Evidence Based Review: Music Therapy

Reviewers	**Amanda Bowens, Evidence Based Healthcare Researcher (principal investigator, literature searching)** **Mai Dwairy, Research Information Specialist (literature searching)**
Date completed	**6 July 2005**

Please note:

This evidence based review summarises information on the effectiveness of music therapy in rehabilitation. It is not intended to replace clinical judgement or to be used as a clinical protocol. A reasonable attempt has been made to find and review papers relevant to the focus of this report. It does not claim to be exhaustive. This document has been prepared by staff of the ACC Evidence Based Healthcare Advisory Group. The content does not necessarily represent the official view of ACC or represent ACC policy. This report is based upon information supplied up to the end of April 2005.

Executive summary

Background

ACC currently purchases music therapy on a case-by-case basis. However, in response to proposed changes to ACC's Training for Independence contracts, the New Zealand Society for Music Therapy has asked ACC to consider using music therapy more widely in rehabilitation. The Evidence Based Healthcare Advisory Group has therefore been asked to review the effectiveness of music therapy as a rehabilitation intervention.

Search strategy

Relevant databases and websites including Medline, Psycinfo, AMED, Cinahl, Cochrane Library and BMJ Clinical Evidence were searched in December 2004 and April 2005.

Selection criteria

Meta-analyses, systematic reviews and primary quantitative studies of the effectiveness of music therapy in rehabilitation were included in the review if: (i) published in English; and (ii) published between January 1995 and April 2005.

Data collection and analysis

Included studies were appraised and graded for methodological quality according to an evidence grading system developed by the Scottish Intercollegiate Guidelines Network.

Main results

A total of 38 studies met the selection criteria and were included in the review; 27 studies involved adults or adults and children and 11 involved children and/or adolescents only. The studies covered the following disorders and clinical fields: traumatic brain injury; physical rehabilitation; pain management; burns; cerebral palsy; stress, anxiety and depression; violence, abuse and post-traumatic stress disorder; developmental disorders and intellectual handicap; and emotional and behavioural problems. The quality of the 38 studies was on the whole poor. Only seven of them achieved a "1+" grading, indicating that they provided moderate quality evidence of the effectiveness of music therapy.

Reviewer's conclusions

The studies included in this review do not constitute a strong evidence base to support the use of music therapy in rehabilitation. The strongest of the included studies provide moderate quality evidence for the use of music therapy in:

- Reducing agitation and enhancing orientation during post-traumatic amnesia following brain injury
- Reducing perceptions of pain in osteoarthritis sufferers
- Relieving symptoms of work-related stress and improving staff morale
- Reducing symptoms of anxiety and depression in some depressed subjects
- Improving behavioural and developmental outcomes in children and adolescents with behavioural, developmental or mixed diagnosis disorders

Music therapy appears to be a reasonably safe intervention. However, it may be appropriate for music therapists wishing to work with some ACC clients to have relevant training or condition-specific experience in rehabilitation. It is recommended that ACC continues to purchase music therapy services on a case-by-case basis.

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1. Background

ACC currently purchases music therapy services on a case-by-case basis, as appropriate to individual claimant needs, and where it can be shown to be contributing effectively to a claimant's social rehabilitation. Music therapy is not currently included in the standard collection of rehabilitation interventions funded by ACC.

However, the New Zealand Society for Music Therapy (NZSMT)[a] believes that music therapy has much to offer as a rehabilitation intervention and should be more widely purchased by ACC. Under planned changes to ACC's Training for Independence contracts, the NZSMT wants music therapists to be classed as Rehabilitation Professionals rather than Rehabilitation Coaches as currently proposed. It also wants music therapists to be listed as part of the mainstream multidisciplinary rehabilitation team.

Before it can consider changing the status of music therapists as rehabilitation providers, ACC requires robust evidence of the effectiveness of music therapy in rehabilitation. ACC Healthwise has therefore asked the Evidence Based Healthcare Advisory Group to review the evidence on the effectiveness of music therapy as a rehabilitation intervention.

2. Objectives

The objectives of this review are to:

- Review the evidence on the effectiveness of music therapy in rehabilitation
- Identify the injuries, conditions and disorders for which music therapy may be an effective rehabilitation intervention
- Investigate the status of music therapy and music therapists internationally

3. Health technology

3.1 What is music therapy?

Music therapy involves the prescribed use of music and musical interventions to restore, maintain and improve emotional, physical, physiological and mental health. A music therapist uses music to establish a therapeutic relationship with the client, then works to improve their physical and mental functioning through structured musical activities. These activities can include listening to music, singing, playing instruments, composing, song writing and moving to music. Music therapists work towards specific therapeutic

[a] See http://www.musictherapy.org.nz/index.html

objectives such as the development or restoration of motor, communication, social or coping skills. They work with both individuals and groups.

This review focuses on music therapy as practised by trained music therapists. However, please note that other health practitioners, for example nurses and physiotherapists, sometimes use music in patient care.

3.2 Music therapy in New Zealand

Music therapy is a relatively new profession in New Zealand. A Master of Music Therapy programme was launched at Massey University in 2003. Prior to that, NZ music therapists had to study abroad or enrol on a local accreditation programme approved by the NZSMT. An independent registration board was endorsed by the NZSMT in 1999 and established in 2000. Appropriately qualified applicants who register with the board are permitted to use the credentials "RMTh" to indicate that they are NZ-registered music therapists. The board also grants practising certificates that can be renewed every three years on submission of evidence of continuing professional development. However, the registration board is independent, registration is voluntary and music therapists do not have a scope of practice under the ***Health Practitioners Competence Assurance Act 2003***.

The current Master of Music Therapy is a two year, full-time programme based at the Massey Conservatorium of Music in Wellington[b]. Entrants must hold an undergraduate degree in music or other relevant subject (e.g. psychology, sociology or education) with at least 25 points in psychology or a related discipline. They must have a sound musical training and be able to play at graduate level. The Masters programme includes supervised clinical placements and modules on indigenous music focusing on Maori music and culture. Successful postgraduates are encouraged to become registered music therapists.

There are currently ***(as of July 2005)*** around 27 music therapists in New Zealand, of whom 17 are registered with the NZSMT. The majority were trained overseas.

3.3 The status of music therapy overseas

In the United Kingdom, music therapists are state registered arts therapists regulated by the Health Professions Council (HPC)[c]. The HPC was created under the provisions of the ***Health Professions Order 2001*** and is the statutory regulation and registration body for 13

[b] See http://study.massey.ac.nz/programme.asp?prog_code=93306
[c] See http://www.hpc-uk.org/index.html

health professions. It requires registered practitioners to meet specified standards of proficiency, conduct and ethical behaviour. Music therapists must be state registered before they can be employed by the National Health Service or local council social services departments. Only state registered music therapists can use the title "music therapist". In order to register, applicants must first complete an approved postgraduate programme.

Elsewhere the situation is similar to New Zealand, i.e. regulation tends to be overseen by independent rather that state bodies and registration is voluntary.

Australian music therapists who have completed an accredited undergraduate or postgraduate degree programme may join the Australian Music Therapy Association (AMTA)[d] and register with the AMTA National Registration Committee. Once registered, they are bound by the ***Code of Professional Conduct and Ethics of AMTA Inc.*** and may use the credentials "RMT".

In Canada, music therapists who have completed an approved undergraduate degree may register with the independent Canadian Music Therapy Association (CAMT)[e] and use the credentials "Music Therapist Accredited (MTA)". In addition, six of the ten Canadian provinces have established provincial music therapy associations that work closely with CAMT. In British Columbia, however, music therapy is to become a state regulated profession under the province's ***Health Professions Act*** [f]. Under the ***Act***, music therapy will be overseen be a college or governing body representing several health care professions related to counselling. The British Columbian legislation will be similar to the United Kingdom's ***Health Professions Order 2001.***

4. Methodology

4.1 Criteria for selecting studies for the review

Eligible studies published in English from 1995 to date that investigated music therapy as a rehabilitation intervention were selected for inclusion in the review.

Types of studies: quantitative primary research (randomised controlled trials [RCTs], controlled trials without randomisation and pre-/post-test or case series with ≥ 2 subjects) and secondary research (systematic reviews and meta-analyses) that covered relevant primary studies were included in the review. Single case reports were excluded.

[d] See http://www.austmta.org.au/
[e] See http://www.musictherapy.ca/
[f] See http://www.qp.gov.bc.ca/statreg/stat/H/96183_01.htm

Types of participants: research that focused on rehabilitation or other areas of interest to ACC was included in the review. Typically this might involve participants receiving music therapy to assist with physical or psychological rehabilitation following an accident, injury or other trauma, or to develop and improve life skills impaired by some form of injury at birth. Studies involving healthy volunteers were excluded. The inclusion and exclusion criteria applied to participants and disorders are summarised as follows:

Include: focus on rehabilitation	Exclude: no rehabilitation or ACC interest
Adults & children: • Rehab post-injury, e.g. burns, spinal injury, traumatic brain injury • Trauma post-incident, e.g. sexual abuse • Physical rehab, e.g. pain management, recovery of function, gait training • Psychological rehab, e.g. depression, anxiety, post-traumatic stress disorder (PTSD), social functioning • Rehab of speech, communication, cognitive functioning, behaviour • Occupational stress **Mainly children:** • Problems related to injury at birth, e.g. cerebral palsy, cognitive impairment, speech & communication disorders, developmental problems, movement disorders, socialisation	**Mainly adults:** • Dementia & Alzheimer's disease • Parkinson's disease & stroke • Multiple sclerosis • Psychotic mental illness, e.g. schizophrenia **Adults & children:** • Use in acute care, e.g. in the intensive care unit (ICU) • Post-operative pain or anxiety • To distract patients from pain or anxiety whilst undergoing procedures • Cancer care • Terminal care • Autism & learning disabilities • Congenital conditions • Healthy volunteers

Types of interventions: music therapy and related interventions such as vibroacoustic stimulation were included in the review.

Types of outcome measure: studies reporting functional outcomes (e.g. gait parameters) and other outcomes potentially relevant to rehabilitation (e.g. anxiety, mood) were included in the review.

4.2 Search strategy

The following Ovid-hosted databases were searched in December 2004: Medline, Pre-Medline, Embase, Cinahl, Psycinfo, Amed, Cochrane Database of Systematic Reviews (CDSR), Cochrane Controlled Trials Register (CCTR), ACP Journal Club and Database of Abstracts of Reviews of Effects (DARE). These databases were searched using the subject

descriptor and free text terms "music therapy" combined with database-specific search filters[g] (where available) to distinguish research studies from more general literature. The search was repeated in mid April 2005 to ensure that any additional studies published while the review was in progress were picked up.

As well as the Ovid databases, the following evidence based, web-hosted databases were also searched in March 2005 using the free text term "music therapy": Bandolier, BMJ Clinical Evidence and Trip+. Several specialist music therapy websites were also checked for relevant research. See Appendix 1 for details of these databases and websites.

4.3 Methods of review

Studies that met the inclusion criteria were critically appraised and graded 1++ (strongest) to 3 (weakest) according to their methodological quality and therefore level of evidence. Grading was carried out according to a system developed by the Scottish Intercollegiate Guidelines Network (SIGN)[h]. See Appendix 2 for a description of SIGN's grading system.

Grades or levels of evidence were assigned according to the methodological quality of the studies. Factors taken into account included sample size, whether blinding and randomisation were carried out, period of follow-up, drop-out rates, generalisability and sources of potential bias. Evidence tables summarising the levels of evidence, outcomes and other characteristics of included studies are presented in Appendix 3.

5. Results

5.1 Description of studies

A total of 38 studies met our selection criteria and were included in the review; 27 studies involved adults or adults and children and 11 involved children and/or adolescents only. Four studies covered a range of disorders. The remaining studies dealt with the following disorders and intervention areas: traumatic brain injury (8 studies), physical rehabilitation (2), pain management (4), burns (2), cerebral palsy (2), stress, anxiety and depression (9), violence, abuse and post-traumatic stress disorder (2), developmental disorders and intellectual handicap (3) and emotional and behavioural problems (2). Study designs included meta-analyses (3), systematic reviews (5), RCTs (17), quasi-RCTs or controlled studies without randomisation (5) and prospective case series (8). Studies tended to be of poor quality. See Appendix 3 for more detailed descriptions of included studies.

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[g] Available from the SIGN website at http://www.sign.ac.uk/methodology/filters.html
[h] See http://www.sign.ac.uk/

5.2 Effectiveness of music therapy in rehabilitation

Our findings are summarised below. Studies involving adults are dealt with first. More information on study characteristics, evidence gradings and the methodologies used can be found in the evidence tables in Appendix 3.

ADULTS

Systematic reviews or meta-analyses covering a range of conditions: two studies identified, see evidence table 1. Snyder and Chlan[1] reviewed around 85 primary studies on the use of music therapy in nursing and clinical settings. They focused on passive rather than active interventions (i.e. listening to music rather than music-making or moving to music). They found evidence to support the effectiveness of such interventions for reducing state anxiety, promoting relaxation, improving mood, reducing pain, improving cognitive and physical performance, decreasing aggression and facilitating guided imagery interventions. The review included primary studies with a wide range of experimental designs and was not limited to RCTs alone. The findings must be viewed with caution as the methods and results of source studies were not described in detail, and their quality was neither formally assessed nor taken into account when reporting results. There was no attempt to statistically synthesise or pool study results. However, the authors did make some general observations about the quality of included studies. They noted that populations, methodologies and duration of music exposure varied widely, and that sample sizes tended to be small. This review was graded "1-".

Standley's meta-analysis[2] included 92 empirical studies where music was used in a wide range of medical and dental applications. Large (defined as > 0.8) effect sizes were estimated for anxiety reduction in patients with chronic illness and for muscle relaxation in adults with cerebral palsy. Both these estimates derived from single studies. Few of the other included studies were relevant to typical ACC clients. The included studies were not described in detail and their methodological quality was not taken into account in the meta-analysis. Standley's paper was therefore graded "1-". One included study that also met our inclusion criteria is discussed separately – see Hurt ***et al***.[3] (adult TBI, below).

Traumatic brain injury (TBI): eight studies identified; see evidence table 2. The reviews of music therapy by Adamek ***et al***.[4] and Purdie[5] reported some beneficial effects on cognitive, psychological and communication outcomes in TBI patients. However, it is difficult to take consistent messages from these reviews due to their poor quality. Both were given a "3" grading as the primary studies they covered appeared to be mostly case series.

Adamek's review included one study that also met our inclusion criteria. This study is discussed separately – see Hurt ***et al***.[3] (adult TBI, below).

A randomised crossover study by Baker[6] (graded "1+") found that both live and taped music reduced agitation and enhanced orientation in in-patients with post-traumatic amnesia following brain injury. The researchers used musical pieces that the subjects knew and enjoyed. However, the study was of relatively short duration and the extent to which immediate and short term effects might translate to longer term benefits for rehabilitation and recovery of function was not explored.

A controlled trial by Nayak ***et al***.[7] concluded that music therapy improved social interaction in in-patients with TBI and stroke. The treatment group in Nayak's study was subject to further examination in a subsequent paper by Wheeler ***et al***.[8] that investigated the effect on outcomes of number of group versus number of individual sessions attended. Wheeler concluded that number of group sessions attended was associated with significant improvements in social interaction. As neither study was of particularly good quality, their findings should be treated with caution. Both were graded "2-", as they were controlled but not randomised.

The three remaining studies were case series and were therefore graded "3". Bright and Signorelli[9] concluded that recorded and live music improved communication levels and quality of life in seven profoundly brain injured, bed-bound in-patients. However, due to the absence of a control group or long term follow-up there was little evidence that music (as opposed to increased staff attention) had a causal effect, or that short term effects translate to long term benefits in a population with such severe functional limitations.

Hurt ***et al***.[3] found that a five-week, home-based programme of rhythmic auditory stimulation[i] significantly improved gait parameters in five TBI patients. The sample was small and participants varied widely with regard to time lapsed since their injury. There was no longer term follow-up to determine whether benefits persisted post-therapy.

Magee and Davidson[10] found that a group of 14 subjects with neurological disabilities reported significantly improved mood states immediately after individual music therapy sessions. The extent to which the findings can be generalised to ACC clients is limited as all subjects had significant musical interests or ability and the aetiology of disability was TBI in only five cases. The majority of subjects had multiple sclerosis or stroke.

[i] a gait training intervention involving walking at various speeds to a musical beat

Physical rehabilitation (general): two studies identified; see evidence table 3. Staum's review[11] of music and music therapy in physical rehabilitation reported beneficial effects on motor skills and gait in children with cerebral palsy, and on gait in brain injured adults. However, the review did not assess the quality of included studies and was graded "1-". Not all included studies were randomised controlled trials, and the majority (39 out of 48) were older studies published prior to our cut-off date of 1995. Two included studies that also met our inclusion criteria are discussed separately – see Hurt ***et al***.[3] (adult TBI, above) and Kvam[12] (adult cerebral palsy, below).

The case series by Zelazny[13] (graded "3") found that electronic keyboard playing improved dexterity and reduced discomfort in four elderly women with osteoarthritis of the hands. The sample was small and generalisability to typical ACC clients may be limited.

Pain management: three studies identified, see evidence table 4. The RCT by Chesky ***et al***.[14] found that a single session of music listening plus music-modulated vibration in the 60-300 Hz frequency range had no significant effect on pain perception in subjects with fibromyalgia. The study was graded "1-" due to its short duration and lack of follow-up.

The RCT by Le Roux[15] found that subjects reported significantly lower levels of spinal pain following physiotherapy accompanied by classical music than after physiotherapy alone. The study did not investigate whether improvements were maintained beyond immediate post-session assessment and focused on music as an adjunct to physiotherapy rather than music therapy proper. It was graded "1-".

McCaffrey and Freemantle's RCT[16] found that a 14 day, home based music listening programme significantly reduced self-rated pain in elderly people with chronic osteoarthritis. Although the study was of moderate quality (graded "1+"), generalisability to typical ACC clients may be limited due to the nature of the study sample.

The quasi-randomised study by Kenny and Faunce[17] examined the impact of a group singing intervention on subjects attending an intensive chronic pain management programme. No significant differences in pain, coping or mood were observed between the singing and control groups. The study was marred by poor compliance and marked baseline differences between groups. It was graded "2-".

Burns: two studies identified, see evidence table 5. Ferguson and Voll[18] added relaxing music to the rehabilitation regimes of patients with burns crossing at least one major joint. The music group experienced no significant reductions in pain or anxiety during therapy

compared to the non-music group. This RCT was marred by a small, clinically unrepresentative sample and non-homogenous groups. It was therefore graded "1-".

Prensner ***et al***.[19] report a pilot study comparing different music therapy protocols in an in-patient burns unit. Protocols requiring a higher degree of active patient involvement appeared to be more successful in distracting subjects from pain and anxiety during rehabilitation exercises and treatment procedures. The report was brief and few details were given on the number and duration of music therapy sessions or rehabilitation and treatment co-interventions. The study was not randomised and was therefore graded "2-".

Cerebral palsy: one study identified, see evidence table 6. Kvam's RCT[12] found no strong evidence for the effectiveness of vibroacoustic therapy in adults with cerebral palsy. However, compared to music listening alone, some beneficial effects on muscle control were observed. This was a fair quality study, despite its small sample. It was graded "1+".

Stress, anxiety and depression: seven studies identified, see evidence table 7. The meta-analysis by Pelletier[20] concluded that recorded music or music-assisted relaxation techniques significantly decreased arousal due to stress (mean overall effect size ***d*** = +0.67). Verbal suggestion with music appeared to be the most effective technique, followed by vibrotactile stimulation, music-assisted progressive relaxation, combinations of two or more stress reduction techniques with music, then passive listening. Guided imagery with music appeared to be the least effective intervention. However, these findings should be interpreted with caution as the methodological quality of the individual source studies was neither assessed nor taken into account in the analysis. The inclusion of less rigorous studies in the meta-analysis may have led to over-estimation of the overall effect size[21], which remained in a positive direction even after outliers were removed. Pelletier's paper was therefore graded "1-". The author found significant heterogeneity and therefore carried out further investigation into the relationships between effect size and study characteristics. Although described as a "quality analysis", this investigation focused on aspects of the studies, subjects and interventions unrelated to methodological quality (e.g. subject gender, type of intervention, study setting). One of the included studies also met our inclusion criteria and is discussed separately – see Hammer[22] below.

A reasonable quality crossover RCT by Bittman ***et al***.[23] (graded "1+") examined the impact of a music therapy intervention on occupational stress. It found that a six week, in-house recreational music-making programme significantly improved the morale of stressed workers at a care facility for elderly people. The authors noted that an economic impact

model developed by independent consultants estimated that the increased staff satisfaction created by the programme could potentially cut employee turnover by 18.3% annually.

The RCT by Cheek ***et al***.[24] also focused on occupational stress, this time among school teachers. It concluded that a six week course of cognitive behavioural group therapy integrated with music therapy techniques produced greater reductions in symptoms of occupational burnout than the group therapy intervention alone. However, the study was marred by absence of blinding and allocation concealment. In addition, poor reporting led to a lack of clarity over which group did better on which set of measures. The study was consequently graded "1-". Generalisability is limited by the study setting.

The RCT by Hammer[22] found that state anxiety in staff and residents of an alcohol and drug rehabilitation unit who received a 10 week programme of guided imagery with music was significantly reduced compared to a no-treatment control group. However, lack of a credible control treatment meant that placebo effects were not controlled for. In addition, the two groups were not assessed simultaneously and the control group was evaluated at the start of the year, a time which anecdotal evidence suggests is particularly stressful for those recovering from alcoholism. This study was included as ACC clients requiring rehabilitation for stress may present with co-morbidities related to alcohol or drug use, but its generalisability to typical clients is obviously limited. It was graded "1-".

Kerr ***et al***.[25] found that stress and anxiety symptoms were significantly reduced in a group of anxious subjects who received a cognitive-behavioural intervention accompanied by music, compared to a control group who received a similar intervention without music. They concluded that the use of music may enhance some cognitive-behavioural techniques for reducing anxiety and improving mood. However, the findings are based on a single treatment session and their clinical significance is not clear. The study was graded "1-".

Lai's RCT[26] found that listening to music reduced respiratory rates and blood pressure in a group of depressed Taiwanese women. Again, the findings were based on a single treatment session and their clinical significance is not clear. Generalisability was limited by gender, cultural factors and some subjects' co-morbidities. The study was graded "1-".

The RCT by Wu[27] found that a 10 week music therapy programme significantly reduced anxiety in a group of depressed and anxious undergraduates compared to a no-treatment control group. When subjects were followed up two months post-treatment, the music therapy group continued to report significantly lower anxiety, and their depression symptoms were significantly lower also. The study was of reasonable quality, although the

inclusion of a credible control group would have been useful and generalisability is limited by cultural factors. The study was graded "1+".

Abuse, violence and post-traumatic stress disorder: one study identified, see evidence table 8. A prospective case series by Whipple and Lindsey[28] evaluated the effects of a group music therapy programme on 15 domestic violence victims residing at a temporary shelter for battered women. The authors reported that subjects' mean self-ratings indicated they found music therapy beneficial. However, the effectiveness of the programme is difficult to assess as session attendance was highly variable and on the whole poor, and statistical analysis was limited. The programme consisted of eight interactive group sessions, each with a specific therapeutic goal such as raising self-esteem or enhancing coping skills. It was designed to run for eight weeks, with subjects attending one session per week. The fact that women were only allowed to reside in the shelter for a maximum of five weeks appears to have been overlooked. The study was graded "3".

CHILDREN

Systematic reviews & other studies covering a range of conditions: two studies identified, see evidence table 9. Gold ***et al***.[29] carried out a fair quality meta-analysis of 11 studies of group and individual music therapy for children and adolescents with psychopathology. They found that music therapy had significant positive effects on a range of clinically relevant outcomes (e.g. self-esteem). Benefits tended to be greater for children with developmental, behavioural or mixed diagnoses than for those with emotional disorders alone. Effects on behavioural and developmental outcomes tended to be larger than those on social skills and self-concept. Music therapy interventions that took an eclectic approach, combining a range of techniques and theories, appeared to be more effective than those based on purely behavioural models. Although the quality of the source studies was not formally evaluated, they were described in reasonable detail and the meta-analysis was weighted for sample size. Tests for publication bias and heterogeneity were carried out. After one outlier was excluded, effect sizes were found to be homogenous. The meta-analysis was graded "1+". Two of the included primary studies also met our inclusion criteria and were appraised separately - see Aldridge ***et al***.[30] [31] (child developmental disorders) and Montello and Coons[32] (child emotional and behavioural disorders) below.

A pilot study by Gold ***et al***.[33] examined the effects of music therapy on seven children with various mental and behavioural disorders. Some improvements in symptoms and competencies were reported post-therapy. However, the validity of this study was limited

by the small heterogeneous sample and by wide variations in the nature and number of interventions received. There was no post-test comparison with the control group, who were included simply to test the feasibility of carrying out controlled research on a larger scale. The study was therefore graded "3".

Cerebral palsy: one study identified, see evidence table 10. The pilot case series by Ghetti[34] involved six children and adolescents with profound multiple disabilities. Four had cerebral palsy, one had a brain injury and one had suffered anoxia during perinatal surgery. The effect of three different, progressively more active types of music therapy on subjects' alertness was investigated. No significant differences were found between them, or between post-treatment and baseline. The study was graded "3".

Stress, anxiety and depression: two studies identified, see evidence table 11. The RCTs by Field ***et al***.[35] and Jones and Field[36] investigated the short term physiological effects on chronically depressed adolescents of a single brief session spent listening to music. In the first study, the music group experienced significant changes in EEG activation and salivary cortisol (suggestive of reduced depression and stress) compared to a control group who received mental and muscle relaxation exercises. In the latter study, significant EEG effects were observed in both the music group and a control group who received massage. Effects appeared to be greater in the massage group. The main shortcoming of both studies is that they failed to establish whether immediate physiological effects lead to any sustained or meaningful clinical benefit in the longer term. In addition, their generalisability was limited by cultural factors. Both studies were graded "1-".

Abuse, violence and post-traumatic stress disorder: one study identified, see evidence table 12. Finkelhor and Berliner's systematic review[37] of treatments for sexually abused children concluded that although benefits were widely reported, only a small number of the included primary studies were of sufficiently robust quality to demonstrate that effects were produced by the therapies themselves and not by other factors such as the passing of time. The review included one study on music therapy, but it was not among the aforementioned small number of better quality studies. A commentary on the review by the UK Centre for Reviews and Dissemination (CRD) concluded that its findings should be treated with caution due to lack of information about the methodology used[38]. The review was graded "1-".

Developmental disorders and intellectual handicap: three studies identified, see evidence table 13. A pilot randomised, crossover study by Aldridge ***et al***.[30 31] found that a three

month course of active, improvisation-based music therapy was associated with significant improvements in hearing and speech, and slight improvements in social interaction and hand-eye co-ordination, in eight children with developmental delay. The study had reasonable duration and follow-up periods, but was marred by small sample size, unclear reporting, drop-outs and groups that were not comparable at baseline. It was graded "1-".

A multi-centre RCT by Duffy and Fuller[39] compared the effects of a music therapy social skills development programme with a non-music intervention in 32 children with moderate intellectual disability. Improvements in five target areas were seen in both groups, but neither performed significantly better than the other. The study was graded "1+". The authors suggested that the music intervention might have been more effective had it been delivered by trained music therapists rather than day centre staff, or involved more demanding elements such as improvisation. They concluded that musical activities did "not appear to be the important element in the intervention process".

The prospective case series by Ma ***et al***.[40] found that attending a music therapy playgroup for three weeks improved target communication skills in six toddlers with pervasive developmental disorder. Subjects responded most strongly to musical play activities that were interactive, tailored to their abilities, or incorporated tactile stimulation such as vibration as well as verbal prompting and song. This was a small pilot study with limited quantitative analysis and no longer term follow-up. It was graded "3".

Emotional and behavioural disorders: two studies identified, see evidence table 14. This area is of interest to ACC as emotional or behavioural problems are sometimes experienced following injury or trauma. The crossover trial by Montello and Coons[32] compared the effects of passive and active music therapy on US school pupils with emotional, learning and behavioural problems. Although both approaches produced some improvements in behaviour, results were conflicting and active therapy appeared to increase hostility in subjects with attention deficit hyperactivity disorder (ADHD). However, the authors observed that children with natural talent or previous musical experience or ability appeared to benefit more from therapy and were able to motivate their peers. The study was not randomised and was marred by a small sample, baseline group differences and the exclusion of some subjects from follow-up. It was graded "2-".

The RCT by Rickson and Watkins[41] examined whether an eight week music therapy programme improved the behaviour of aggressive adolescent boys attending a special residential school. Of the 38 studies included in our review, this was the only one with a

New Zealand setting or Maori participants. The study detected no statistically significant treatment effects. While social workers reported that music therapy may have helped the boys interact more appropriately in their residential settings, teachers observed a slight increase in disruptive classroom behaviour, particularly among boys with ADHD. The study sample was small and, despite randomisation, the treatment and control groups differed significantly at baseline. In one group, all subjects had been diagnosed with ADHD. The study was graded "1-".

5.3 Relationships between reported effectiveness & subject or therapy characteristics

Pelletier's meta-analysis[20] (graded "1-") found that music and music-assisted relaxation techniques achieved greater stress reduction in studies where subjects were aged under 18 or had previous musical experience. Individual treatment appeared to be more effective than group interventions, and music established by previous research to have a relaxing effect had a greater impact than subject-selected music. The meta-analysis by Standley[2] (also graded "1-") found that music provoked greater responses in studies involving women, children (but not infants), adolescents, dental or chronic pain patients; where subjects were experiencing some pain (however, effectiveness appeared to decline as pain increased); where outcomes were rated by self-report, behavioural observations or physiological measures; where live, rather than recorded, music was presented by a trained music therapist; and where subjects' preferred choice of music was used.

While the two meta-analyses agreed that music interventions tended to have larger effects on child or adolescent subjects, they disagreed on whether the actual music used should be chosen by the subjects themselves or based on previous research. Pelletier's finding that effects are greater in subjects with previous musical experience were echoed by Montello and Coons[32], whose non-randomised study (graded "2-") found that children with musical experience or ability were more responsive to music therapy. However, the findings should be interpreted with caution as all three studies had methodological flaws.

The fair quality meta-analysis by Gold ***et al***.[29] (graded "1+") concluded that eclectic music therapy interventions were more effective than purely behavioural approaches for children and adolescents with psychopathology. It also found that children with developmental or behavioural disorders, or with mixed diagnoses, appeared to benefit more from music therapy than children with emotional disorders alone.

5.4 Safety and adverse effects

Relatively few adverse effects were described in the 38 studies included in our review. No adverse physical effects were reported. Music therapy therefore appears to be a reasonably safe intervention when practised appropriately by properly trained therapists.

Instances of subjects becoming overwhelmed or distressed on hearing certain recorded music were reported in two papers[9 33] and a study involving depressed subjects found that music provoked negative as well as positive feelings[26]. As music can arouse troubling emotions and unpleasant memories, care should be taken when using music therapy with children, depressed or traumatised patients, or people whose ability to communicate distress is impaired.

Two studies reported that music therapy appeared to increase disruptive behaviour in children with ADHD[32 41]. The authors of one paper advised caution when introducing music therapy to children with ADHD and warned that small group numbers and a highly structured approach may be necessary to minimise over-stimulation[41]. Others recommended that a more passive approach focusing on listening rather than music-making should initially be used with emotionally disturbed children or adolescents[32].

6. Discussion

6.1 Methodological quality of the selected studies

The quality of the 38 included studies was moderate to poor. None of the studies appeared to merit a "1++" grading. Only seven studies achieved a "1+" grading, indicating moderate methodological quality. Of these seven, six were RCTs and one was a meta-analysis. A further 16 studies were graded "1-". Of these poorer quality papers, 11 were RCTs, three were systematic reviews of the literature and two were meta-analyses. There were five non-randomised controlled studies, all graded "2-", and eight prospective case series (graded "3"). Two systematic reviews were also given a "3" grading as the majority of primary studies they covered appeared to be case series rather than RCTs[4 5].

None of the meta-analyses or systematic reviews formally assessed the methodological quality of included studies. The authors were not therefore able to weight their findings appropriately. Only one meta-analysis (graded "1+") was weighted for sample size[29]. In addition, the secondary research papers tended to give limited information about the design, subjects and findings of included primary studies, and the approach taken by some reviews was narrative or descriptive rather than analytical[1 4 5].

Few of the RCTs described how randomisation was carried out or, if appropriate, how allocation concealment or blinding were maintained throughout the trial. Sample sizes were relatively small. Mean sample sizes were 46.8 in the better quality "1+" trials and 26.2 in those graded "1-". The limitations of the 11 poorer quality RCTs included:

- Use of participants who were not representative of the typical clinical population
- Treatment and control groups that were not comparable at baseline
- Short duration trials with very brief exposure to treatment and control interventions (e.g. single sessions only) and no longer term follow-up to establish whether short term effects were (i) maintained and (ii) clinically significant
- Lack of blinded, or at least independent, outcome assessment

The mean sample size of the five non-randomised ("2-") studies was 36.8. The main flaws here were poor reporting, lack of baseline group comparability and poor compliance (i.e. non-attendance) in some music therapy groups, in one case due to inconvenient scheduling of treatment sessions[17]. The eight case series (graded "3") were all small and none were of particularly good quality. The mean sample size was 8.4 cases per study.

6.2 Effectiveness and safety of music therapy in rehabilitation

Effectiveness: the available research literature does not provide a strong evidence base to support the use of music therapy in rehabilitation. Most of the 38 studies included in our review had significant weaknesses and only seven were judged to be of moderate quality. The disorders for which the largest volumes of research were identified were traumatic brain injury (8 studies) and stress, anxiety and depression (9 studies). The findings of the seven better quality studies (graded"1+") included in our review are summarised below:

- The crossover RCT by Baker found that both live and taped music reduced agitation and enhanced orientation in patients with post-traumatic amnesia following brain injury[6]. The extent to which reported benefits persisted post-treatment was not clear.
- The RCT by McCaffrey and Freemantle found that listening to classical music reduced perceived osteoarthritis pain in community-dwelling elderly people[16]. Generalisability to typical ACC clients may be limited.
- Kvam's RCT found that music plus vibroacoustic therapy was not significantly more effective than music alone for improving muscle control in adults with cerebral palsy[12].

- The crossover RCT by Bittman ***et al***. concluded that a recreational music making programme reduced symptoms of work-related burnout and improved staff morale among workers at a long term elderly care facility[23].

- Wu's RCT found that a music therapy programme reduced depression and anxiety in depressed undergraduates[27]. Generalisability may be limited by cultural factors.

- Duffy and Fuller's RCT concluded that a music therapy programme was no more effective than a non-music intervention for improving social skills in children with moderate intellectual disabilities[39].

- The meta-analysis by Gold ***et al***. found that music therapy had significant positive effects on a range of clinical outcomes in children and adolescents with psychopathology[29]. Benefits tended to be greater for behavioural, developmental and mixed diagnosis disorders than for emotional disorders alone.

Due to the limitations of the evidence it is difficult to make strong statements about the relative effectiveness of different music therapy approaches and the type of patients most likely to benefit (see section 5.3). Gold ***et al***. concluded that more eclectic styles of music therapy appeared to benefit children with psychopathology more than approaches based upon purely behavioural models[29].

Two lower quality meta-analyses (both graded "1-") found that the effects of some music interventions tended to be greater: (i) in subjects with previous musical experience or where individual rather than group treatment was given[20]; and (ii) in female subjects, in cases where some (but not severe) pain was present, and where live, rather than recorded, music was presented by a trained music therapist[2]. Both studies agreed that subjects under 18 appeared to be more responsive[2 20]. The findings must be interpreted with caution and generalisability is limited to cases where the music intervention in question is similar to those covered in the meta-analyses.

Safety: few adverse effects were reported in the 38 included studies. Those that were described related to instances where certain music aroused troubling memories or emotions, or where the introduction of music therapy increased disruptive behaviour among children or adolescents with ADHD (see section 5.4).

No adverse physical effects were reported. However, this does not necessarily mean that all music therapy interventions used in physical rehabilitation are risk-free. In order to work safely and effectively with ACC clients, music therapists may need to have relevant

training or specific experience in rehabilitation, particularly when interventions with a physical dimension (e.g. gait training, vibroacoustic stimulation) are used. Likewise, it is advisable that music therapists wishing to work with traumatised clients, such as sexual abuse victims, also have appropriate training in psychology, psychotherapy or counselling.

6.3 Limitations of the review

A reasonable attempt was made to find eligible quantitative primary and secondary research studies through searches of relevant medical, nursing, psychology, evidence based medicine and complementary therapy databases and of selected evidence based medicine and music therapy websites. However, education databases such as ERIC[j] were not searched and the review did not include qualitative research, unpublished studies, non-English language material or papers published prior to 1995. Judgements about study quality were made purely on the basis of published study reports; authors were not contacted and full study protocols were not obtained.

7. Conclusions

7.1 Implications for practice

On the whole, the quality of the available research is moderate to poor and the studies included in this review do not provide a strong evidence base for the use of music therapy in rehabilitation. However there is some evidence from a small number of moderate quality RCTs that certain music therapy interventions may be effective in: (i) reducing agitation and enhancing orientation during post-traumatic amnesia following brain injury; (ii) reducing perceptions of pain in osteoarthritis sufferers; (iii) relieving symptoms of work-related stress and improving staff morale; (iv) reducing symptoms of anxiety and depression in some depressed subjects; and (v) improving behavioural and developmental outcomes in children and adolescents with behavioural, developmental or mixed diagnosis disorders. Music therapy appeared to be a reasonably safe intervention. However, it is desirable that music therapists wishing to work with some ACC clients have relevant training or condition-specific experience in rehabilitation.

7.2 Implications for research

Several previous papers have criticised the quality of music therapy research, citing its lack of rigorous methodology, reliance on small samples, limited use of follow-up data and

[j] See http://www.eric.ed.gov/

overall poor understanding of the principles of evidence based medicine[1 42-45]. The generally poor quality of music therapy research has also been highlighted in Cochrane reviews and meta-analyses[46 47] of music therapy for dementia, and in a systematic review of music therapy for children with autistic spectrum disorder[48].

Although our review focused on rehabilitation and did not examine the full spectrum of recent music therapy research, the variable quality of the studies we identified bears out the above comments and suggests that there is still a shortage of good quality studies on the effectiveness of music therapy. Future research should focus on: using appropriate sample sizes and random allocation to achieve study groups that are comparable at baseline; choosing suitable control, comparison or placebo interventions; and ensuring that trial and follow-up periods are of sufficient duration.

The Cochrane Collaboration is currently conducting two systematic reviews of music therapy that may be of interest to ACC. One will cover pain relief (due for publication in September 2005[49]) and the other will focus on depression (due mid 2005[50]). However, both reviews were still in progress at the time of finalising this report (November 2005).

7.3 Implications for policy and purchasing decisions

To date ACC has purchased music therapy for rehabilitation on a case by case basis. Our findings suggest that this should remain the case until the quality of the evidence improves and that music therapists should continue to be listed as Rehabilitation Coaches.

Music therapy is a relatively new profession in New Zealand and the number of practitioners is small. Qualified therapists may register with an independent registration board endorsed by the NZSMT and use the credentials "RMTh". It is recommended that ACC only funds music therapy provided by New Zealand-registered music therapists.

In most circumstances, ACC is unlikely to fund music therapists to provide purely passive or adjunctive intervention such as playing recorded music to clients in order to improve their mood or ability to perform exercises. Where such use of music is appropriate, ACC expects mainstream providers such as physiotherapists, counsellors or specialist nurses to employ music as part of their standard care and in accordance with their scope of practice. ACC would not normally fund additional personnel (i.e. music therapists) to provide this.

8. Acknowledgements

The authors wish to thank the following individuals for their comments on this evidence based review: (1) Dr Siiri Bennett, Dr Margaret Pack, Colleen Shramka, Sonya Murray, Gill Hall and James Chal of ACC; and (2) Rowena Cave of the New Zealand Guidelines Group.

The authors would also like to thank the ACC Information Services team (Christine Powell and Helen Brodie) for obtaining copies of the included studies.

9. Conflicts of Interest

None declared.

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Appendix 1: other databases and websites searched

Website	URL (web address)
Bandolier	http://www.jr2.ox.ac.uk/bandolier/index.html
BMJ Clinical Evidence	http://www.clinicalevidence.com/
Trip+	http://www.tripdatabase.com/
New Zealand Society for Music Therapy	http://www.musictherapy.org.nz
Nordoff-Robins Music Therapy	http://www.nordoff-robbins.org.uk/html/therapy.html
British Society for Music Therapy	http://www.bsmt.org/index.htm
Canadian Association for Music Therapy	http://www.musictherapy.ca/
Music Therapy World	http://www.musictherapyworld.net/

Appendix 2: Scottish Intercollegiate Guidelines Network (SIGN) Revised Grading System*

Levels of evidence

1++ High quality meta analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias

1+ Well conducted meta analyses, systematic reviews of RCTs, or RCTs with a low risk of bias

1 - Meta analyses, systematic reviews of RCTs, or RCTs with a high risk of bias

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2++ High quality systematic reviews of case-control or cohort studies
High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal

2+ Well conducted case control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal

2 - Case control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal

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3 Non-analytic studies, e.g. case reports, case series

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4 Expert opinion

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* From http://www.sign.ac.uk/guidelines/fulltext/50/section6.html. In our review, studies were given a "2" grading if: (i) they were controlled but not randomised; or (ii) an attempt at randomisation was made, but the method used was not adequate to ensure true randomisation (such studies are sometimes referred to as quasi- or pseudo-randomised trials).

Appendix 3: evidence tables. Part 1 - studies involving adults only, or adults and children

Evidence table 1: systematic reviews and meta-analyses covering a range of conditions

Table 1	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Snyder & Chlan 1999[1]	Systematic review of literature published 1980-1997 identified via Medline & Cinahl	Approx. 85 studies on: reducing anxiety/stress; controlling pain; improving performance; decreasing agitated/aggressive behaviour; guided imagery with music (GIM); psycho-neuroimmunological effect; and generally achieving desirable outcomes with various patient groups	Music therapy interventions in clinical & nursing settings; the review focuses on passive therapy (e.g. music listening) rather than active intervention (e.g. music making, moving to music)	The review concluded there is evidence that music therapy may be effective in: reducing state anxiety & promoting relaxation; improving mood; reducing pain; improving cognitive & physical performance; reducing aggression & agitation; and facilitating guided imagery interventions However, it found wide variations in type of music used, dosage (e.g. number of sessions, length of exposure), populations studied & methodologies used; sample sizes were usually small Studies tended to be published in clinical rather than research-based journals, as they rarely met the more stringent requirements of the latter re sample sizes, etc. The reviewers called for: larger studies; more detailed reporting of the music used & subjects' prior musical experience; more studies on music therapy v. other interventions; further replication of findings; greater synthesis & meta-analysis of primary research; and involvement of a wider range of ethnic groups	The review included studies with a wide range of experimental designs and was not limited to RCTs only Methods & results of included studies were not reported in detail; their relative quality was neither assessed nor taken into account Narrative rather than statistical synthesis used; results were not pooled; no evidence or summary tables Evidence level 1-

Table1 cont.	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Standley 2000[2]	Meta-analysis of published & unpublished studies from 1950-2000 identified via Medline, previous bibliographies & reviews, music therapy journals and relevant abstracts & indexes; mean effect sizes were computed for the 233 dependent variables reported in the studies	92 empirical studies (mostly controlled) involving clinical populations with actual symptoms; studies on healthy volunteers were excluded	Music used in any type of medical or dental treatment	Effect sizes of 0.98 were estimated for state trait anxiety (from one pre-1995 study of music therapy for patients with chronic illness) and 0.85 for muscle relaxation (from one pre-1995 study of music & biofeedback for adults with cerebral palsy); most of the included rehabilitation studies were of limited relevance to ACC (e.g. post-stroke rehab) or published before our 1995 cut-off date Music appeared to produce greater effects: in women, children (except infants) & adolescents; where patient outcomes were self-rated; where pain, if present, was not severe; and where music was performed live by a trained music therapist	Not confined to interventions delivered by qualified music therapists; gives few details & no quality assessments of included studies; presents practice recommendations that are not explicitly linked to the evidence; one included study is analysed separately[3] Evidence level 1-

Evidence table 2: traumatic brain injury

Table 2	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Adamek *et al*. 2000[4]	Systematic review of literature published 1970-2000 identified via Eric, Psychlit, other databases & hard copy sources	22 studies focusing on treatment & rehabilitation of speech & language skills in brain-injured individuals; study designs varied widely; populations ranged from n=1 to n=80	Music therapy including specialist techniques such as rhythmic training & melodic intonation therapy	Some beneficial effects reported on speech, language & communication abilities	The included studies are mostly case series or case reports; their quality is not assessed; one included study is analysed separately[3] Narrative synthesis; the summary table outlines the characteristics of "selected studies" only Evidence level 3

Table 2 cont.	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Purdie 1997[5]	Systematic review of literature published 1981-1996 identified via a comprehensive search of Medline, Psychlit & hard copy sources	80 studies on music based therapies in neurorehabilitation of adults and/or children; 13 studies dealt specifically with TBI	Music therapy "as practised by registered professionals"; includes specialist techniques such as rhythmic auditory stimulation & melodic intonation therapy	Physical rehabilitation, speech & language revalidation, cognitive & psychological adjustment Some beneficial effects reported on cognitive & psychological outcomes in TBI, including memory, attention, motivation & behaviour	Review is descriptive rather than analytical; methods & results of included studies are not reported in detail and quality is not assessed No attempt to summarise or synthesise findings; no evidence or summary tables TBI studies mostly appear to be case series Evidence level 3

Table 2 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Baker 2001[6]	Randomised crossover trial based at private rehabilitation facility, Victoria, Australia	22 in-patients with post-traumatic amnesia (PTA) after brain injury (17 male, 5 female, mean age = 34); all subjects scored < 9 on the Westmead PTA Scale and were free of intellectual disability, mental illness & dementia	Subjects acted as their own controls & were exposed in random order, twice over 6 consecutive days for approx. 12 minutes per day, to 2 sessions each of (1) live familiar music, (2) taped familiar music, and (3) control (no music)	Agitation assessed on Agitated Behaviour Scale; orientation & recall assessed on Westmead PTA scale; recall re-assessed at follow-up when subject "emerged from PTA" Both live & taped music significantly reduced agitation and enhanced orientation compared to control, but neither was significantly better than the other; music had a non-significant effect on recall; at follow-up, 77% of subjects were able to recall the music interventions	Music appeared to have some immediate and short-term effects on PTA symptoms Longer term impact on functional rehabilitation, memory recovery, duration of PTA etc. are unclear Evidence level 1+

Table 2 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Nayak *et al*. 2000[7]	Controlled trial based at inpatient rehabilitation facility, New Jersey, USA	18 in-patients with TBI or stroke; 6 men, 12 women, aged 31-84 (mean=60); all subjects had moderate to severe functional impair-ments & depression scores ≥ 4 on Faces Scale rating tool[51]	Therapy (n=10): standard rehab + active music therapy (30-40 minutes) 2-3 times per week; total of 4-10 sessions per patient, mean=5.9 Control (n=8): standard inpatient rehab regime	Subject's mood rated on 7-point visual analog scale by subject, family members & main therapist; level of social inter-action rated on pre-validated scale by family members; participation in therapy (motivation, etc.) rated by main therapist Family-rated social interaction & therapist-rated participation significantly improved in therapy group; trend towards greater improvement in self- and family-rated mood observed in therapy group	Small sample; not randomised due to problems scheduling treatment; number & group allocation of TBI patients not stated Compliance was an issue in therapy group; attendance varied widely Improvements in therapy group related to their increased social interaction rather than music therapy *per se*? (confounding) Evidence level 2-

Table 2 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Wheeler *et al*. 2003[8]	Controlled trial based at in-patient rehabili-tation facility, New Jersey, USA	10 in-patients with TBI (n=3) or stroke (n=7); therapy group from Nayak study[7] – see table above for further info; 4 men, six women, aged 24-74 (mean=60.5)	Standard rehab + music therapy as described above Treatment 1 (n=6): group sessions only Treatment 2 (n=4): group & individual sessions	Outcome measures described above Number of group sessions attended was associated with significant improvements in social interaction; number of individual sessions attended was associated with modest improvements in motivation	Small sample Group allocation of TBI patients not stated Possible confounding effect of increased social interaction Evidence level 2-

Table 2 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Bright & Signorelli 1999[9]	Prospective case series based at a residential care facility in New South Wales, Australia	7 profoundly brain injured in-patients, all bed-bound; all but one lacked purposeful movement & verbal communication; aetiologies included violence, sub-dural haematoma, drug overdose, suicide attempt, train crash, cerebral aneurysm	12 weeks of passive music therapy, involving listening to live playing/singing at the bedside & recorded music played through headphones; therapists sought to match the style of music to what was known about patients' pre-injury musical preferences	Communication levels as indicated by frequency & duration of eye contact; in the 6 patients for whom this was assess-able, eye contact post-intervention was 2 to 18 (mean = 7) times more frequent than at baseline Quality of life variables (eg. enjoyment) as subjectively assessed by music therapists, other staff & relatives; slightly higher values for most variables recorded during music therapy sessions	No control group, so causal relationships difficult to prove Frequency & duration of treatment sessions not reported QoL outcomes subjectively assessed (partly by treatment providers) during therapy sessions only; no independent assessment/long term follow-up Evidence level 3

Table 2 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Hurt *et al*. 1998[3]	Prospective case series based at gait laboratory, university music therapy research centre, Colorado, USA	Experiment 1: 8 patients with persisting gait disorder 4-24 months post TBI; all aged 25-35 & able to walk independently	Experiment 1: single session of rhythmic auditory stimulation (RAS); subjects instructed to walk at normal then fast pace to the beat of rhythmic music	Experiment 1: immediate effects of RAS on gait parameters (velocity, cadence, stride length & symmetry) were measured using a computerised stride analysis system and compared to baseline values; on average, non-significant increases were obtained for all parameters post-RAS at normal pace, and for symmetry at fast pace	Small sample sizes; subjects varied widely with regard to time elapsed post-injury Not clear if benefits persist beyond 5 weeks Compliance may be an issue with home based regimes Evidence level 3
		Experiment 2: subgroup (n=5) of the 8 patients described above	Experiment 2: 5-week home-based gait therapy programme; subjects walked to RAS tapes at normal & fast pace for set period daily	Experiment 2 (effects on gait at 5 weeks): statistically significant increases were reported in velocity (50%), cadence (15%) & stride length (29%) at normal pace post-treatment; non-significant increases were observed in symmetry at normal & all 4 parameters at fast pace	

Table 2 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Magee & Davidson 2002[10]	Prospective case series based at a specialist neuro-disability rehab unit, London, UK	14 patients with severe, acquired neurological disability due to TBI (n=5), multiple sclerosis (n=5) or stroke/anoxia (n=4), all able to communicate & play light musical instruments; all had prior musical interests and/or ability pre-TBI	Subjects participated in one individual, active music therapy session per week for 2 weeks; one session used a pre-composed song and the other involved spontan-eous improvisation	Mood states on adapted Bipolar Profile of Mood States (POMS-BI) test[52] assessed immediately pre- & post-each session by independent assessors; statistically significant positive effects observed post-intervention on *composed-anxious*, *agreeable-hostile* & *energetic-tired* subscales; no significant results on *elated-depressed* subscale; no significant relationship between results & aetiology or format of therapy session	Small number of sessions & no long term follow-up Some subjects had difficulty completing the POMS-BI May not be generalisable to non-musical populations Evidence level 3

Evidence table 3: physical rehabilitation (general)

Table 3	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Staum 2000[11]	Systematic review of literature published 1950-1999 identified via a comprehensive search of Medline, Psychlit and other electronic & hard copy sources	48 experimental studies (including English language books, theses & published papers) focusing on physical rehabilitation of persons with neuro-muscular, motor or skeletal disorders	All aspects of music therapy & any intervention using music	Some beneficial effects on motor skills & gait in children with cerebral palsy and gait in adults with brain injury	Mostly older studies - only 9 published after 1995 No attempt made to assess quality or validity of studies, or to pool or synthesise findings Evidence level 1- (but not all studies are RCTs) Note: two included studies also met the inclusion criteria for our review & are analysed separately[3 12]

Table 3 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Zelazny 2001[13]	Prospective case series based at a residential care facility, Kansas, USA	4 female residents aged 84-88 & with osteoarthritis of the hands; 3 subjects had little keyboard playing experience	20 minutes of electronic key-board playing 4 days a week for 4 weeks	Hand function measured by finger pinch strength, finger dexterity & range of motion; arthritic discomfort & enjoyment of therapy self-assessed on Likert scale Statistically significant improvements in finger dexterity were experienced by 3 subjects & in arthritic discomfort by 2 subjects	Small sample, limited generalisability No long term follow-up Evidence level 3

Evidence table 4: pain management

Table 4	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Chesky *et al*. 1997[14]	Randomised controlled trial based at university rheumatology facility, Texas, USA	26 out-patients with fibromyalgia of mean duration >10 years; subjects all had moderate to high levels of current pain	Single 30 minute session of either: Music vibration delivered via music vibration table (MVT) that played music while delivering a musically fluctuating 60-300Hz vibration derived from that music (n=13) Control sinusoidal vibration at a constant 20 Hz delivered via the MVT (n=13)	Pain self-rated on visual analogue scale (VAS); tender point index (TPI) & tender point average pain threshold (TPA) assessed pre- & post session by blinded assessor Music vibration patients reported no significant changes in perception of pain but were able to tolerate greater pressure on tender points (TPA)	Single session of intervention/control & no long term follow-up Write-up is unclear on the statistical signifi-cance of some outcomes Evidence level 1-

Table 4 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Le Roux 1998[15]	Randomised controlled trial based at private medical practice, South Africa	30 subjects (mean age = 49) with spinal pain of intensity ≥ 8 on short form McGill Pain Questionnaire (MPQ)	Treatment (n=15): daily physio-therapy (mobilisation, ultrasound, massage & traction) accompanied by steady tempo classical music Control n=15: physiotherapy only	Pain assessed on MPQ pre- and post-treatment on days 1 & 4 On both days, post-treatment pain scores were significantly lower in the treatment group	Randomisation method not described; immediate effects, no long term follow-up; no blind or independent outcome assessment Evidence level 1-

Table 4 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
McCaffrey & Freemantle 2003[16]	Randomised controlled trial based in Florida, USA	66 community-dwelling elderly volunteers aged ≥65 with chronic osteoarthritis pain	Daily for 14 days: Treatment (n=33): listening to 20 minutes of pre-recorded relaxing classical music Control (n=33): sitting quietly for 20 minutes	Perceived level of pain self-rated pre- & post-test on days 1, 7 & 14 using the Pain Rating Index (PRI) & Visual Analog Scale (VAS) of the short form McGill Pain Questionnaire The treatment group recorded significantly greater decreases on PRI & VAS on days 1, 7 & 14; pain scores in the treatment group decreased steadily thought the 14 day study period	Self-selected sample of motivated volunteers No longer term follow-up No information given on compliance or drop outs Evidence level 1+

Table 4 cont.	Methods & setting	Subjects	Intervention	Outcomes & results	Comments & level of evidence
Kenny & Faunce 2004[17]	Quasi-randomised controlled trial based at an out-patient pain clinic, Sydney, Australia	77 chronic pain patients enrolled on a multi-disciplinary pain management programme	All subjects attended an intensive cognitive-behavioural & functional restoration programme daily for 3 weeks; therapy was identical apart from block rand-omisation (in groups of 10) to: Treatment: 9 x 30 minute group singing sessions* Control: 9 exercise sessions accompanied by music *Subjects in the treatment group who failed to attend ("FTA") their song sessions were analysed as a separate comparison group	Mood, coping & perceived pain assessed pre- & post-programme and at 6 months Post-programme: no significant differences between treatment & control groups; treatment group tended towards greater improvement in active coping compared to FTA group At 6 month follow-up: pain disability had increased in treatment group but decreased in control group; active coping had decreased in treatment group but increased in FTA group	**Not a true RCT:** subjects were block randomised according to date of entering programme **Selection bias:** allocation to FTA group was on the basis of non-attendance rather than randomisation; non-attenders tended to have pain of shorter duration **No intention-to-treat analysis:** subjects were NOT analysed in groups to which they were originally allocated Total no. of subjects in each group not reported; groups differed significantly at baseline with respect to duration of pain; attendance was poor in the treatment group as singing sessions were scheduled early in the morning Difficult to isolate effects of singing from the confounding effects of other interventions received during the intensive pain management programme Evidence level 2-

Evidence table 5: burns

Table 5	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Ferguson & Voll 2004[18]	Randomised controlled trial based at hospital rehabilitation service, Virginia, USA	11 in-patients with partial thickness or deeper burns crossing at least one major joint	Treatment: range of motion (ROM) rehabilitation exercises (type & number of repetitions based on patient need) accompanied by relaxing music Control: ROM exercises as above, but without music	Pain measured on VAS & anxiety on State-Trait Anxiety Inventory (STAI); vital signs (blood pressure, respiratory & heart rate) Post-intervention, anxiety was significantly lower in treatment group compared to control group; however, treatment group reported no significant changes in pain & anxiety compared to their baseline levels	Small & unrepresentative sample; generalisability limited Groups not clinically comparable at baseline ROM regime not standardised Evidence level 1-

Table 5 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Prensner *et al*. 2001[19]	Controlled pilot study based at hospital burns unit, Ohio, USA	63 in-patients; no further details given about subjects or selection criteria	Relaxation response elicitation (RRE): uses musical tempo to influence patients' body rhythms (e.g. to slow down heart rate) Adapted progressive muscle relaxation, APMR (systematic relaxation of muscle groups to music) and/or music based imagery, MBI (visualisation with music and song)	Intervention judged "successful" or "not successful" on the basis of observable muscular relaxation, relaxed affect, positive patient feedback and measurable changes in "vital rhythms" (e.g. heart rate) APMR/MBI judged 98% successful; RRE judged 60% successful	No mention of randomisation No mention of blinded or independent outcome assessment Brief report only: few details on number & duration of sessions, rehab and treatment co-interventions, etc. Evidence level 2-

Evidence table 6: cerebral palsy

Table 6	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Kvam 1997[12]	Randomised controlled trial based at neurological rehabilitation centre, Oslo, Norway	12 cerebral palsy patients aged 27-48 years (mean= 40.5); 3 female, 9 male; subjects were pair-matched for age, level of physical functioning, level of independence & communication skills; one of each pair was then randomly allocated to treatment, and the other to control	Treatment: a 25-30 minute session of music & vibroacoustic therapy twice weekly for 9 weeks; treatment involved sitting in a reclining 'music chair' that delivered music combined with low frequency acoustic vibrations (40-80Hz) Control: as above, but with music only (no vibroacoustic stimulation)	Nic Waals muscle test, pulse oximetry & drawing/writing tests found no significant differences between the two groups Subjects' self ratings of effectiveness were more favourable in the treatment group When 20 gross & fine movements comprising 6 different motor tasks were assessed via videotape by 4 blinded assessors pre & post study, the treatment group tended towards better performance; however, group differences were not significant; inter-rater reliability was 90%	Small sample Inclusion of a 'no treat ment' group would have been useful Outcomes were mostly subjective or based on personal judgements; however, assessors were blinded & inter-rater reliability was high Evidence level 1+

Evidence table 7: stress, anxiety and depression

Table 7	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Pelletier 2004[20]	Meta-analysis of studies identified via Medline, Psychinfo and previous literature reviews	22 quantitative studies dealing with 8 types of stress (self-assessed, occupational, surgical, med-ical procedure, traumatic diagnosis, labour, labour preparation and artificially induced)	Music & music-assisted relaxation techniques used to decrease arousal due to stress; interventions included passive listening, guided imagery through music, vibrotactile stimulation, progressive muscle relaxation with music, and other combinations of music, verbal suggestion, autogenic training and breathing exercises	Music alone and music-assisted relaxation techniques significantly decreased arousal due to stress (mean overall effect size $d = 0.67$); however, results were not homogenous: greater stress reduction was reported in studies (i) where subjects were aged < 18 or had previous musical experience; (ii) that used individual rather than group interventions; (iii) that dealt with stress related to preparation for labour; (iv) where choice of music was based on research rather than subject choice Verbal suggestion with music appeared to be the most effective technique followed by vibrotactile stimulation, music assisted progressive relaxation, combinations of > 2 stress reduction techniques plus music, then passive listening; guided imagery with music was least effective	Validity hard to judge as included primary studies are only briefly described (no details of blinding, randomisation, etc.), their methodological quality was not assessed & analysis was not therefore appropriately weighted; significant level of heterogeneity detected between studies One included study is analysed separately[22] Evidence level 1-

Table 7 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Bittman *et al*. 2003[23]	Randomised crossover trial based at elderly care facility, Philadelphia, USA	125 long term care workers & other employees selected at random from total workforce of 375 (24 male, 101 female; aged 19-78, mean = 44 years); subjects were stratified according to job type then randomised to inter-disciplinary A & B groups	Intervention: recreational music making programme (1 hour per week for 6 weeks) Control: no treatment Crossover at 6 weeks; group A received the intervention first	Three burnout variables (emotional exhaustion, depersonalisation & lack of personal accomplishment) assessed on MBI; seven mood variables rated on Profile of Mood States (POMS[52]); all outcomes assessed at baseline and at end of weeks 6 & 12 Immediately post-therapy, both groups reported statistically significant improvements for all variables except depersonalisation (burnout) & confusion/bewilderment (mood); at 12 week follow-up, improvements for all variables except personal accomplishment (burnout) & confusion/ bewilderment (mood) were reported in a subset of group A (n=43)	Some workers were excluded from selection pool due to shifts and scheduling problems 13 subjects dropped out and were not followed up Managers and supervisors were not inc-uded in group A's 12 week follow-up Compliance among completers (n=112) was reasonable: mean attendance was 5.35 sessions out of 6 Evidence level 1+

Table 7 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Cheek *et al*. 2003[24]	Randomised controlled trial; community based; suburban area of south western USA	51 teachers from 2 elementary schools (3 male, 48 female; mean age 35-39); subjects had reported symptoms of occupational stress & 'teacher burnout'	Treatment (n=28): cognitive behavioural group therapy integrated with music therapy techniques Control (n=23): cognitive behavioural group therapy alone Groups met at their respective schools for 1 hr 15 minutes weekly for 6 weeks	Maslach Burnout Inventory (MBI) used to assess subject perceptions of three occupational burnout variables: 1. emotional exhaustion; 2. depersonalisation; and 3. lack of personal accomplishment Authors claim treatment group did significantly better on MBI variables 1 & 2, with control group slightly better on 3; however, figures given in tables suggest the authors have confused the groups on variable 1 and indicate that the control group did slightly better overall	Potential biases due to lack of blinding & allocation concealment (i.e. both therapist/researcher and subjects would have been aware of group allocation) Generalisability limited by setting Poor reporting makes efficacy of music intervention difficult to judge Evidence level 1-

Table 7 cont.	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Hammer 1996[22]	Randomised controlled trial based at alcohol & chemical dependency rehabilitation unit, Minnesota, USA	16 staff members and residents who perceived themselves as stressed or anxious	Treatment (n=9): guided imagery through music; one 30 minute session weekly for 10 weeks Control (n=7): no treatment	State-Trait Anxiety Inventory (STAI) administered one week after final treatment session; treatment group demonstrated statistically significant reduction in state (but not trait) anxiety compared to control group Treatment group's subjective evaluations suggested they found the therapy calming	Groups not tested simultaneously; no credible control for placebo effects Small sample; number & allocation of staff/residents not described; generalisability limited due to co-morbidities Evidence level 1-

Table 7 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Kerr *et al*. 2001[25]	Randomised controlled trial based at University of Victoria, British Columbia, Canada	40 anxious staff & students with State-Trait Anxiety Inventory (STAI) scores ≥ 40; 28 females, 12 males; mean age = 27.25	Control: typical cognitive-behavioural reframing intervention involving visualisation of anxiety-provoking situations Treatment: music-assisted reframing intervention	STAI, State-Trait Depression Adjective Checklist, Subjective Units of Distress Scale & Think Aloud method used to assess differences in anxiety, mood and cognitive & physiological variables Post-test outcomes for all variables were significantly better in the treatment group	Groups comparable at baseline, but numbers in each group not given Single intervention session only; no longer term follow-up Evidence level 1-

Table 7 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Lai 1999[26]	Randomised controlled trial based in a Taiwanese psychiatric unit	30 female in- and out-patients with major depression; subjects aged 28–65, mean age = 47	Treatment (n=15): listening to music for 30 minutes; subjects selected their piece of music from a choice of 4 styles Control (n=15): listening to "pink sound" (a spectrum of frequencies similar to white noise) for 30 minutes	Heart rate, respiratory rate, blood pressure & immediate mood states The treatment group experienced significantly greater decreases in respiratory rate & systolic blood pressure than the control group	Single intervention session only, with no longer term follow-up; the clinical significance of immediate physiological effects is not clear Generalisability is limited by cultural factors & some subjects' co-morbidities Evidence level 1-

Table 7 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Wu 2002[27]	Randomised controlled trial based at a Taiwanese university	24 undergraduates with major or minor depression, anxiety and low self-esteem; subjects aged 19 - 21; 12 male, 12 female	Treatment: 10 week music therapy course (one 2 hour group session per week with wide-ranging active & passive components) Control: no treatment	Self-rated anxiety, depression & self-esteem, and subjective impressions of treatment efficacy; outcomes assessed post-treatment & at 2 month follow-up Treatment group reported significant reductions in anxiety post-treatment, and in anxiety & depression at follow-up	No credible control for placebo effects Generalisability limited by cultural factors Evidence level 1+

Evidence table 8: abuse, violence and post-traumatic stress disorder

Table 8	Methods & setting	Partici-pants	Inter-vention	Outcomes & results	Comments & level of evidence
Whipple & Lindsey 1999[28]	Prospective case series based at US temporary shelter for battered women	15 female victims of domestic violence residing at the shelter	8 week music therapy group programme involving one hour long session per week	Level of relaxation and feelings about self & situation self-rated on 5-point scale after each session by all who attended; outcome data was obtained from a total of 26 attendances Mean scores "determined that music therapy …was beneficial for the surveyed battered women"	Marred by small sample, poor attendance and lack of baseline & follow-up assessment; group composition varied weekly: no subject attended more than 5 sessions and most (n=11) attended only 1 or 2 sessions Evidence level 3

Appendix 3: evidence tables. Part 2 - studies involving children only

Evidence table 9: meta-analyses and other studies covering a range of conditions

Table 9	Methods	Included studies	Intervention	Outcomes & results	Comments & level of evidence
Gold *et al*. 2004[29]	Meta-analysis of published and unpublished studies identified via systematic searches of Medline, Psycinfo, other relevant databases, indexes, conference proceedings & journals; no date or language limits	Eleven studies involving 188 child and adolescent subjects with a range of psychopathologies; the included studies all had pre-/post-test designs with or with-out control groups; they were conducted between 1970 and 1998; eight were carried out in the US and three in Europe	Individual or group music therapy; studies on the effects of music alone or music education were excluded	Music therapy appeared to have statistically significant positive effects on clinically relevant outcomes Effects tended to be greater for: behavioural, developmental & mixed, rather than emotional, disorders; for behavioural & developmental outcomes, rather than social skills & self-concept; and where music therapy took an eclectic approach, rather than being based upon purely behavioural models	Comprehensive literature search & clear inclusion criteria Source studies were small (mean n=17), but the meta-analysis was weighted for sample size; however, quality & validity of source studies were not assessed Evidence level 1+ Note: two included studies also met the inclusion criteria for our review and are analysed separately[30 31 (same study), 32]

Table 9 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Gold *et al*. 2001[33]	Pilot study based in educational and thera-peutic settings, Vienna, Austria	7 children with a range of mental & behavioural disorders; 2 girls, 5 boys; age range 4 - 11 (mean = 8.5) years	Treatment (n=5): individually-tailored, out-patient music therapy sessions; the therapist, method, setting and duration varied from subject to subject Subjects received a total of 4 - 31 sessions each over 2 - 5 months Control (n=2): no treatment	Symptoms & competencies were rated by parents on the Child Behaviour Checklist; quality of life (QoL) was rated by parents & children on a German health-related quality of life scale known as KINDL Outcomes were also co-rated by the principal therapist There was no post-test assessment of the control group; when compared against their own baseline measures, the treatment group's post-test results demonstrated "medium to large" positive effects on mean symptom & competency scores and a small improvement in mean QoL; however, effects on symptoms varied widely from subject to subject	Small pilot study involving subjects with a broad range of disorders & symptoms; the treatment regime was not standardised and varied widely from subject to subject This is a case series rather than a true controlled study as there was no post-test comparison between treatment and control groups Evidence level 3

Evidence table 10: cerebral palsy

Table 10	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Ghetti 2002[34]	Prospective case series (pilot) based at special school, USA	6 children and adolescents aged 7-17 years with profound disabilities & severely limited functioning; developmental ages ≤ 36 months; medical diagnoses included cerebral palsy (n=4), TBI (n=1) and anoxia during perinatal surgery (n=1)	Individual music therapy sessions involving 10 mins each of 3 progressively more active conditions: (i) rhythmic stimulation (therapist played a steady rapid drum rhythm); (ii) singing (therapist sang and played, prompting subject to respond at set points); and (iii) multi-sensory instrument playing (subject tapped drum or strummed guitar) 2 sessions per week for 6 weeks; baseline measures taken prior to each condition	Subjects' behaviour during sessions was videotaped & coded according to the Guess Behaviour State Code by two raters; time spent in alert states A^1 and A^2 during each music therapy condition was compared No significant differences were found between the 3 music therapy conditions & their baseline measures, or between the 3 baseline periods; inter-rater reliability was 91%	The authors suggest that the small sample, short duration of treatment sessions & limitations of the outcome measure may have contributed to the lack of significant results Evidence level 3

Evidence table 11: stress, anxiety and depression

Table 11	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Field *et al*. 1998[35]	Randomised controlled trial based at an adolescent clinic, Florida, USA	28 chronically depressed African American & Hispanic girls aged 14 - 19 (mean age 16.8); all subjects scored > 16 on the Beck Depression Inventory & met diagnostic criteria for recurrent dysthymia (chronic depression)	Treatment (n=14): single 23 minute session of listening to popular, "uplifting" music Control (n=14): 23 minute session of mental & muscle relaxation	Salivary cortisol (stress hormone); EEG* activation ratio; self-rated depression; affect & anxiety assessed by 2 independent raters Significant changes in EEG & cortisol were reported post-music, suggesting reduced depression & stress respectively; however, there were no corresponding changes in self- or observer-rated mood or anxiety	Single session, no follow-up; short-term physiological effects may have few clinical benefits in real life Generalisability limited by cultural factors Evidence level 1-

Table 11 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Jones & Field 1999[36]	Randomised controlled trial based at an adolescent clinic, Florida, USA	30 chronically depressed African American & Hispanic adolescents (mean age 18.8); all subjects met diagnostic criteria for major dysthymia (chronic depression)	Music (n=16): single 15 minute session of listening to popular, "uplifting" music Massage (n=14): 15 minute session of Swedish massage to back, neck, hands & arms	EEG activation ratio Compared to baseline, EEG asymmetry was significantly decreased during & immediately post-treatment in both groups; post-treatment effects appeared to be greater in the massage group	Similar shortcomings to Field *et al*.[35] above No formal statistical comparison between groups Evidence level 1-

* Electroencephalogram – a technique for recording electrical activity in the brain.

Evidence table 12: abuse, violence and post-traumatic stress disorder

Table 12	Methods	Included studies	Interventions	Outcomes & results	Comments & level of evidence
Finkelhor & Berliner 1995[37]	Systematic review of unpublished & published studies identified via previous reviews, search of relevant journals & contact with researchers in the field	29 studies that (i) used quantitative measures to evaluate sexually abused children aged < 18 at 2 points in time, and (ii) involved at least 5 children; only 1 included study dealt with music therapy	Music therapy, sex education, family therapy, group therapy & cognitive-behavioural therapy	The studies used various parent, therapist, teacher & self-report measures of distress, anxiety, depression, self-esteem, behaviour, acting out etc. Improvements with therapy were widely reported, but only 5 of the 29 studies were of sufficient quality to provide evidence that recovery was not simply due to passage of time or some other factor not related to therapy; the paper involving music therapy was NOT one of these 5 studies	Little information on search strategy & on how quality, validity etc. of studies were assessed The UK Centre for Reviews & Dissemination (CRD) advise that the conclusions of this review be treated with caution[38] Evidence level 1-

Evidence table 13: developmental disorders and intellectual handicap

Table 13	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Aldridge *et al*. 1995[30 31] (same study published in 2 different journals)	Randomised crossover trial based at outpatient clinic, Germany	8 children with developmental delay; subjects were aged 4-6.5 years but had developmental ages 1.5- 3.5	Treatment (A, n=5): 3 months of active improvisation-based music therapy; subjects received one 30 min session per week tailored to individual needs & delivered by 2 music therapists working together Crossover with wait list control (B, n=3) at 3, 6 & 9 months	Developmental, psychological & functional variables assessed on Griffiths scale at 3,6,9 & 12 months by "initially blind" independent assessor Music therapy was associated with significant improvements in hearing and speech, and with non-significant improvements in social interaction and hand-eye coordination	Small sample; 4 of the originally recruited 12 lost to follow-up Groups not comparable at baseline; group A significantly more impaired than B Report lacks clarity Evidence level 1-

Table 13 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Duffy & Fuller 2000[39]	Randomised controlled multi-centre trial based at 4 intellectual disability day centres, Ireland	32 children aged 5-10 years with moderate intellectual disabilities; 8 children were selected & randomised from each of the 4 participating day centres	Treatment (n=16): music therapy group programme (activities + recorded music) designed to enhance key social skills Control (n=16): non-music group programme targeting same social skills Programmes consisted of two 30 min sessions per week for 8 weeks; at each participating centre, a staff member was trained to provide each programme; groups were similar in age & ability	Five target social skills (turn-taking, imitation, vocalisation, initiation & eye contact) rated on 5-point Likert scale by 2 independent raters In both groups, significant pre-post improvements were observed in all 5 target skills; however, neither intervention was significantly more effective than the other; staff ratings of skill improvements were slightly higher for the non-music group	No non-treatment group; authors suggest Hawthorne effect and/or spontaneous improvement cannot be ruled out Music therapy was not provided by trained music therapists Evidence level 1+

Table 13 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Ma *et al*. 2001[40]	Prospective case series based at infant development programme, New York, USA	6 children aged 31-40 months (mean 35.3 months) with pervasive developmental disorder (mean developmental age 18 months); all subjects had significant communication & speech delays	6 x 30 minute music therapy playgroup sessions over a 3 week period; sessions involved playing instruments, singing and interacting with each other and the therapist; all subjects participated in at least 4 of the 6 sessions	4 communication abilities (motoric/ gestural language, interaction, expressive language & receptive language) assessed on Rosetti speech & language scale by panel of researchers Improvements were observed in all 4 communication skills; interactive activities tailored to the abilities of the child & involving both verbal prompting and tactile stimulation (e.g. vibration) elicited the strongest responses	Brief report of small preliminary study; quantitative analysis was limited No longer term follow-up Evidence level 3

Evidence table 14: emotional and behavioural disorders

Table 14	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Montello & Coons 1998[32]	Controlled crossover trial based at public middle school, New York, USA	16 children enrolled on special education programme for learning, emotional & behavioural disorders; 14 males, 2 females, aged 11-14 (mean = 12) years; 6 white, 7 African American, 3 Hispanic	**Group A (n=6):** active rhythm-based music therapy involving story-telling, playing instruments & improvisation **Group C (n=6):** as above **Group B (n=4):** passive listening-based music therapy Groups received one 45 min session per week for 12 weeks; groups A & B were then crossed over to the alternative therapy for a further 12 weeks; group C continued to receive active therapy for a total of 24 weeks	Attention, motivation & hostility rated by teachers on Achenbach's Teacher Report Form Passive therapy significantly reduced motivation problems & hostility in some subjects; active therapy significantly reduced hostility in some subjects, but significantly increased it in others	Therapy was integrated into the normal school curriculum, so randomisation was not possible; conflicting results may have been partly due to baseline group differences No non-music group to control for placebo effects; group C was not followed up at 24 weeks Evidence level 2-

Table 14 cont	Methods & setting	Participants	Intervention	Outcomes & results	Comments & level of evidence
Rickson & Watkins 2003[41]	Randomised controlled crossover trial based at a residential special school, Christchurch, New Zealand	18 adolescent boys aged 11-15 (mean = 13) attending the school; all had social, emotional & learning deficits and displayed significant aggressive behaviour; 9 Maori, 9 NZ European	Groups 1 & 2 (n=12): music therapy programme comprising 2 x 30-45 minute sessions per week; sessions involved listening, song-writing & playing instruments; 16 sessions in total during term 3 Group 3 (n=6): wait list control; crossover to treatment as above in term 4	Behaviour assessed by residential social workers & teachers on Developmental Behaviour Checklist No statistically significant treatment effects were detected; social workers reported that music therapy may have helped the boys interact more appropriately in the residential setting, but teachers observed an increase in disruptive classroom behaviour	Small sample; 3 subjects dropped out in early stages and were not followed up Age & diagnosis differed significantly between groups Evidence level 1-