

Research report 36



**Arts in health: a review of the
medical literature**

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Foreword and acknowledgements

It gives me great pleasure to introduce this review of the medical literature on the arts and health. We are developing our first national arts and health strategy, and this review will play an important part in informing the development of that strategy.

Artists have long been aware of the benefits of their work in healthcare settings and we know from evaluation reports that the arts can have a positive impact on health. What we have lacked thus far is systematic evidence of some of the clinical and other outcomes of the arts that is sufficiently robust to carry weight with those responsible for delivering health care.

Through her research at the Chelsea and Westminster hospital, Dr Rosalia Staricoff has seen at first hand the benefits of the arts for staff, patients and carers. By bringing together a huge body of literature for this review, Dr Staricoff has made a significant contribution to strengthening the evidence base and to improving our understanding of the impact of the arts on health.

Her review shows us that, in clinical settings, encouraging patients to engage with the arts can help them to manage pain and the side effects of some treatments, to alleviate stress and anxiety and to come to terms with what can be major and distressing episodes in their lives. Incorporating the arts into the design of health care facilities has positive benefits for staff, for patients and for their carers. Integrating the arts into the training and professional development of health professionals helps them better communicate with and understand their patients, from all social and ethnic groups.

The health benefits of the arts are, however, not confined to clinical settings; they are available to us all. Dr Staricoff quotes Swedish research showing that engagement with the arts is associated with longer life expectancy.

I would like to thank Dr Staricoff for her thorough and painstaking work in preparing this review; her report will provide a valuable underpinning to Arts Council England's future work on the arts and health.

Peter Hewitt
Chief Executive, Arts Council England

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Executive summary

Introduction

This review of medical literature published between 1990 and 2004 explores the relationship of the arts and humanities to healthcare, and the influence and effects of the arts on health. The aim of the study is to strengthen existing anecdotal and qualitative information demonstrating the impact that the arts can have on health.

Background and context

In its report of July 1999, Policy Action Team 10 (PAT 10) argued that participation in the arts and sport can help to address neighbourhood renewal by improving communities' performance on the four key indicators of health, crime, employment and education (DCMS, 1999). The report noted, however, that although there was much 'anecdotal evidence that the arts and sport are successful in promoting community development, relatively little "hard" evidence existed about the cost and benefit of arts and sport in community development, and about what sorts of projects provide value for money'.

This literature review does not seek to be the definitive evidence base for arts in health interventions. It is clear that there are still many areas for exploration and review. Two examples would be: the emerging evidence around the use of arts interventions in community settings to improve health; and work that is concerned with the first hand engagement of artists with patients and staff in healthcare settings. The broader context of research into arts in health interventions is currently being considered as a part of Arts Council England's development of a national strategy for arts and health.

Although the therapeutic effects of the arts have been recognised for many centuries, it is only in recent years that there have been systematic and controlled studies of these effects. There are still many areas to explore, such as the relationship between the introduction of arts and humanities into the healthcare environment and the recruitment and retention of staff. There is a widespread interest in evaluating the effect of the arts and humanities on the education and training of nursing and medical staff, looking in particular at the effect on performance and interactions with the patient. There is also a growing interest in understanding the contribution of different artforms to creating a supportive therapeutic environment in mental healthcare.

Within the arts and health movement, there have been a number of evaluation studies of community-based participation projects. A review of these by the Health Development Agency (2000) concluded that it was 'impossible to give precise details of improved health, particularly in the light of the fact that so few projects directly provide information on health, or social matters related to health, which are based on formal instruments of measurement'. The review suggested there was more evidence (albeit anecdotal) of increased patient wellbeing and self-esteem.

Methodology

This study explored the important contribution of the arts and humanities towards:

- achieving clinical outcomes for the benefit of patients
- raising staff morale and job satisfaction
- widening the skills of nurses and doctors
- providing better quality of healthcare
- enhancing the quality of life of mental health users
- helping mental health providers manage the service

The review also includes an analysis of the effects of different types of artforms and an overview of the current scientific knowledge on:

- mechanisms of art perception
- mechanisms of art processing
- association of art and emotions

This literature review on the associations between arts, humanities and medicine recognises the individual evolution of these three areas and their relationship throughout history. The study focuses on studies published from 1990 to 2004, although it also includes a selection of papers from outside this period which are relevant and significant to one of the stated areas of interest.

The following electronic databases and internet sites were searched, covering the period 1990 to 2004:

- Medline for healthcare in general, medicine and mental health
- CINAHL (Cumulative Index to Nursing and Allied Health Literature) and BNI (British Nursing Index) for nursing issues
- Cochrane Library for reviews on healthcare
- PsycInfo for psychology and psychiatry records
- www.medicalhumanities.com, www.dur.ac.uk and www.ucl.ac.uk for humanities in medicine
- www.societyartshealthcare.org

Keywords, among many others used, included: fine arts and clinical outcomes; music and clinical outcomes; paintings and mental health; arts and mental health; music and dementia; visual arts and dementia; creativity and mental health; work environment and performing arts; medical education and humanities.

Key findings

The effect of the arts on clinical outcomes

This review has identified a number of medical areas in which the research studies have shown clear and reliable evidence that clinical outcomes have been achieved through the intervention of the arts. Specific outcomes for both in-patient and outpatient departments include the following:

- **Cancer care:** visual art and live and taped music have been used in a number of studies addressing high anxiety and depression during chemotherapy. The arts were effective in reducing both anxiety and depression, and acted as a potent adjuvant (see Glossary) to avert side-effects of the treatment
- **Cardiovascular unit:** the use of appropriate music, through tapes, video-music or personal headphones led to reports of a significant reduction in anxiety levels and the levels of vital signs – blood pressure, heart rate, demand for myocardial oxygen
- **Intensive care unit:** the use of music in neonatal intensive care has shown statistically significant improvement in clinical and behavioural states. Very importantly, the benefits significantly reduced the length of stay in hospital
- **Medical procedures:** a number of medical procedures for screening and/or diagnosis generate high levels of stress. Arts interventions have been shown to increase the perception of comfort, to reduce the levels of cortisol (a hormonal indicator of stress), and to significantly control blood pressure levels
- **Pain management:** music induced significant reductions on physiological and psychological variables related to pain indicators. A number of authors reported a significant reduction in the use of medication to reduce pain after surgery
- **Surgery:** self-selected music, live music and the visual arts have been shown to reduce stress and anxiety, as well as helping to control vital signs. The use

of music was found to be very effective in the post-operative recovery period, reducing requirements for sedatives

The effect of the arts and humanities on staff outcomes

This review has analysed a number of studies concerning job satisfaction, including:

- the introduction of works of art and of nature features in the design of the healthcare service
- the intervention of music in creating a non-aggressive environment
- the use of the arts in nursing and medical training to improve communication, empathy and understanding of patients' needs

The literature does not include reliable studies on the possible relationship between the use of arts in the healthcare environment and its effect on the recruitment and retention of staff.

The effect of the arts and humanities on the education and training of practitioners

This section reviews the available evidence on the direct effect of the arts on health practitioners. It also addresses the key issues emerging as a result of incorporating the arts and humanities into medical and nursing undergraduate and post-graduate courses. The following topics are presented:

- Evidence that listening to self-selected music increases mental task performance in surgeons
- The benefits of using music in operating theatres to create a less stressful environment, and the problems that the use of music could pose for the surgical team
- The role of the visual arts in developing the observational skills of the medical practitioner and in increasing ability in drawing, stereo vision and three-dimensional thinking in neurosurgeons
- The evaluation of the results of introducing nursing students to the fine arts, showing that the arts increase awareness in dealing with illness and bereavement, as well as strengthening students' confidence in their own practice

- The introduction of the arts and humanities into nursing and medical education led to an increased capacity in students for critical analysis and understanding of illness and suffering. This prompted health practitioners to respond in a more humane and thoughtful manner to medical, ethical and social needs

The effects of the arts in mental healthcare

The use of the arts in mental healthcare helps to improve the communication skills of mental health users, helping in their relationship with family and mental health providers. It also provides patients with new ways of expressing themselves, stimulates their creativity skills and enhances their self-esteem.

The use of the arts in mental health services also brings about behavioural changes in mental health users: patients become more calm, attentive and collaborative. These changes help in the everyday managing of a mental health service, diminishing the need for medication and physical restraint.

Different artforms have been shown to have different effects.

- The use of literature, creative writing and poetry in mental health services produces significant benefits for both the patient and the care provider. It enables patients to regain control over their own inner world, increasing their mental wellbeing. It helps the nursing and medical staff to understand the cultural, social, ethnic and economic factors influencing the behaviour of patients
- Theatre, drama and visual arts all provide patients with powerful ways of expressing themselves and understanding their own world. This promotes empathy between patients and staff
- Music, singing and dancing all help mental health patients to recall events from their lives. These artforms help them to express themselves and, on a physical level, to increase their range of movement

The effect of different artforms

There is a lack of rigorous research on the contribution of different types of artforms to healthcare.

- Positive clinical outcomes are induced by the intervention of classical and meditative types of music. They reduce stress, anxiety and perception of pain. Live music, when appropriate, has more significant benefits than recorded music
- Familiar tunes, which are pre-selected by the patient, are shown to be a very effective approach in mental healthcare; triggering familiar memories and enjoyment
- The introduction of visual art into healthcare proved to play an important role in improving observational skills in health practitioners and in increasing patients' wellbeing

Mechanisms involved in the perception and processing of art

- Science and technology are getting closer to understanding the mechanisms underlying perception, processing and the emotional responses elicited by the arts. Many of the different areas of the brain and neural networks involved in these processes have been identified
- The exploration of the association between the mental and physical state of artists and their artistic work gives an insight into the process of artistic creativity, helping scientists to understand the causes of numerous diseases and to find potential treatments. This is achieved through an analysis of artists' work, how their work changes throughout time and on the use of shapes, forms or colours, which can be related to specific changes occurring in the brain
- The understanding and description of the patterns of emotional response elicited by different artforms contribute to the rational and appropriate use of the arts in creating a powerful therapeutic environment

Conclusions

This review includes 385 references from medical literature related to the effect of the arts and humanities in healthcare. It offers strong evidence of the influence of

the arts and humanities in achieving effective approaches to patient management and to the education and training of health practitioners. It identifies the relative contribution of different artforms to the final aim of creating a therapeutic healthcare environment.

It highlights the crucial importance of the arts and humanities in:

- inducing positive physiological and psychological changes in clinical outcomes
- reducing drug consumption
- shortening length of stay in hospital
- increasing job satisfaction
- promoting better doctor-patient relationships
- improving mental healthcare
- developing health practitioners' empathy across gender and cultural diversity

Recommendations for future research

- The effect of the arts and humanities as contributing factors in recruitment and retention of staff has not yet been evaluated. The literature refers to their influence on job satisfaction, but the link and repercussion on recruitment and retention has not been evaluated
- The type of musical instruments in relation to the clinical setting deserves further research, perhaps leading to the introduction of guidelines to optimise the beneficial outcomes of music in healthcare environments
- The effect of integrating different artforms and humanities into the healthcare culture in issues such as social inclusion and cultural understanding should be evaluated

1 Introduction

1.1 The policy context

In its report of July 1999, Policy Action Team 10 (PAT 10) argued that participation in the arts and sport can help to address neighbourhood renewal by improving communities' performance on the four key indicators of health, crime, employment and education (DCMS, 1999). The report noted, however, that although there was much 'anecdotal evidence that the arts and sport are successful in promoting community development, relatively little "hard" evidence existed about the cost and benefit of arts and sport in community development, and about what sorts of projects provide value for money'.

The Arts Council, in its response to PAT 10, identified five ways in which work on the arts and social exclusion would be taken forward: advocacy, examining the role of regularly-funded organisations, research and evaluation, multi-agency working and targeting resources (Arts Council of England, 2000).

The Arts Council's Corporate Plan 2003–06 (Arts Council England, 2003a) includes a commitment to developing strategies on 'arts and health' and 'arts and criminal justice' to underpin its strategic priority to 'place cultural diversity at the heart of our work' (Arts Council England, 2003b). This review of the medical literature on arts and health was commissioned to inform the development of the policy on arts and health.

This literature review does not seek to be the definitive evidence base for arts in health interventions. It is clear that there are still many areas for exploration and review. Two examples would be: the emerging evidence around the use of arts interventions in community settings to improve health; and work that is concerned with the first hand engagement of artists with patients and staff in healthcare settings. The broader context of research into arts in health interventions is currently being considered as a part of Arts Council England's development of a national strategy for arts and health.

1.2 The research context

The therapeutic effects of the arts have been recognised for many centuries but it is only in recent years that systematic and controlled studies of these effects have been carried out. The relationship between the introduction of arts and humanities into the healthcare environment and the impact on recruitment and retention of

staff, however, remains to be established. There is widespread interest in evaluating the effect of the arts and humanities on the education and training of nursing and medical staff, looking in particular at the effect on performance and interactions with patients. There is also a growing interest in understanding the crucial contribution of different artforms in creating a supportive, therapeutic environment in mental healthcare.

Within the arts and health movement, a number of evaluation studies of community-based participation projects have been carried out. A review of these studies by the Health Development Agency (2000) concluded that it was 'impossible to give precise details of improved health, particularly in the light of the fact that so few projects directly provide information on health, or social matters related to health, which are based on formal instruments of measurement'. The review suggested that there was more evidence (albeit anecdotal) of increased wellbeing and/or self-esteem.

This literature review on the associations between arts, humanities and medicine recognises the individual evolution of these three areas and their relationship throughout history. The study focuses on studies published from 1990 to 2004, although the review does include a selection of papers from outside this period, which are relevant to one of the stated areas of interest.

1.3 Methodology

For the purposes of this literature review, the following electronic databases and internet sites were searched, covering the period 1990 to 2004:

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Keywords, among many others used, included: fine arts and clinical outcomes; music and clinical outcomes; paintings and mental health; arts and mental health; music and dementia; visual arts and dementia; creativity and mental health; work environment and performing arts; medical education and humanities.

Selection criteria

The selection criteria for studies to be reviewed included:

- randomised and non-randomised controlled trials
- peer-reviewed studies or papers from reputable source
- studies performed before and after the intervention of the arts

The selection was based on an analysis of the quality, design, methodology and research protocols of each study, as well as a rigorous evaluation of the data presented. It includes studies with contrasting findings on some of the issues.

1.4 Structure of the report

Main findings

The main findings in this literature review are divided into six sections:

- The effect of the arts on clinical outcomes
- The effect of the arts on staff outcomes
- The effect of the arts and humanities on the education and training of health practitioners
- The effects of the arts in mental healthcare
- The effect of different types of artforms
- Mechanisms of art perception

Each section presents a summary of the findings of the reviewed individual studies. The review includes recommendations for extending research.

Glossary

The glossary in Appendix 1 contains a definition of the medical terms used in this review, according to the *Black's Medical Dictionary* (Macpherson, 2002).

Bibliography

This review includes 385 articles published in specialised journals and books.

2 Main findings

2.1 The effect of the arts on clinical outcomes

The therapeutic effect of the arts has been recognised for many centuries, however, systematic and controlled studies on the intervention of the arts and clinical outcomes are a more recent development. Studies conducted on non-clinical populations have shown the relationship between encouraging people to attend cultural events such as theatre, concerts or exhibitions, and a reduction in their levels of blood pressure and hormonal benefits, compared with a similar group of people not attending cultural events (Konlaan, 2000).

The effect of relaxing music on subjective anxiety, heart rate, systolic blood pressure and immune response was measured in undergraduate students preparing for oral presentations. The results showed that music prevented stress-induced responses, independent of gender (Knight, 2001). The intervention of music reduces the perception and physiological consequences of pain and anxiety in adult patients admitted to hospital. It also contributes to an increase in satisfaction with the quality of care received (Taylor-Piliae, 2002).

There is extensive literature on the effects of the arts, mainly music, on different healthcare specialities, both for in-patients and for those attending out-patient departments (Biley, 2000; Evans, 2002). This review has identified several areas which are summarised below.

Cardiovascular unit

The introduction of music to provide a quiet and restful environment resulted in significant reductions in heart rate, respiratory rate, and myocardial oxygen demand in patients recovering from acute myocardial infarction, compared to a control group treated as usual (White, 1999). Patients admitted with ischemia of the heart showed a beneficial effect on their levels of blood pressure, heart rate, anxiety and muscle relaxation after two or three 30-minute sessions of light classical music using personal tape players or headphones. The authors suggest that the study needed to cover longer sessions with music and a larger number of patients to show significant differences (Elliot, 1994). The effect of second and third day post-operative music intervention, using tapes or music-videos, on pain and sleep after coronary artery bypass graft operations showed a significant reduction on recorded pain intensity and increased sleep (Zimmerman, 1996). The evaluation of the impact of music played during surgery showed no difference

between the music and no-music groups on length of post-operative stay (Blankfield, 1995).

Intensive care unit

The intervention of music in intensive care induces beneficial outcomes (Updike, 1990; O'Sullivan, 1991). Anxiety levels were measured in a study of myocardial infarction patients and it was found that anxiety was greatly reduced in those patients who listened to music (Bolwerk, 1990). A study of the use of synthesised female vocal music and lullabies in new-born intensive care units has shown that there was a statistically significant improvement in levels of oxygen saturation and behavioural states (Collins, 1991). Another study using the same type of musical intervention reported a beneficial effect on weight and caloric intake, and a significantly reduced length of hospital stay (Caine, 1991). A study of the effect of music played to premature babies in a neonatal intensive care ward in the United States of America (USA) showed that it induces significant benefits (Standley, 2002).

Cancer care

There is an imperative need to find creative interventions to alleviate patients' concern and anxiety in cancer treatments. Studies addressing the level of anxiety during radiation therapy found that, despite a lack of significant differences between the group listening to music using headphones, before and during daily treatment, and the non-listening group, music intervention remains highly beneficial (Smith, 2001). Visual art and live music greatly diminished the levels of anxiety and depression of patients having chemotherapy treatment (Staricoff, 2003). Other studies also reported significant differences on levels of anxiety when using taped music during four courses of chemotherapy, compared to the group of patients having no music intervention (Sabo, 1996; Weber, 1997).

Research comparing the effect of music with distraction for procedural pain and anxiety found that both are important interventions. However, the effect of music did not differ from that of simple distraction and the author concludes that a strategy should be offered that is consistent with patients' preferences (Kwekkeboom, 2003). An early controlled study of the effects of music on the chronic pain of cancer patients found that the group of patients exposed to music reported a significant reduction in their amount of pain (Zimmerman, 1989).

A later study found different degrees of pain reduction, as measured by the McGill Pain Scale, on patients listening to music twice daily for three days, compared to the control group not listening to music (Beck, 1991).

Music is an effective adjuvant to pharmacological anti-emetic regimen on patients suffering from the side effects of chemotherapy treatment. Significant differences were found in the perception of nausea and episodes of vomiting between the experimental group and the control group without music (Standley, 1992; Ezzone, 1998). The effect of listening to music was found to be of significant relevance for activating the immune system and decreasing the levels of the hormone cortisol, an indicator of stress, in cancer patients (Burns, 2001).

A recent article (Homicki, 2004) confirmed the positive effect on patients and family of introducing rotating art exhibitions in the waiting room of a cancer centre.

Pain management

This area has received attention from different perspectives. Some authors have measured physiological variables as indicators of pain or its impact on levels of anxiety and depression, other researchers have related pain to analgesic consumption. Patients with rheumatoid arthritis volunteered to listen to their preferred music for 20 minutes a day. The statistical analysis of pre- and post-test data revealed a highly significant reduction in the perception of pain (Schorr, 1993). A review of the literature on the use of music as an audio-analgesic in chronic and acute pain concluded that it has a positive and significant effect (Good, 1996).

The intervention of music during urological operations showed no difference for vital signals, such as blood pressure, heart rate, and respiratory rate, compared to the group without music in the operating theatre. However, the music group used fewer sedatives (Koch, 1998). This significant reduction of requests for sedatives has also been reported for patients undergoing orthopaedic and plastic surgery under regional anaesthesia (Walther-Larsen, 1988).

The effect of listening to music through headphones in post-general anaesthesia care in the recovery room did not induce differences in pain level, sedative requirement or length of stay in the room. However, there was a significant delay in requesting analgesia in the music group (Heitz, 1992). The effect of intra-operative, compared to post-operative, music on control of pain was evaluated in a controlled study of patients undergoing day surgery. The authors found that

patients exposed to music during or after an operation reported significantly lower pain intensity and required fewer analgesics in the immediate post-operative period than those patients not exposed to music (Nilsson, 2001; Nilsson, 2003). The effect of music and relaxation tapes was studied in a randomised-controlled trial measuring the reduction of pain after gynaecological surgery. The results showed a significant reduction in the level of pain and the use of patient controlled analgesia on post-operative days (Good, 2002).

Listening to music through headphones during gynaecological procedures showed beneficial clinical outcomes, reducing the levels of respiratory rates and the scores for pain (Davis, 1992). The effect of a combination of music and relaxation on post-operative pain after abdominal surgery was also researched and it was found to be significantly effective. The authors recommend that clinicians and nurses preparing patients for surgery and caring for them afterwards, should encourage patients to use relaxation and music as complements to medication for post-operative pain (Good, 1999).

A randomised study evaluating the impact of music on perceived pain, in this case following abdominal hysterectomy, found no difference between the control and trial group during the post-anaesthetic period (Taylor, 1998). A randomised-controlled trial of the use of music during laceration repair showed that the group listening to their preferred music recorded significantly less pain than the control group (Menegazzi, 1991). The perception of pain and stress decreased in subjects who had blood taken in a room with visual arts compared to those in a room with no visual arts (Palmer, 1999).

Pre and post-natal care

The use of music as an adjuvant to medical care for women in the prenatal and postnatal period produced an improvement of clinical outcomes and medical cost savings (Schwartz, 1997). The use of daily preferred music during pregnancy was shown to be important in pain and stress management during labour and birth (Browning, 2000). Live music in the waiting area of an ante-natal high-risk clinic reduced the levels of blood pressure of pregnant women waiting for their appointments (Staricoff, 2003). The effect of affective music stimuli during the first 12 months of life showed that there is a clear developmental change on the brain activity of infants. The authors have found that affective music significantly increases brain activity at three months of age and has a calming effect afterwards (Schmidt, 2003).

Surgery

Appropriately selected music may decrease the stress levels of staff and conscious patients in the operating theatre, and may significantly improve the efficiency of those who work in this environment (Thompson, 1995; Seukeran, 1997). Self-selected music during ambulatory ophthalmic surgery reduces levels of blood pressure, heart rate and perceived stress (Golden, 2001). Elderly patients undergoing cataract surgery were more satisfied with their experience if they heard relaxing music, but there were not significant differences between a control and trial group who were assessed for anxiety levels before and after surgery (Cruise, 1997). The anxiety levels of patients who listened to music of their choice during the pre-operative period were found to be significantly reduced (Wang, 2002; Walker, 2002).

In another study, the authors reported a significantly lower state of anxiety and respiratory rates in patients undergoing breast biopsy after a pre-operative period listening to music, compared with a group that had no music (Haun, 2001). Music also has a significant effect in reducing anxiety during local and regional anaesthesia (Frandsen, 1990; Eisenman, 1995; Mok, 2003). Patients who listened to their choice of music before ambulatory surgery showed a reduction in blood pressure, respiratory rates and anxiety levels, compared to the control group (McGreevy, 1990; Hains, 1996; Augustin, 1996). The patients' perception of listening to music during surgery was studied and showed a significant positive result. The patients felt relaxed and distracted and their tolerance to pain was increased (Stevens, 1990).

The response to stress in pre-surgical situations was also measured by monitoring changes in salivary cortisol; listening to music resulted in a marked reduction in the levels of this hormone (Miluk-Kolasa, 1994). The use of music was also shown to be beneficial during the post-operative recovery period (Heiser, 1997; Shertzer, 2001). Out-patients undergoing surgery with spinal anaesthesia showed a significant reduction in sedative requirements during the procedure if they were listening to music of their own choice (Lepage, 2001).

Neurological disorders

Active programmes of listening to and performing music have been shown to help the management of patients with Parkinson's disease. The use of music stimulated emotional and motor responses, improving the quality of life of those patients (Pacchetti, 2000). Music induced rhythmic foot beating in patients with cerebral

palsy, an effect which was never achieved on command, indicating the positive effect of music in subjects affected by neurological disorders (Ghika, 1995).

Medical procedures

Screening for the detection of colon cancer induces high stress levels. Anxiety and discomfort were greatly reduced in a group who listened to music during the examination, compared to a control group examined under routine conditions (Chlan, 2000). The introduction of soothing music increased the degree of tolerance of gastroendoscopic procedures (Bampton, 1997), and also significantly reduced the anxiety levels of patients awaiting gastrointestinal procedures (Hayes, 2003). Music increased the perception of comfort during bronchoscopy in the out-patient unit (Dubois, 1995). It has also been shown that music enhances patients' comfort during Magnetic Resonance Imaging studies (Silfer, 1991; Grey, 2000). Anxiety levels were reduced in patients listening to music after coronary artery bypass grafting (Barnason, 1995). The levels of cortisol in plasma, indicating stress levels, were very high in patients undergoing cerebral angiography. The intervention of music during the procedure maintained stable levels of cortisol and significantly reduced systolic blood pressure (Schneider, 2001).

2.2 The effect of the arts and humanities on staff outcomes

A wide variety of factors have been analysed by many authors as contributors to the achievement of job satisfaction, career choices and training, communication with management, clinical supervision, the reduction of stress, and welfare considerations (Williamson, 1999; Shaver, 2003).

The integration of the arts and humanities into nursing education has provided new dimensions to nursing practice. Bruderle and Varliga (1997) outlined a number of strategies for increasing awareness, communication and understanding of people across races, gender and cultures through the introduction of nursing staff to the fine arts.

The work environment is one of the scales in an index developed to measure staff satisfaction (Whitley, 1994). The provision of the best working conditions for staff is related to the provision of good quality care (Lovgren, 2002). The design of the healthcare service, the introduction of works of art and nature features have also been recognised as having an impact on staff satisfaction, and possibly contributing to reduced staff turnover (Ulrich, 1992). The importance of ward

design has been emphasised in recent studies, especially in facilities for the elderly and for mental healthcare (Lawson, 2000; Tyson, 2002).

A study of the impact of an active arts programme integrated into the healthcare environment showed that it is a major consideration for staff when applying for a job or remaining in their current positions. This indicates that the arts and design might have an influence in staff recruitment and retention (Staricoff, 2001; Staricoff, 2003).

A study of the transformation of a hydrotherapy room by the incorporation of visual art, and of the effect of colour and design on patients and staff, showed that it induced positive psychological and clinical outcomes (Duncan, 2003).

The benefits of introducing music in hospital waiting rooms were reported, showing that music reduces self-reported stress levels among visitors. This finding has implications for diminishing aggression against staff and increasing visitors' perceptions of the quality of service (Routhieaux, 1997). The benefits of improving working conditions for staff and the effects on patients' clinical outcomes are discussed further in another study, where the authors analysed the results of replacing hospital noise pollution with music (Cabrera, 2000).

2.3 The effect of the arts and humanities on education and training of practitioners

In an early study, Winner (1982) observed that, 'studies of the perception of art have revealed the extremely active, problem-solving stance that perceivers adopt when attempting to make sense of a work of art.' The increasing emphasis on the importance of incorporating arts and humanities in the education and training of nurses has resulted in its introduction to many and diverse courses. Teaching strategies involving the use of art have been incorporated to develop a personal philosophy of nursing which gives students an opportunity to be creative and assertive. Studies have shown the benefits of implementing practical ideas linking art with patient care, and the power of creativity in nursing practice (Evans, 2002; Whitman, 2003).

Visual arts

Another interesting approach consists of introducing students to selected works of art in a gallery. The participants have to provide health assessments of the mental, physical and environmental activities of the characters in the paintings. This

exercise develops skills of observation, increases trainee awareness of dealing with health problems across cultures and strengthens confidence in their own nursing abilities (Loden, 1989; Davis, 1992; Inskip, 2001).

A theoretical perspective on how the humanities can empower students to learn special human caring skills, and how to integrate humanities into the clinical setting is discussed further by other authors (Ehrhart, 1993; Darbyshire, 1994). The use of creative artforms has been shown to be effective in enhancing the counselling skills of hospice professionals when dealing with the bereaved (Zamierowski, 1995). In nursing education, the introduction of a piece of art which had an elderly woman as its subject resulted in an improved perception of ageing and developed a more sensitive and humane approach to care (Wikstrom, 2000).

The idea of using fine arts in medical undergraduate courses has been discussed for many decades. Research carried out in this field has shown that first year medical students taking part in art appreciation classes, which involved describing photographs of dermatological lesions, significantly improved their observational skills (Dolev, 2001). The development of this crucial skill in medical practice has also been achieved by using different techniques, including learning to look at artefacts in an art museum (Belkin, 1992; Bardes, 2001).

It has been recognised that drawing abilities and stereovision, imagery and thinking three-dimensionally are of great importance in neurosurgery, and in the surgical profession generally. These skills are partly a gift and partly a response to training. It is in this context that the visual arts play a significant role in the formation of a neurosurgeon (Pasztor, 1993).

Works of art, both classical and contemporary, can be used to increase understanding of the complex nature of human beings and their conditions. Medical schools will benefit by forming allegiances with local artists and museums to fulfil these objectives (Boisaubin, 2000). King's College Hospital (UK) initiated a visual arts course for medical students in 1999, aiming to visualise the body by establishing a link between the arts and science (Weller, 2002). Leicester Warwick Medical School introduced The Arts and Medicine as a special module. An evaluation of its results showed that the students considered that their personal and professional development had been enhanced by studying the arts, and that they would like to continue to use the arts in the future (Lazaraus, 2003).

Medical humanities

The role of humanities and arts in medical education, with special reference to neurosurgery, was discussed at the European Congress of Neurosurgery in Moscow in 1991. Speakers highlighted the importance of introducing neurosurgeons not only to scientific and technological advances in the understanding of the human brain, but to the products and achievements of the creative brain (Udvarhelyi, 1993). A recent article describes a course on the representations of HIV/AIDS in the visual arts, aiming to share experiences within the framework of educational courses in a medical curriculum (Tapajos, 2003).

There is evidence that autonomic reactivity was reduced and mental task performances increased in surgeons listening to self-selected music, compared with no music (Allen, 1994; Hawksworth, 1998). Playing music in the operating theatre is quite common, and welcomed by a large number of anaesthetists. However, an important study suggests that some of them felt that music reduced their vigilance and impaired their communication with the team or distracted their attention from alarms (Hawksworth, 1997). A study in Swedish and Finnish nursing home settings showed that nursing staff found that dancing and movement to music benefited the wellbeing of elderly people (Palo-Bengtsson, 1997).

Medical humanities seek to induce personal development through all artforms, encouraging the medical practitioner to become more humane, understanding and sympathetic in the process. The arts and humanities can also contribute to re-conceptualising medicine, bringing together academic, intellectual and educational pursuits, responding to social, ethical and scientific needs (McManus, 1995; Calman, 1996; Calman, 1997). An overview of the results of a one-month humanities elective for fourth year medical students has shown that the students can learn to care for patients in a more humane and thoughtful manner (Anderson, 2003). The incorporation of arts and humanities into undergraduate education via special modules has shown that the most successful was a module which was voluntary, part of the curriculum and examinable (McNaughton, 2000). These findings correlate with the belief that a good doctor is an educated doctor; it is in this context that the arts and humanities play a valued role (Gillon, 1997; Downie, 1999).

An evaluation comparing the analytical skills of medical undergraduates – before and after taking a module which included arts, literature and philosophy – showed that the students were better able to analyse the arguments used in the passages. This educational experience may prove to be of instrumental value for medical

students' development and for their future medical practice (Downie, 1999). A survey of medical schools in the USA showed that the inclusion of the arts into the curriculum is expanding, and that there is wide support for arts-related extra-curricular programmes (Strickland, 2002).

Literature

The study of literature as part of undergraduate courses in medical and nursing schools aims to promote clarity of observation, expression and fluency in ordinary language (Moyle, 1995; Stowe, 1996). These are essential aspects for developing the skills of communication and enhancing students' understanding of the doctor-patient relationship (Smith, 1998; Skelton, 2001). The exploration of visual art, music and literature were the subjects of another course for doctors and nurses aiming to improve and enrich professional decision-making and communication skills (Jeffrey, 2001). Education in the humanities can broaden scientific perspectives and critical analysis, helping students to engage in the dialogue which is the base of doctor-patient relationships (Weiss, 2000; Kottow, 2002). The teaching of literature and the understanding of particular interactions between the characters are very relevant in the professional development of a psychiatrist and in the relationship between therapist and patient (Bokey, 2002; Podrug, 2003).

Poetry during medical rounds is a model for the integration of humanities into residency training. It involves using 20 minutes out of the 90 minutes allocated to daily rounds for the reading and discussion of pre-selected poems by members of the clinical team. This has proved to be extremely successful and Horowitz (1996) suggests that each team should adapt the frequency of poetry reading and discussion to their routines. A recent nurse-initiative development in Aberdeen involving patients, visitors and staff featured a wall-mounted selection of poems, followed by discussions and implementation of the lessons learned from the experience of reading the poems and understanding their meaning (Macduff, 2002).

Similar results have been found in previous studies which introduced the humanities in residency education and training (Risse, 1992; Barnard, 1994). The value of introducing literature and poetry in nursing education and training resides in helping nurses and midwives to gain insights into aspects of death, physical disabilities and mental illness (Begley, 1996; Castledine, 1998; Macduff, 1998). Positive outcomes for mental health users and providers have been found as a result of using literature, creative writing and poetry in the service (McArdle, 2001). The poet's ability to deal with complex thoughts and translate them into essential

words makes poetry relevant for doctors, especially neurosurgeons (De Villiers, 1993).

Medical humanities seek to achieve other objectives; to allow practitioners a process of reflection to discover new insights into their ways of practising and to increase their understanding of the experience of illness and suffering (Kirklin, 2001). It is also important for doctors to understand what the arts and humanities can offer them (Meakin, 2000; Scott, 2000). Developing the medical humanities is the subject of continuous discussion and research, emphasising the relevance of these courses in medicine (Evans, 2001).

The relationship between the arts, particularly literature and medicine, stimulates insights into shared human experiences and individual differences, and increases the language and thoughts of the practitioner. Major works of Western literature raise questions about the meaning of being ill and suffering and, indeed, of dying; those are the issues also present in daily clinical practice. This connection illustrates the relationship between literature and medicine (McMellan, 1996). The important role of literature in helping physicians to develop empathy across gender, race, class or culture is discussed by Charon (1995) and Hunter (1995). Literature has the potential to impart knowledge and shape attitudes; and so contribute to enriched medical practice (Grant, 2002).

Another recent study analyses the arguments in favour and against the role of literature in medical education and medical practice. The study recognises that a pure bio-scientific education offers a limited view of human beings and argues that the introduction of literature directly induces greater sensitivity and empathy in the reader (Beveridge, 2003).

2.4 The effect of the arts in mental health

In 1948 the World Health Organisation defined health as 'a state of complete physical, mental, and social wellbeing and not merely the absence of disease'. Health is the domain of physical and mental functioning and depends on the degree to which these functions are in equilibrium with the physical, biological and social environment (Lock, 2001). The arts play a pivotal role in achieving this equilibrium (Jamison, 1994). Art interventions provide support for both the patient and the mental health professional, and create new approaches to aid the diagnosis and treatment of mental health disorders (Killick, 2000; Argyle, 2003).

This section of the review looks at:

- the relevance of using art in mental health environments
- the therapeutic contribution of the arts to mental health
- the use of different artforms in association with medication
- the effect of arts intervention on mental health users and providers

The introduction of the arts into mental healthcare helps the patient to find new ways of self-expression and acts as a vehicle for establishing communication with others (Killick, 1999a; Killick, 1999b; Allan, 2000). It is important to distinguish between the active and passive involvement of patients with mental illness in different artform activities. Patients can actively participate in the creation of work, engaging themselves in artistic and aesthetic pursuits under the guidance of art specialists. This process is the domain of art therapy which is used in mental care centres, although clinical outcomes still remain controversial. The reports are mostly empirical or anecdotal rather than based on evidence from randomised and controlled studies (McKernon, 1996; Odell-Miller, 1996; Lloyd, 1999). This review includes some studies carried out in the field of art therapy which have made a contribution to the objectives of the review.

Alternatively, the patient can be a passive recipient of different artforms. This approach aims to induce particular responses and therapeutic effects in mental health users; however, few controlled and randomised studies have been carried out. The introduction of a creative arts programme, as a therapeutic approach, was tested on 58 psychiatric patients with different diagnoses. The authors assessed the changes in clinical symptoms and in patients' difficulties in communicating. They concluded that the use of the arts induced significant improvements in all patients, and give information on the use of specific creative arts programmes which should be tailored to patient requirements. The authors also suggest that creative arts should be used as a treatment to complement conventional therapy (McGarry, 1998; Korlin, 2000).

It is important to note that the introduction of creative arts, such as dance and drama, music, visual arts and creative writing in mental health could have potential risk factors. These are associated with the psychological effects of being engaged in these activities, which could become too demanding for the patient. They could also result in physical injuries (Graham-Pole, 2002). Therefore, it is crucial that the art therapist is trained to develop the interpersonal skills needed for gaining the confidence of the patient, as well as maintaining an awareness of the potential dangers of these activities (Dobson, 2000; Mottram, 2003).

The importance of employing trained staff, the power of performances and the rewards that this stimulation brings, have been studied in patients with Alzheimer's disease. The results showed an increase in patients' self-esteem and a more positive attitude towards their families and staff (Smith, 1992). Other authors have found that the creative arts are uniquely suited to the task of preserving and maximising the sense of self in patients with mental disorders, mainly because they are non-verbal modalities which encourage self-expression, reminiscence and socialisation (Johnson, 1992). The nature of mental illness, the biological mechanisms underlying it, and its links with creativity have been explored extensively; a recently published book analyses all these aspects (Nettle, 2001). It is also interesting that the use of the arts has been recognised by mental health professionals as a positive intervention to facilitate counselling (Gladding, 2003).

Creative writing, literature and poetry in mental health

The relationship between creative writing and mental wellbeing is the subject of extensive debate and research. In mental health, the use of writing as a means of expressing feelings and thoughts can have therapeutic value. This process enables individuals to organise and regain control over their own inner world, increasing their mental wellbeing (Jensen, 1997). A number of different approaches involving expressive and therapeutic reading and writing have been used in mental health services (Bolton, 1999). Developing the narrative of their own mental illness helps not only the patients but also their families and caregivers (McGihon, 1996). Personal stories of successful treatments and recoveries bring hope to other patients. They also give an insight into how the disease manifests itself, how different the experience can be for each person and the importance of adapting treatment to individual needs (Jones, 1997).

Therapeutic storytelling and poetry therapy also induce positive clinical outcomes, possibly because the individual can safely identify him or herself with fictional characters, making it easier to project themselves as somebody else (Mazza, 1993). This interesting area needs more scientific research in order to provide the clinical evidence of the benefits to mental health (McArdle, 2001). Another study showed a significant reduction in levels of depression in those patients who were guided to read selected literature, fiction or poetry, compared to a control group who did not participate in reading (Smith, 1997). Other studies have found that these improvements, although very valuable, had no long-lasting effect (Scogin, 1996; Esterling, 1999). For people with Alzheimer's disease, the introduction of narratives or stories which they can relate to their own experiences produced positive results (Manthrope, 2000).

Selected literature has been introduced into a learning unit within the Mental Health Branch programme of the Diploma in Higher Education of Nursing. This aims to give students a better understanding of people's experiences of living with mental health problems. The learning unit enhances the process of relating interpretation of the text to the real world, although some students found this approach questionable (McKie, 2001). Other authors suggest that reflective narratives are important in helping nursing staff to think about the patient as a whole person (Graham, 1999). Burr et al. (1998) argue that the introduction of arts and humanities into the training and education of medical and nursing staff is essential for their understanding of the cultural, social, ethnic and economic factors influencing patients' behaviour.

Theatre, drama and visual art in mental health

An evaluation of the role of therapeutic theatre as a method of therapy for people with deficits in communication, cognition and social skills showed a positive effect in alleviating these disabilities (Snow, 2003). The use of drama therapy responds to the deeper psychological need of people with dementia to express and understand their own world (Knocker, 2002). Drama is also a powerful tool in mental health nursing education. It challenges the power position of participants and promotes empathy and understanding between students, teachers and patients (Wasylo, 2003).

The artist Willem de Kooning was diagnosed as having Alzheimer's disease and associated dementia; however, he continued creating works of art. Espinel (1996) suggests that painting helped de Kooning maintain his creativity in spite of the development of Alzheimer's disease and associated dementia. He claims 'recovery' in the sense that colours and forms gave him a pathway for the restoration of his self. In this context, art was an aid to managing his illness and his life. The analysis of the work produced during illness gives an insight into the understanding of dementia and shows how art can contribute to the study of the mind (Espinel, 1996). The effect of teaching visual arts skills to mental health users is described as effective and positive because it enables patients to achieve personal expressiveness and positively influences their behaviour (Malley, 2002).

Mental health professionals also use visual art as an aid for diagnosis. A pilot study reports the development of a coding system for evaluating paintings produced by psychiatric patients. This approach is very valuable for reaching diagnosis in circumstances in which verbal material is not available; the results suggest that clear differences appear in patients' works which could be related to

different psychiatric disorders (Hacking, 1996; Lev-Wiesel, 2003). Wall murals painted over an exit door contributed to a change in the behaviour of patients with dementia. The assessment showed a significant decrease in patients' agitation, and an improvement in keeping patients away from situations of potential harm (Kincaid, 2003).

Dancing and singing in mental health

The introduction of social dancing gives patients another way of communicating, supports spontaneous activity and increases physical movements (Hokkanen, 2003). The potential benefits of dancing, and how people with dementia behave during dance sessions, was investigated in another study. The results showed that their emotional and functional motor activities are largely preserved. The authors indicated that this type of activity creates a supportive environment and helps the patient to achieve a state of independence (Palo-Bengtsson, 1998; Palo-Bengtsson, 2000).

Another type of nursing intervention in mental healthcare is singing. It has been shown to increase the quality of life of people with progressive dementia; to provide comfort and awareness, and very importantly, allows for the inclusion of people from different cultural and social backgrounds (Clair, 1990; Clair, 1996; Clair, 2000). Research studies found that encouraging care providers to sing familiar tunes during daily routines has a valuable therapeutic effect (Gotell, 2000; Gotell, 2002). Singing increases verbal communication, stimulates patients' collaboration during routine tasks, improves their mood and reduces agitation (Brown, 2001). A study of the effect of singing on patients showing impairment of their naming abilities due to memory loss showed a clear improvement in the percentage of correct face-name recognitions in the group of patients who were involved in singing sessions (trial group) compared to patients in the control group, who did not have singing support (Carruth, 1997; Brown, 2001).

Music intervention in mental health

Behavioural problems of mental health users, such as agitation and confusion, are often expressed as an inappropriate verbal, vocal, or motor activity that is generally managed by medication or physical restraint. It is therefore important to identify alternative interventions to help patients and healthcare professionals to control this type of situation. The review of the literature in this particular field suggests that music intervention is one of the most useful tools available to care givers. The findings show that music plays a vital role in helping to deal with the

behavioural problems of mental health patients, including eating and sleeping patterns, memory loss and other disorders (Lou, 2001). Another study compared the effect of reading and listening to music, where the authors measured changes in behaviour in a group of patients during, immediately after and a week after having personalised sessions of reading or listening to music. The results showed that most of the patients benefited from both interventions, although some responded better to reading than to music. These findings confirm the need to plan arts interventions according to the characteristics of each patient (Gardiner, 2000).

The use of individualised music was evaluated in a controlled study. Patients were divided into two groups. The control group had no music and the trial group listened to music of their choice using an audio-cassette. The results showed a significant decrease in agitated behaviour in patients who listened to music. Interestingly, this beneficial effect lasted for another hour after the music ended (Gerdner, 1993; Gerdner, 1997; Gerdner, 1999). Other authors analysed the responses of patients to individualised music, using material obtained from video-recorded sessions. The sessions included either music selected by the patient or classical music selected by the staff; patients in the control group had no music. The results showed a significant reduction in the levels of agitation in the group of patients who listened to their preferred music compared to that of the other two groups. This study also found that the use of music had a minimal effect in people with severe dementia (Ragneskog, 2001). These findings confirmed previous studies in the same field (Casby, 1994; Clair, 1994; Malaret, 1998). The effect of individual sessions of music therapy on children and adolescents with mental or behavioural disorders was assessed by using specially designed scales. The authors compared current ratings with retrospective assessments and found a clear improvement in the quality of life of those patients (Gold, 2001).

The effect of listening to preferred music on occurrences of aggressive behaviour during routine daily tasks, such as bathing and eating, has also been measured. Results indicate that in 80 percent of patients, the total number of aggressive or hitting behaviours significantly decreased and cooperation with the caregiver increased (Thomas, 1997). Other authors reported the positive effect of music intervention in inducing normal sleeping patterns in patients with senile dementia (Lindenmuth, 1992). These findings are relevant for enhancing the wellbeing of mental health users and the quality of mental health services (Brotons, 1996; Clark, 1998).

The use of music to reduce disruptive and violent behaviours during social dining interactions and the effect that it might have on the dining room environment has

been explored (Denne, 1997; McDaniel, 2001). The introduction of background music characterised as relaxing, even if it was unfamiliar to the patient, significantly reduced the number of incidents such as agitation and disruptive behaviour (Courtright, 1990; Ragneskog, 1996; Hicks, 2002). The authors measured the number of incidents of different types of behaviours: aggressive, verbally agitated, hiding and physically non-aggressive. The authors developed a protocol of weekly alternation of music and no music in the dining room. The findings showed a significant reduction in the numbers of agitated, physically non-aggressive, and verbally agitated incidents during the weeks with music, although there were no significant reductions in the number of aggressive and hiding behaviours (Goddaer, 1994; Ragneskog, 1996). The hypothesis is that relaxing music contrasts with noise levels in the dining room of nursing homes, inducing a calming effect, which reduces disruptive behaviour. Studies conducted outside scheduled routine mealtimes and routine care concluded that calming music provides a structured environment with less disturbing stimuli resulting in an improved patient behaviour (Tabloski, 1995; Remington, 2002). The studies reviewed here indicate the relevance of music intervention as an alternative method of controlling behavioural disturbances (Clark, 1998; Herrman, 2001).

Music is one of the aids used in mental health services to assist patients who are confused or have memory loss impairing their ability to recall events of their personal lives. This important part of mental care, called 'reminiscence therapy', needs more research in order to identify the effectiveness of music intervention, and to produce evidence-based guidelines for its use (Spector, 2000). One study of this type evaluated the ability of patients to recall life events when confronted with different situations; familiar music versus novel music and background noises or silence. The results showed that the patients' recall abilities were significantly better in the presence of music compared to either noise or silence. The authors suggest that auditory stimulation by music enhances arousal and attention, helping patients to remember life events (Foster, 2001; Larkin, 2001). The use of familiar music also helps people who experience memory loss (amnesia) as a consequence of stroke or traumatic accidents (Baker, 2001).

Music also has a role in helping mental health users to adjust to living in a long-term care setting (Kydd, 2001). The intervention of music for recreation or therapy is recognised for its therapeutic value. With the intervention of a music therapist, it is possible to build a communicative and interactive relationship with the patient, even when their responses are limited by the disease (Kneafsey, 1997; Kyle, 2000). Similar conclusions are drawn from published reviews of the literature on the use of music therapy in patients with dementia (Brotons, 1997; Koger, 1999).

This field needs better designed studies to show conclusive evidence (Koger, 1999; Koger, 2000).

The use of music as a therapy working alongside medication for the rehabilitation of psychiatric patients has recently been recognised (Rose, 2001; Houghton-Becki, 2002). The attitude of mental health providers (psychiatrists, clinical psychologists, social workers and nurses) towards the relevance of music therapy as a psychiatric treatment has also been investigated. Significant differences were recorded; for example, psychologists did not consider music intervention as an essential part of therapeutic intervention. Other professionals responded less positively to its inclusion as part of the treatment. The same study showed that patients value the use of music therapy less favourably than the staff (Choi, 1997). However, in a more recent study, a self-reported survey of patients' opinions of the use of music concluded that they perceive music therapy as very helpful. Patients indicated that music reduced their levels of anxiety, stimulated them to seek help and encouraged them to talk about their own problems (De l'Etoile, 2002). More efforts should be directed to finding out whether music intervention could reduce the consumption of drugs in mental health services (Grasel, 2003).

Researchers found no difference between using recorded or live music or between listening or participating in musical sessions with mental health users. Interestingly, playing classical music was less effective in reducing psychotic symptoms than using familiar tunes of non-classical music (Silverman, 2003). The use of background music during examination did not modify patients' responses (Silber, 1999). This area deserves more research.

The influence of music on patients with Alzheimer's type of dementia has been extensively explored. In one study the responses of male patients were evaluated after a programme of music therapy sessions. The authors found no significant differences when evaluating affective type of responses, such as smiling, anger, depressed or tearful reactions, but reported a clear increase in patients' positive behaviour. Importantly, they found a reduction in the stress levels of mental health providers (Korb, 1997). Previous studies have indicated that music also helps Alzheimer's patients to maximise their social functions (Glynn, 1992; Sambandham, 1995). The effectiveness of musical activities such as movement, rhythm and singing, presented at high or low level of demand, were measured in patients with different degrees of impairment of their cognitive functions. Patients participated more in movement and rhythm activities than in singing, especially when these activities were presented at lower levels of demand (Hanson, 1996).

Music plays a significant role in controlling wandering behaviour in people with senile dementia of Alzheimer's type; it was found to be significantly more effective than reading (Groene, 1993; Fitzgerald, 1993; Groene, 2001). It has been recently confirmed that music significantly reduces physical agitation in patients with this type of dementia (Jennings, 2002), increasing their willingness to participate in other types of activity or routine tasks (Mathews, 2001; Cevasco, 2003). All these findings are of great importance for the management of patients with Alzheimer's disease and could be used as an effective way of diminishing the need to physically restrain patients; a procedure associated with loss of control and increased feelings of anxiety (Janelli, 1997).

Specific clinical tests have shown that Alzheimer's patients retain considerable musical skills in spite of the development of the disease (Beatty, 1994). The retention of this ability in cases in which the disease has caused cognitive deterioration is very useful for developing examination tests and treatments (Aldridge, 1994; 1995; 1998). A study found a significant improvement in patients completing special visual tasks after listening to 10 minutes of a Mozart piano sonata in comparison to the control group which had 10 minutes of silence (Johnson, 2002). A number of techniques are applied to stimulate and capitalise on any of the remaining cognitive functions still present in senile demented patients; among them, music is found to be one of the most effective interventions for inducing improvements in speech and communication (Mahendra, 2001). It is reported that nostalgic types of music stimulated long-term memory and positive behaviour in patients attending an Alzheimer's day care centre (Olsen, 2000). Other research studies confirm these findings; the authors concluded that the introduction of music programmes in residential facilities is very valuable (Forbes, 1998; Chain, 2002).

An interesting study measured mood and mental state among Alzheimer's patients in three different situations. One group of patients had 1920s and 1930s music played during their recreation period, a second group had puzzle exercises and a third group had routine painting and drawing activities. This programme was run for six months. Statistical analysis of the data showed that the group who were exposed to music had a higher rate of recalling their personal history and were also more alert and happier than patients in the other two groups (Lord, 1993; Cohen, 2000). These results were confirmed by a recent study in which mental health providers perceived and reported a significant improvement in the social and emotional state of patients who were exposed to music (Brottons, 2003).

An analysis of the preferences of people with Alzheimer's disease for participating in different types of musical activities such as singing, playing instruments, dancing or composition, showed that they enjoyed playing an instrument and dancing more than any of the other activities (Brotons, 1994). The staff recognised that music and dancing provide a non-invasive and non-threatening method of relating with the patient. This creates an environment conducive to decreasing anxiety levels and to inducing positive physiological, emotional and psychological outcomes in mental health users (Ragneskön, 1997). More research is needed to understand the association between the intervention of music and clinical outcomes, and very importantly, the long-term effect on patients and on mental health services.

2.5 The effect of different types of artforms

There are a considerable number of studies outlining the positive effect of the arts in medicine; however, less attention has been paid to the relative contribution of different types of artforms. This review includes the most relevant research studies analysing different types of music, different types of instruments, the use of live, video or recorded performances, drawings and paintings, traditional and contemporary art.

The exploration of the therapeutic value of music has identified specific types of music which seem to produce more consistent physiological effects than others. An interesting study measured the cardiovascular, hormonal and mental stimulation responses of healthy volunteers after listening to different types of music: a waltz by Johann Strauss, a modern classic piece by Hans Werner Henze, or a meditative type of music by Ravi Shankar. The authors showed that the waltz had a significant effect on regulating the function of the heart, that meditative music induced mental stimulation and classical music reduced the levels of some stress-related hormones (Mockel, 1994).

Researchers have also studied the correlation between listening to preferred music or background music and levels of stress reduction. The results showed a significant reduction of stress in patients who pre-selected their preferred tunes (Mornhinweg, 1992). The use of familiar tunes selected by the patient or 'individualised' music is very effective in controlling people's behaviour. Studies that compare responses to classical 'relaxation' music with 'individualised' music show that the latter induces a significant reduction in levels of agitation in mental health users (Thaut, 1993; Gerdner, 2000).

Another study evaluated the effect of soothing and stimulating music on the perception of pain. They found that both types of music significantly increase the levels of tolerance to pain (Whipple, 1992) and, interestingly, reported that the harp is one of the instruments most capable of reducing stress and pain (Williams, 1993). The relationship between the type of music, different musical instruments and the management of pain should be further investigated.

Previous musical training, exposure to music, cultural attitudes and personality could have an influence on how an individual perceives music; however, all listeners develop a certain degree of expectation of a musical event, with repercussions on their moods or mental states. Researchers at the University of Nottingham used an objective method to quantify mood before and after participants were exposed to a particular piece of music. Each subject listened to pieces of music from a total of six different categories using headphones. The authors classified the categories as vigorous pop music, fatigued indie, angry heavy rock or rap, depressed indie or heavy rock, tense indie or pop and friendly music for all moods. The results showed that all types of music caused significant changes in the mood of the participants. The type labelled friendly music for all moods induced the greatest positive change. The 'tense' type of music evoked the most negative mood change. Some types of music induced feelings of loneliness or desperation, while others produced happiness and lifted depression. This study provides an insight into the type of music that could be used as a therapeutic aid in mental health services (Smith, 1998; McCraty, 1998).

A previous controlled study reported differences in response to 'excitative' and 'sedative' musical pieces by measuring variability in participants' heart rates. This research classified works by Wagner, Stravinsky and Respighi as 'excitative', while works by Mozart, Satie and Dvorak were considered 'sedative'. Certain differences in responses to works by composers within the same category were explained by the fact that the work by Wagner was mainly played by strings and was melodious, whereas the work by Stravinsky involved more percussion and brass and was more dynamic in nature. The authors found that different types of music elicited subjective feelings of relaxation, calming or exciting emotions that could be related to the variability in the measurements of heart rate of participants. These conclusions highlight the importance of selecting the right type of music for different medical settings (Iwanaga, 1997). There is also a claim that different types of music affect the level of some hormones, but the results are not conclusive (McKinney, 1997).

Other authors have explored the effect of background music by measuring responses to the mode and speed of the music and communication between participants. Communication was rated more satisfactory, but productivity was not altered by the presence of background music (Blood, 1993).

The effect of Indian classical music played before and during a particular medical procedure was tested in a group of patients. The results showed a marked reduction on patients' levels of stress and anxiety (Kotwal, 1998). This type of music was also found useful for treating sleeping disorders (Gitanjali, 1998). Israeli folk music was effective in dealing with patients with Alzheimer's disease (Silber, 1999). The potential of sacred and secular music in helping remember life events and evoking past feelings among elderly people was studied. The statistical analysis of the data showed that both types of music had a positive and effective influence (Lowis, 1997).

Early studies suggested that some types of music, such as *The Planets* by Gustav Holst, could induce different outcomes. 'Mars' was rated as evoking arousal, while 'Venus' was rated as calming. The authors studied the relationship between this emotional effect and brain activity and found activation in the frontal region of the brain after listening to the stimulating type of music (Iwaki, 1997). Adolescents who listen to music with negative lyrics or themes, especially heavy metal music, present more pre-admission dysfunctional behaviours than hospitalised adolescents who listen to non-negative, non-aggressive lyrics (Weidinger, 1991; Montello, 1998). In a controlled study, adolescents with depression were divided into two groups; one group listened to rock music and the other group had no music. The measurements of the changes in the mood of the patients showed no differences between the groups (Field, 1998). A smaller study found that listening to pop music reduced the number of reported incidences of hallucinations in mental health users. This type of music was more effective than other experimental conditions studied, such as background noise, irregular electronic blips or silence (Gallagher, 1994). Other studies discussed the crucial importance of selecting the appropriate type of music in achieving therapeutic aims (Ogata, 1995; Staruser, 1997).

Interestingly, the medical literature reports cases of individuals who experienced changes in their musical taste, from classical to pop music, after the onset of dementia affecting the frontal and temporal parts of the brain. Although there is no definitive explanation, this finding is relevant for the understanding of the biological mechanisms underlying the appreciation of music material (Geroldi, 2000). It appears that new skills could emerge after the onset of dementia, suggesting that

the loss of function in one area of the brain can release new functions in other areas of the brain (Miller, 2000; Laino, 2003). Recently, the case of a visual artist was studied; as dementia progressed, her language declined but her paintings became freer and more original. The authors suggest that artistic development does not require language, and furthermore, it may inhibit certain aspects of visual creativity (Mell, 2003).

Some authors have addressed the question of whether live music elicits different and more positive responses than tape-recorded music; however, rigorous research is sparse. An early research study was carried out at the Memorial Sloan-Kettering Cancer Center. Patients were randomly selected and placed in different groups. One group of patients listened to 25 minutes of live songs; the other group of patients listened to the same but taped songs. Mood states before and after music were recorded and analysed to determine levels of anxiety, depression, anger, vigour, fatigue and confusion. The results showed a significant increase in positive mood and vigour and a decrease in anxiety and fatigue in the group of patients who were exposed to live music (Bailey, 1983).

The contribution of the visual arts to healthcare has been addressed from different angles. A recent study has explored the relative influence of nature or abstract paintings in the recovery of patients. The authors found a more positive result in those patients exposed to nature (Ulrich, 1993). A comparison of the responses to pictures or paintings showing either angry or happy faces was studied, measuring heart rate variability in a group of people divided by gender. The main findings indicated more changes in heart rate variability in response to angry than to happy faces, particularly in men. The authors believed that this effect is due to increased attention to aversive stimuli (Jonsson, 2003).

Viewing pictures elicits a number of physiological reactions, not only in heart rate but also in skin conductance responses, which are recorded using special equipment. An International Affective Picture System (Lang, 1999) which is available on CD-ROM and as photographic slides, classified pictures as unpleasant, pleasant and neutral. Using a selection from this catalogue, 50 students were presented with 54 pictures (18 of each type) and their responses measured. The responses to the unpleasant and pleasant pictures were compared to those produced by the neutral pictures. It was found that unpleasant or pleasant pictures produced a significant greater reaction in skin conductance reactivity which was related to the intensity of the emotional response. This was a long-lasting effect, even after a brief presentation of the picture (Codispoti, 2001).

2.6 Mechanisms of art perception

The arts are defined by the *Chambers 21st Century Dictionary* as: 'The branch of knowledge that covers the study of subjects that are generally considered to be non-scientific and non-vocational.' The scientific world, however, is interested in finding out what happens in the human brain in the presence of a work of art. The understanding of human responses to art and its relationship with the functioning of the brain has extensively developed in the last decade, although many questions remain to be answered. This review presents selected studies on the relationship between arts, science and medicine in the following areas:

- the mechanisms involved in the perception of artforms
- the mechanisms involved in processing music and visual arts
- the relationship between the arts and emotional responses

In the past 20 years, science and technology have made extraordinary progress towards the understanding of what happens in our brain when confronted with works of art. At a basic level, the patterns followed by the brain in perceiving art are very similar among individuals, in spite of the variety and richness of artistic creation. Indeed, no aesthetic experience is possible without the active participation of different areas of the brain (Zeki, 1999). Experimental work designed to gain insight into the complexities involving the experiences of viewers in the presence of works of art suggests a link between affective and cognitive processes and the perception of aesthetic values (Takahashi, 1995). The relationship between brain structures or specific neural processes and the variability and expression of artistic creativity remains unsolved (Zeki, 2002).

In the process of seeing a painting, the image is formed when the light enters the eyes and is converted into an electrical signal which is taken by the optic nerve to other regions of the brain. The image is then reconstructed into motion, depth, colours and forms. Individual cultural experiences influence the interpretation of meaning and aesthetics and result in an emotional response towards the work of art (Rhodes, 1990; Koster, 1998). Paintings such as Johannes Vermeer's *Woman holding a balance* have been studied scientifically using advanced technology. The authors aim to unveil how the brain sees the painting by analysing the pigments and the brush strokes used (Espinel, 1998). A model of the pathways involved in the perception of images has recently been proposed. It includes sensory features, neural structures and a cascade of events which researchers suggest may be organised in a hierarchical order (Henderson, 1999; Sergin, 2003). Research studies suggest that drawing errors found in some pictures could be the result of

the artist's misperception of the object (Cohen, 1997). This fascinating field requires more research.

The analysis of complex sound is important for understanding how we perceive music. Neurologists studying the perception and production of music take advantage of developments in technology; techniques such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET) and transcranial magnetic brain stimulation (TMS) are used. Many studies exploring which areas of the brain are activated in order to receive and structure the response to sound found that the 'primary auditory cortex' plays the main role (Griffiths, 1999; Begley, 2000).

The perception of complex sound phenomena is the result of specialised neural mechanisms encoding musical sounds (Tervaniemi, 2001). The total experience of music appears as the result of decomposing the auditory stimulus, and distributing each component to different cortical areas, specially adapted to receive the information. Rhythm and space (pitch intervals) occur mainly in the left hemisphere, while timbre and melody (contour) are processed mainly in the right hemisphere. The brain develops neural networks to establish communication between all the activated regions and the result is the final experience of music perception.

If the listener is also a performer, additional networks are formed to link the sensory system with the motor system (Ogata, 1995; Warren, 1999). The understanding of the mechanisms underlying the effect of rhythm, as one of the most essential structural elements of music, and the physical response of the motor system could have medical implications. The study suggests the potential therapeutic use of music in the rehabilitation of people with movement disorders (Thaut, 1999).

Professional musicians report that listening to a piece of music, which they have learned involuntarily, triggers the respective finger movements. This observation was confirmed by studies showing the activation of a specific region of the brain during this process (Haueisen, 2001). The experience of repeating finger tasks plays a significant role in achieving the independence of fingers in musicians; this finding could be applied to the treatment of disorders affecting some functions of the hands (Slobounov, 2002).

The process of building a coherent perception of music requires synchronisation of the neuronal information within and between multiple brain areas. A study showed

that the degree of spatial synchrony is significantly increased in musicians in comparison to non-musicians (Bhattacharya, 2001). Also, differences appeared between the regions activated in the brain of musicians compared with the activated regions found in non-musicians after listening to a particular vocal part of a musical phrase (Satoh, 2003).

Other authors suggest that musicians and non-musicians have different strategies for perceiving musical stimuli. A marked involvement of the right hemisphere of the brain during harmony perception was noted in non-musicians, while musicians presented an attentive mode of listening which contributed to more activation of the left hemisphere (Matteis, 1997; Evers, 1999; Bhattacharya, 2001). The differences that appear in the brain of professional musicians compared to non-musicians are due to one of the most important properties of the brain, namely its plasticity (Ozturk, 2002).

Researchers explored the areas of the brain involved in selective attention to pitch, timbre and rhythm during the task of recognising familiar tunes. The participants, who were right handed, young, healthy individuals without musical training, developed a visual mental imagery strategy during the test. Using high technology, such as positron emission tomography (PET), the authors identified a number of regions in the brain involved in this process (Platel, 1997). The results are confirmed by other studies, which mapped the regions of the brain activated by the interaction of music and visual imagery (Nakamura, 1999).

Multiple representations are created in the brain when listening to music, learning to play an instrument or training professionally. Each specific task induces the adaptation of different regions of the brain including widely distributed neuronal networks in both hemispheres (Altenmuller, 1997; Altenmuller, 2001). Recently, researchers have tracked the activation of a region of the brain, the prefrontal cortex, as the centre of perception of tonal structures, and specifically the region responding to tonalities of the Western type of music (Janata, 2002a).

An interesting study investigated the neural basis of musical ability in an early blind musician. This topic was investigated because it has been suggested that early blind individuals may possess advanced musical skills, which could be the result of neural plasticity. At this point the authors do not qualify the term 'early'. However, the case they investigate and present in their paper was an individual who was born blind. Researchers detected additional activation in various regions of the brain in comparison with those found in the brain of sighted subjects, and suggested that other cerebral areas, apart from those already described, may be

also involved in the developing of musical skills (Ross, 2003). Another study found that patients with degenerative diseases affecting a specific part of the brain, namely the cerebellum, had impaired discrimination of pitch. The cerebellum is also implicated in the sensory and cognitive processing of music, but not in the motor response (Parsons, 2001).

Auditory perception is a topic of great interest which is developing through the observation of individuals with a selective loss of musical abilities, known as auditory agnosia or amusia. Researchers are addressing the question of whether there is functional independence between language and music, and the congenital or acquired nature of music perception disorders (Platel, 2002). A rigorous study showed that there are people who present alterations only in pitch perception associated with deficient ability to recall or memorise musical information. The authors suggest that the deficit observed is the result of an initial failure of the system of perception, and that it could be of a genetic origin (Ayote, 2002). Congenital amusia is the medical term for what is commonly known as tone deafness, and research is being carried out to understand the music-specific networks underlying this disorder (Peretz, 2001). Acquired amusia is quite common in patients who have suffered a stroke (Munte, 1998; Kohlmetz, 2001).

There are a number of clinical conditions that manifest changes of musical perception mechanisms. Some patients with brain damage have impairments in music perception as a consequence of lesions. It has been found that patients with left-hemisphere damage show significant deficits in the discrimination of melodic structures, while patients with right-hemisphere damage reveal a more extended impairment of music perception (Schuppert, 2000). Other authors have reached similar conclusions after studying patients who have undergone brain surgery and, as a consequence, lost their ability to solve some musical perception tasks (Ayotte, 2000). Previous studies of patients with Alzheimer's disease have localised the regions of the brain affected by the lesions that are responsible for a decrease in music perception in these patients (Guenther, 1993).

Research studies have shown that there is a strong association between the musical and verbal component of familiar songs and that this relationship can be altered in patients with brain damage (Hebert, 2001). Brain lesions may destroy some connections of the musical network, leaving other functions intact. There are well-researched cases of famous people, like the composer Ravel, who developed a disease which destroyed his ability to express musical ideas, although his comprehension remained intact (Sergent, 1993). Benjamin Britten had a stroke which affected his speech but spared his musical faculties, illustrating the

dissociation between verbal and musical processing that occurs in some cases (Henson, 1988).

Mechanisms involved in processing music and visual arts

The processing of music and language have similarities (Nakada, 1998; Holden, 2001). Recent studies suggest that music and speech are processed in the same area of the brain, called Broca's area, although the effects of music are more pronounced in the right hemisphere of the brain, and speech functions are mainly localised in the left hemisphere (Patel, 2003). It appears that there are gender differences in musical processing; in females, processing of music is mapped in both hemispheres, while in males it is predominant in the right part of the brain (Koelsch, 2003). This distribution is also found in subjects with no musical training, which suggests that the brain has an implicit ability to receive and analyse music following these patterns (Koelsch, 2000; Koelsch, 2002).

The same author, who is himself a musician, studied the mechanisms of processing music by children aged five to nine, and concluded that children process music and language in the same part of the brain, highlighting the importance of introducing music for the acquisition of language (Koelsch, 2003). Very recent studies support the concept that music, like language, can convey meaning beyond associations with emotions and feelings (Janata, 2004). Moreover, the use of high technology showed that both music and language can carry information based on similar physiological patterns (Koelsch, 2004).

Applying advanced technology, researchers have localised the areas of the brain involved in singing, which are found in the cortical areas of the brain (Perry, 1999; Jeffries, 2003). Another report has shown differential activation of brain regions as a response to either speech or singing (Riecker, 2000). Interesting studies support the theory that there are some aspects of poetry and music, such as duration, meter and timbre that the brain can process using shared systems; in contrast, linguistic syntax and musical pitch are processed in different domains of the brain (Lerdahl, 2001).

An intriguing question is how the brain is able to connect piano keys, piano sounds and the actual skill of piano playing. The responses of two groups of people, one with no musical experience and the other consisting of professional pianists, were tested listening to a melody, adapting to a practising procedure or pressing the keys on a silent piano. The results showed a similar distribution of the activated areas of the brain in both groups. Practising develops the capacity of co-

representing sound and movement like a map in the brain. This is one of the models used for understanding the mechanism by which the motor system (movement of the fingers) under auditory control responds to the high demands of the quick and precise coordination required for playing the piano (Bangert, 2001; Andrade, 2003).

The demands of playing a musical instrument on the sensory and motor systems induce a re-organisation of the human brain, which is made possible due to its plasticity. This process involves the unmasking of existing brain connections and the establishing of new ones, which explains the differences found when comparing some characteristics of the brain in musicians and in non-musicians (Pascual-Leone, 2001). Musicians have cerebral characteristics that correlate with the age they began their musical studies (Baeck, 2002) and they also develop more accurate sensory memory functions (Tervaniemi, 1997; Otte, 2001). The volume of grey matter in the brain of musicians was found to be greater than in non-musicians. This structural difference is induced by learning motor and auditory skills from an early age and acquiring the ability to translate visually perceived symbols into motor commands with simultaneous auditory monitoring (Gaser, 2003).

Musically trained subjects performed significantly better than non-musically trained people in mentally forming images of musical or familiar sounds. The complex sequence of activation in different regions of the brain was studied in trained musicians, who were presented with visual notes and asked to imagine the corresponding sounds. Using special techniques, the studies showed that musicians use this process of mental imagery to accomplish their performing tasks (Aleman, 2000; Janata, 2003). Jacqueline du Pre was able to play by mentally visualising the position of her fingers on the cello, even when her tactile feelings were distorted by the lesions in her brain which were due to multiple sclerosis (Wilson, 1998). These types of studies help us to understand the biology behind artistic skills (Schurmann, 2002; Stewart, 2003).

The cerebellum is the part of the brain involved in motor learning and cognitive functions. Research studies have found that the relative volume of the cerebellum is significantly larger in musicians compared to non-musicians and correlates with the intensity of musical practice (Hutchinson, 2003). These results denote structural adaptation of the cerebellum to the long-term motor and cognitive demands of training and performance (Schlaug, 2001).

The use of advanced technology confirms the activation of different regions of the brain during the process of listening to music. However, further studies are necessary to clarify whether any difference would appear between musicians and non-musicians (Sato, 2001). Another study has found significant differences in the activation of brain regions after either listening to single timbres or single instruments or across multiple instruments (Janata, 2002b). The cultural environment also has an effect on the mechanisms of the brain involved in processing music. Familiar tunes played by instruments culturally related to the listener induce more activation of the specific areas of the brain than the same tune played by classical instruments (Arikan, 1999).

The processing of pitch responds to mechanisms located in the right auditory cortex, and the processing of pitch patterns, such as melodies, requires the interaction with the frontal cortex. Functional imaging techniques are used to localise changes in these structures in normal and pathological conditions (Hachinski, 1994; Griffiths, 2001). The brain is able to automatically encode musical melodic information, even in the absence of musical training (Trainor, 2002). The neural network underlying the processing of another structural part of music such as timbre is found distributed in both hemispheres of the brain (Menon, 2002).

Researchers are interested in studying the interconnections between the ear, the nervous system and the possible impact on human development. There are many reports claiming that using music as stimuli increases the level of intelligence, but these are mainly anecdotal; there is now a real need for research in this area (Thompson, 2000).

The Mozart effect

In 1993 a study claimed that normal subjects showed a significant increase in their spatial reasoning skills such as paper cutting and folding procedures or solving maze tasks, after listening to Mozart's sonata for two pianos (K448) for 10 minutes. The comparison was made with the data obtained after listening to either relaxation instructions or silence for the same length of time (Rauscher, 1993; Rauscher, 1995). However, these conclusions remain controversial. Some authors were unable to reproduce the findings (Newman, 1995; Chabris, 1999) while others confirmed them (Wilson, 1997; Rideout, 1998). It seems that what is known as the 'Mozart effect' should be limited to the improvement in spatial tasks and not extended to the enhancement of general intelligence. Indeed, investigators studying the responses triggered by Mozart's sonata or minimalist music by Philip

Glass, showed that only Mozart's music improved the results of spatial temporal tests (Rauscher, 1995).

The effect of listening to Mozart sonata K448 for 10 minutes compared to listening to a short story showed that only music had an effect on activating specific areas of the brain. However, this result is not a response unique to this sonata since other pieces of music produced the same effect (Sarnthein, 1997; Nakamura, 1999; Bodner, 2001).

The 'Mozart effect' was found effective in diminishing the number of attacks in patients with epilepsy (Hughes, 1998; Hughes, 1999). In order to understand this important finding a wide range of music was analysed by a special computer programme. The authors found that the increase in spatial temporal performance and the decrease of seizure activity in epilepsy are induced by any type of music which shows a high degree of long-term periodicity like Mozart's music (Hughes, 2000; Samson, 2001). Undoubtedly, these findings are of great importance for its potential use in controlling epileptic episodes and require more research.

It is very interesting that the support for the existence of music-specific neural networks is found by studying pathological conditions such as brain damage after trauma or cerebrovascular accidents, congenital brain anomalies, autism and epilepsy which are capable of affecting some musical abilities leaving the rest intact (Peretz, 2002). The development of a method of recording and analysing different sleep phases and transforming them into music provided a non-pharmacological method of inducing sleep in patients suffering from insomnia. This is called 'brain music', it is very effective and does not have side effects (Levin, 1998). This type of research should be expanded further, considering that it could contribute to the reduction of drug consumption.

The left hemisphere is also involved in processing the meaningful aspects of both pictorial and linguistic tasks. Experimental work comparing the responses of normal subjects to both surrealistic and realistic pictures suggested that specific regions of the brain are activated during the process of interpreting paintings and these regions appear to be associated with the memory of art works and the understanding of metaphors (Zaidel, 1989).

Areas of functional specialisation for colour processing are mainly localised in the occipital visual cortex (Buchner, 1994; Zeki, 1998). Eye movements and three-dimensional object recognition are mapped to specific regions of the brain; the best rates of recognition were obtained from subjects who were trained in fine arts

(Niemann, 1996). A very interesting study of the perception of visual art compared the responses of viewers to slide-projected and computer generated images of nine paintings by renowned artists to the responses obtained from individuals experiencing the original versions of the same works of art. The analysis of the data showed that participants assigned a significantly higher value to the original paintings than to the two types of reproductions (Locher, 2001).

Some research has shown that visual hallucinations, sometimes triggered by migraine attacks, could be the source of inspiration for the artist; examples include Picasso's cubist style of painting and the British artist J.J. Ignatius Brennan's drawings and sculpture amongst others (Podoll, 2000; Laino, 2003). This fascinating field investigates the relevance that a medical condition can have in the process and expression of some artists' creativity.

The relationship between the arts and emotional responses

There is a general acceptance that music is the language of emotions, however, few studies have explored the biological basis of musically induced emotions which are described as pleasant, unpleasant, and/or arousal. One of these studies established the link between the auditory nerve and specific regions of the brain such as the amygdala and the prefrontal cortex. The authors identified them as the centres for the generation and expression of emotions after musical stimuli (Thayer, 2001). Another study explored the mechanisms underlying intensely pleasant emotional responses to music, commonly known as 'shivers down the spine' or 'chills'. The researchers measured cerebral blood flow changes, heart rate and respiration in a controlled experiment and found that cerebral blood flow increases with the intensity of the reported 'chills', demonstrating a physiological response to music. They also reported activation of brain structures which are known to be involved in pleasure and reward (Blood, 2001).

In an earlier controlled study the authors suggested that, although neural networks are involved in the induction of emotional states by music, these networks are different from those associated with music perception or for the release of other emotions such as fear (Blood, 1999). The relationship between vocal expression of emotions and musical expression of emotions is the subject of current research. This important topic is still at the stage of theoretical speculation (Juslin, 2003).

Adults and children listening to pre-selected pieces of music were asked to record their emotional reactions; the results showed no gender differences among adults. However, there were age differences as women recorded stronger emotions of

anger than young girls, and children perceived greater feelings of happiness and fewer feelings of anger than adults (Robazza, 1994). People with brain damage, which impaired their ability to process music, have been tested for their emotional responses to music. The data has shown that emotional judgements such as feeling happy or sad were still present in these subjects and remained resistant to brain damage (Peretz, 1998).

The changes in intensity and quality of the emotions elicited by music have been measured using recognised psychological tests. The data were analysed according to the type of music and the cross-cultural influences. The authors found that the interplay between expectations and the actual musical event has a role in creating tension, emotions, and/or relaxation (Bhattacharya, 2001; Krumhansl, 2002). Other authors measured the changes in some properties of the skin (conductance), as a result of the emotions elicited by music. They found that stimulating the emotions fear and happiness induces significantly greater responses than other emotions, such as sadness and peacefulness (Khalfa, 2002). These results are consistent with a proposed model mapping the specialised regions of the brain which are concerned with perceived positive or negative emotions (Altenmuller, 2002).

The emotional reaction to viewing pictures has also been explored. Researchers have measured facial reactivity of subjects involved in the experiment, their affective judgements and interest, and their behaviour in voluntarily terminating the exposure to the visual stimuli. The experiment used coloured photographs of domestic and wild animals, human faces, and pictures of social interactions. The results showed that facial expressiveness induces specific emotional responses and that intensity of interest and length of viewing times are associated with the degree of pleasure and arousal elicited by the photographs. Although some differences were found between males and females, the affective responses were largely independent of personality factors (Lang, 1993). The relationship between colour and emotions has been studied from a psychological point of view (Barber, 1999). Although further research is needed to establish the biological mechanisms underlying this process, the implications of these studies are of great significance. Understanding how and which emotional response is triggered by colour and sound enables its rational use in creating a powerful therapeutic environment.

3 Conclusions

This review includes 385 references from the medical literature related to the effect of the arts and humanities in healthcare. It offers strong evidence of the influence of the arts and humanities in achieving effective approaches to patient management and to the education and training of health practitioners. It identifies the relative contribution of different artforms to the final aim of creating a therapeutic healthcare environment.

It highlights the crucial importance of the arts and humanities in:

- inducing positive physiological and psychological changes in clinical outcomes
- reducing drug consumption
- shortening length of stay in hospital
- increasing job satisfaction
- promoting better doctor-patient relationship
- improving mental healthcare
- developing health practitioners' empathy across gender and cultural diversity

3.1 Recommendations for future research

- The effect of the arts and humanities as contributing factors in the recruitment and retention of staff has not yet been evaluated. The literature refers to their influence in job satisfaction but the link and effect on recruitment and retention has not been evaluated
- The type of musical instrument/s in relation to the clinical setting deserves further research, perhaps leading to the introduction of guidelines to optimise the beneficial outcomes of music in healthcare environments
- The effect of integrating different artforms and humanities into the healthcare culture in issues such as social inclusion and cultural understanding should be evaluated

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4.1 The effect of the arts on clinical outcomes

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4.7 General publications

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Appendix 1 Glossary of terms

Adjuvant: any substance given with another to boost its activity.

Affective: the emotion or mood associated with a particular idea.

Amygdala: a distinct mass of grey matter located deep inside each cerebral hemisphere; functions are related to mood, instinct, feeling and memory of recent events.

Auditory: relating to the ear or to the sense of hearing.

Auditory nerve: consists of two nerves; one connects the inner ear to the brain and is responsible for body equilibrium; the other connects the brain with the part of the ear involved in processing sounds (hearing).

Alzheimer's disease: is a progressive degenerative process of neural tissue affecting mainly the frontal and temporal lobes of the brain in middle and late life.

Analgesia: drugs which relieve or abolish pain.

Angiography: radiography of blood vessels.

Antiemetic: a drug that counteracts nausea and sickness.

Ambulatory surgery: the intervention does not confine the patient to bed.

Autonomic reactivity: refers to the part of the nervous system which regulates the bodily functions that are not under conscious control.

Behavioural states: indicators such as feeding and sleeping difficulties and agitation.

Bronchoscopy: procedure to visualise the interior of bronchial tubes.

Cerebral: related to the brain.

Cerebral blood flow: supply of blood to the brain. It is maintained at a regular rate.

Cerebral palsy: medical conditions characterised by varying degrees of paralysis.

Cerebellum: part of the brain that lies toward the back of the cerebrum.

Cerebrum: the front part of the brain, which is involved with thought, decision, emotion and character

Cognitive functions: human activities related to knowledge.

Conductance: the reciprocal of electrical resistance.

Cortex: the tissues that form the outer part of an organ, such as the cerebral cortex of the brain.

Cortical: refers to cortex.

Cortisol: a hormone related to stress.

Cognition: the mental process by which a person acquires knowledge.

Congenital: manifestations transmitted directly from the parents.

Dementia: an acquired and irreversible deterioration in intellectual function.

Depression: a collection of psychological symptoms including sadness, poor self-image and downbeat views on the future.

Diastolic blood pressure: denotes the pressure between the heartbeats and is the lower value.

Double-blind studies: trials in which neither the patient/subject nor the assessor knows which regime is allocated to which subject.

Electroencephalography (EEG): is the recording of the changes in electric potential discharged by nerve cells.

Frontal lobe: the anterior part of the cerebral hemispheres.

Functional Magnetic Resonance Imaging (fMRI): technique that directly measures activity – in the form of blood flow – in the brain.

Gastroendoscopy: procedure for viewing the interior of the stomach.

Grey matter: those parts of the brain and spinal cord that comprise mainly the interconnected and tightly packed nerve cells or neurones; found in the outer layers of the cerebrum, which is the zone responsible for advanced mental functions.

Hallucinations: false perceptions arising without an adequate external stimulus.

Hemisphere: One of the two halves of the cerebrum, which is the largest and most developed part of the brain.

Hydrotherapy: the treatment of disorders by application of water or by immersion.

Intra-operative: within surgery.

Ischemia: bloodlessness of a part of the body, such as the heart.

Imagery: the production of vivid mental representations.

Laceration: a wound to the skin or surface of an organ.

Migraine: common condition characterised by recurring intense headaches.

Motor: term applied to nerves, used to describe anything that results in movement.

Magnetic Resonance Imaging (MRI): a non-invasive method of visualising the body and its organs.

Myocardial infarction: heart disease affecting blood supply.

Neur- (neuro-): prefix denoting nerves or the nervous system.

Ophthalmic: related to the eye.

Oxygen saturation: indicates the total oxygen content of the blood.

Paralimbic system: beside or close to the networks in the brain involved in expressing instinct and mood.

Parkinson's disease: progressive and degenerative disease mainly due to the deficiency in the neurotransmitter dopamine.

Perception: the process by which information about the world, as received by the senses, is analysed and made meaningful.

Peri-anaesthesia: around the time of giving anaesthesia.

Plasticity: the property to change.

Positron Emission Tomography (PET): nuclear medicine diagnostic technique, to identify metabolic and chemical activities of tissues, especially brain tissues.

Prefrontal cortex: the region of the brain at the very front of each cerebral hemisphere. The functions are concerned with learning, emotions, memory and social behaviour.

Processing: an organised series of events leading to the final outcome.

Psychotic: referring to someone with psychosis.

Psychosis: one of a group of mental disorders in which the affected person loses contact with reality.

Randomised controlled trials/studies: a method of comparing the results between two or more groups of patients intentionally subjected to different methods of treatment.

Regional anaesthesia: use of local anaesthetic solution to produce circumscribed areas of loss of sensation, for example, when an epidural anaesthetic is administered to the pelvic region during childbirth.

Sensory: description applied to the nervous system dedicated to bringing information on sensations affecting the body to the brain.

Systolic blood pressure: indicating the maximum arterial pressure during contraction of the left ventricle of the heart.

Stroke: sudden development of a focal neurological deficit, usually impaired cerebral blood supply.

Temporal lobe: part of the cerebral cortex in each hemisphere of the brain.

Tomography: a technique using X-rays or ultrasound to build up a focused image of a slice through the body at a given level.

Urology: branch of medicine that treats disorders of the kidneys and urinary tract.

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