td>Physiological measures and Chinese version of the Spielberger state anxiety test.</td>
<td>20 patients randomly assigned to groups.</td>
<td>19-84 years.</td>
<td>ICU in a university hospital in Hong Kong using headphones and classical music.</td>
<td>Music therapy had more significant results than the control group who had a rest period. During the intervention there was no difference physiologically for the music group, however there were statistical differences afterwards.</td>
</tr>
</tbody>
</table>
using music that a child recognises can provide a sense of familiarity even in a potentially unfamiliar environment such as hospital.

Much of the research about children in hospital who receive music therapy uses active music therapy where a music therapist tailors the therapy session to the musical tastes and development of the child (Kennelly and Edwards 1997, Barrera et al 2002, Gold et al 2004). Active music therapy allows for a personalised musical expression of emotions that can be adapted to the context of the environment and situation (Barrera et al 2002). However, there has been no research demonstrating active music therapy in PICU with sedated and ventilated children.

**Effect on heart rate** Studies by Chlan (1995, 1998) show that the heart rate of the participants reduced during the music therapy session, however Almerud and Petersson (2003) noted that heart rate marginally decreased during the session and significantly increased after the session was completed. Almerud and Petersson (2003) had a significantly smaller sample size than Chlan’s studies. Furthermore Almerud and Petersson’s study did not describe their data collection method, which reduces its reliability.

Chlan (1998) conducted the largest study of 54 participants found in the literature in four ICUs in the midwest of the United States. Most of the studies had small sample sizes, however the population size of ICU patients in general is relatively small. This could account for the small sample size and the lack of randomisation in all music therapy studies.

**Respiratory rate** Chlan (1995, 1998), and Hatem et al (2006) demonstrate that respiration rate was reduced during the music therapy intervention; however they did not comment on whether the respiration rate then rose following the music or remained as it was during the intervention. Conversely, Almerud and Petersson (2003) found no significant difference in respiration rate, but the mode of ventilation was not discussed in relation to this. This means that for the patients who were not on a patient trigger mode of ventilation, and therefore could not vary their respiration rate, their respiration rate stayed the same despite music therapy.

**Blood pressure** Almerud and Petersson (2003) did show a reduction in blood pressure; however Chlan (1995) highlighted no statistical changes in the blood pressure of the patients. Neither of these studies mentioned any confounding variables in blood pressure such as the use of inotropic support and sedation in the patient sample, which could affect blood pressure, thus reducing the validity of this data.

**Pain** Music therapy is believed to cause the pituitary gland to release endorphins, the body’s natural opiates, thereby relieving pain (Wong et al 2001). Hatem et al (2006) identified that a 30-minute music therapy session reduces pain scores as rated by the nurses. However, the nurses and researchers who were collecting the physiological measurements and pain scores in this randomised clinical trial were not blinded to those who were having the music and those who had headphones on but no music. This could have introduced bias in terms of data collection.

Although none of the studies demonstrate reduced pain scales objectively, this could be as a result of issues about consent and ethics. All studies need ethical approval, however in ICUs it is difficult to gain consent for trials because the patient is unable to give informed consent. Relatives often have difficult decisions about treatment to make without also being asked to make an additional decision about whether to allow their relative to participate in research.

**Psychological effects**

**Anxiety levels** Almerud and Petersson (2003) assessed anxiety levels using structured interviews after the participants had left ICU or after having been extubated while still in ICU. The psychological element of this study is particularly subjective as there was no standardised time after extubation or being weaned off sedation for the interview to take place. Furthermore, the researcher does not describe how much sedation, if any, the participant was receiving while intubated. Therefore the long-term effects that this may have on the participants’ memory of their ICU experience and how much the music influenced them is not known.

Most participants in Almerud and Petersson’s (2003) study could not recollect their ICU experience. None reported music as a memory, however two in the trial group reported remembering an anxious feeling, which demonstrates the importance of alleviating anxiety by any means. Chlan (1998) used an anxiety-testing tool that had been validated and piloted. However, because of time constraints and the level of attention of the participants, the version of the tool used in the study was shortened which reduced the validity, rendering the results less reliable. Throughout the literature, and despite the

**Most of the studies had small sample sizes, however the population size of intensive care unit patients in general is relatively small**
methodologies being from different paradigms, the results concur that music has an anxiolytic effect on intubated sedated patients (Wong et al 2001).

**Nurse-patient relationship** Gustorff (2005) and Howell suggest that because patients are intubated and therefore cannot communicate verbally, nurses often do not engage in the psychosocial care that they would when patients can communicate verbally. This could be because the precedent at this point is often patient stabilisation and management of clinical symptoms rather than psychosocial care. Howell (2005) proposes that this can lead to patients being objectified by nurses.

Although this literature may be true of inexperienced PICU nurses, from the author’s own experience, nurses that are familiar with this environment communicate effectively with their patient regardless of their conscious state.

Furthermore, research by Updike (1990) and Cardozo (2004) quantifies this, stating that nurses in PICU use communication effectively to build a relationship not only with the patient but their family. Nonetheless, through music therapy, nurses are made aware of the importance of quality human contact with their patients (Aldridge 2005).

Melynk et al (2004) state that by using music the family can have some input into their loved one’s care which is vital to empower the parents. In particular for young people who use music as a form of developing an identity, it is vital that the music used for therapeutic effect is familiar to them and of a genre they will enjoy. This is important because certain types of music may have detrimental psychophysiological effects. This is particularly true if the music is not to the person’s taste. In addition, from experience the music can aid the parents to communicate with the child and therefore orientate the child to the environment through the music and their families’ voices. Music therapy as a nursing intervention supports the holistic care of the critically ill adolescent (Updike 1990).

**Limitations**

There is a lack of research of using music therapy in the PICU environment. The adult ICU literature in this field does not use highly reliable methods and sample sizes remain small, although it is the best available research at present. Also, despite the lack of quality in the research and different methodologies used, there is a significant degree of concurrence between the articles. Furthermore, the results demonstrate similar findings in all the participants, despite their ages, aetiology and nationality. The physiological and psychological effects are synonymous throughout the literature, highlighting the relaxing and anxiolytic effects of music therapy while a patient is mechanically ventilated. This concurs with the author’s own experience of working on a PICU.

The research that is available is not sufficient to support the development of making national guidelines for music therapy use in PICU. There is such a paucity of paediatric-specific research that it cannot be used without careful judgement. Furthermore, the adult research cannot be used to make child guidelines because the aetiology of their admission to ICU is not comparable, and physiologically, children and adult are significantly different. However, this research can influence practice and has highlighted areas for further research and education. Taking the evidence from these studies music therapy must be used with careful clinical judgement. For children and young people's nurses this involves careful negotiation with the child’s parents to obtain consent and help them to participate through choosing the music or being present during the music therapy session.

When children are in ICU, parents often describe feeling a loss of control of the situation; involving them in the care can ameliorate this situation (Noyes1998). Participation leads to parental empowerment (Melynk et al 2004).

**Recommendations**

The National Service Framework for Children, Young People and Maternity Services (Department of Health 2004) highlights the need to provide suitable activities for children and young people in hospital regardless of their age or level of consciousness. Therefore, the need for music therapy is present in paediatric health care regardless of the adaptations necessary to make it accessible in PICU (Gold et al 2004). However, for it to be implemented there needs to be more high quality research and better education for nurses about the use of music therapy.

In terms of future research, larger scale studies in multiple sites need to be executed measuring a wider variety of physiological and psychological data, such as cortisol, glucose and immunoglobulin levels. This will enable a larger amount of data to be analysed, which will increase the reliability of the evidence and allow national guidelines to be developed. Child-specific research on the use of
music therapy in intensive care is critical to ensure safe implementation through national guidelines. In addition qualitative data on children’s of their experiences of music therapy in intensive care would be valuable as there is no research of this nature available at present.

Overall, our aim as children’s nurses is to improve care for all young people in PICU. However, in light of the current financial climate in the NHS, it is unlikely that such music therapy research or services will become part of the mainstream in the next few years (Howell 2005). Despite this, a holistic approach to health suggests that what is beneficial to the person automatically becomes beneficial to their treatment and overall healing. This can then help to reduce the patient’s stay in PICU and reduce costs. Furthermore, the use of music therapy is cost effective, and if administered carefully, the patient could be weaned from pharmacological sedation more quickly, thereby reducing the harmful effects of the drugs and also reducing the cost of the sedation (Biley 2000).

Conclusion
The lack of evidence relevant to young people for study is the main reason that a full conclusion on the use of music therapy cannot be reached. Furthermore, due to the small sample sizes, and lack of transferability of adult research to PICU, the evidence cannot yet be formulated into national guidelines. However, with future research the use of music therapy could be implemented at PICU level. All evidence, regardless of its quality should be implemented with careful clinical judgement and in accordance with the patient’s, or family’s wishes and consent (Newman and Roberts 2002).

Through increased awareness of alternative methods of reducing stress and anxiety among patients in PICU, nurses can use the evidence presented in this article carefully in conjunction with the musical preferences and wishes of each family.

It is an integral part of family-centred care and can aid the development of a therapeutic relationship between the nurse, the young person and the family (Kennelly and Edwards 1997).

Music therapy is essential for developing a holistic approach that focuses care on the developmental level of a child or young person, as well as being an inexpensive, non-invasive therapy, with significant physiological and psychological benefits.

Implication for practice

Consider music for use with all children and young people in clinical practice, not just paediatric intensive care units.

Further reading
American Music Therapy Association
www.musictherapy.org (Last accessed: March 19 2010.)

References


Chilan I (2000) Music therapy as a nursing intervention for patients supported by mechanical ventilation. AACN Clinical issues. 11, 1, 128-138.


