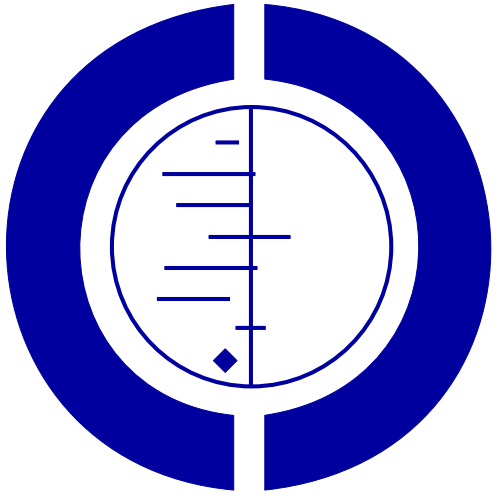
Music for pain relief (Review)

Cepeda MS, Carr DB, Lau J, Alvarez H



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Status: *New*

This record should be cited as:
Cepeda MS, Carr DB, Lau J, Alvarez H. Music for pain relief. *The Cochrane Database of Systematic Reviews* 2006, Issue 2. Art. No.: CD004843.pub2. DOI: 10.1002/14651858.CD004843.pub2.

This version first published online: 19 April 2006 in Issue 2, 2006.
Date of most recent substantive amendment: 10 February 2006

ABSTRACT

Background
The efficacy of music for the treatment of pain has not been established.

Objectives
To evaluate the effect of music on acute, chronic or cancer pain intensity, pain relief, and analgesic requirements.

Search strategy
We searched The Cochrane Library, MEDLINE, EMBASE, PsycINFO, LILACS and the references in retrieved manuscripts. There was no language restriction.

Selection criteria
We included randomized controlled trials that evaluated the effect of music on any type of pain in children or adults. We excluded trials that reported results of concurrent non-pharmacological therapies.

Data collection and analysis
Data was extracted by two independent review authors. We calculated the mean difference in pain intensity levels, percentage of patients with at least 50% pain relief, and opioid requirements. We converted opioid consumption to morphine equivalents. To explore heterogeneity, studies that evaluated adults, children, acute, chronic, malignant, labor, procedural, or experimental pain were evaluated separately, as well as those studies in which patients chose the type of music.

Main results
Fifty-one studies involving 1867 subjects exposed to music and 1796 controls met inclusion criteria.

In the 31 studies evaluating mean pain intensity there was a considerable variation in the effect of music, indicating statistical heterogeneity (I^2 = 85.3%). After grouping the studies according to the pain model, this heterogeneity remained, with the exception of the studies that evaluated acute postoperative pain. In this last group, patients exposed to music had pain intensity that was 0.5 units lower on a zero to ten scale than unexposed subjects (95% CI: -0.9 to -0.2). Studies that permitted patients to select the music did not reveal a benefit from music; the decline in pain intensity was 0.2 units, 95% CI (-0.7 to 0.2).

Four studies reported the proportion of subjects with at least 50% pain relief; subjects exposed to music had a 70% higher likelihood of having pain relief than unexposed subjects (95% CI: 1.21 to 2.37). NNT = 5 (95% CI: 4 to 13).

Three studies evaluated opioid requirements two hours after surgery: subjects exposed to music required 1.0 mg (18.4%) less morphine (95% CI: -2.0 to -0.2) than unexposed subjects. Five studies assessed requirements 24 hours after surgery: the music group required 5.7 mg (15.4%) less morphine than the unexposed group (95% CI: -8.8 to -2.6). Five studies evaluated requirements during painful procedures: the difference in requirements showed a trend towards favoring the music group (-0.7 mg, 95% CI: -1.8 to 0.4).

Authors' conclusions
Listening to music reduces pain intensity levels and opioid requirements, but the magnitude of these benefits is small and, therefore, its clinical importance unclear.

PLAIN LANGUAGE SUMMARY

Music should not be considered a first line treatment for pain relief as the magnitude of its benefits is small.

Listening to music for treatment of pain offers potential advantages of low cost, ease of provision, and safety. This systematic review included 51 studies involving 3663 subjects. The reviewers found that music reduced pain, increased the number of patients who reported at least 50% pain relief, and reduced requirements for morphine-like analgesics. However as the magnitude of these positive effects is small, the clinical relevance of music for pain relief in clinical practice is unclear

BACKGROUND

Pain affects the lives of large numbers of patients and their families. Surveillance data on the incidence of cancer-related pain indicate that a majority of patients experience pain at some point during their course of treatment (Goudas 2001). Individuals with acute pain due to diagnostic or therapeutic medical procedures also often suffer from pain despite pharmacologic intervention (Carr 1992; Strassels 2002). Pain undermines mood, sleep patterns, physical and social functioning, and hence impairs quality of life (Reyes-Gibby 2002; Strassels 2000). Fortunately, bringing pain under control enhances function and quality of life (Goudas 2001; Reyes-Gibby 2002; Rogers 2000a; Rogers 2000b; Strassels 2000).

Non-pharmacological interventions are widely used for pain control. However, some of these techniques lack efficacy and for others the analgesic effect is at best moderate (Goudas 2001). Listening to music to decrease pain intensity or analgesic requirements, or both has been employed (Carr 1992; Jacox 1994) particularly as a distraction measure during brief interventions as a supplement or as an alternative for pharmacotherapy. Listening to music, as is true for many nondrug therapies such as hypnosis or distraction, offers potential advantages of low cost, ease of provision, and safety. However, the efficacy of music to reduce pain intensity or analgesic requirements has not been established (Cepeda 1998; Good 1996; Koch 1998).

OBJECTIVES

To evaluate the effect of listening to music on acute, chronic or cancer pain intensity, pain relief, and analgesic requirements.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

We considered only randomized controlled trials (RCTs) for inclusion, as blinding a patient to the treatment (music) is not always possible, we also included unblinded or single blinded trials.

Types of participants

We included studies that evaluated the effect of music on acute, chronic, neuropathic, cancer pain or experimental pain, in children or adults.

Types of intervention

Included studies had to evaluate and report the effect of music (as defined by the investigator) on pain intensity levels or on analgesic requirements. Included studies had to compare music with no music or with another pharmacologic or nonpharmacologic (e.g., hypnosis or acupuncture) treatment.

We excluded trials that reported the results of combined nonpharmacological therapies such as music with hypnosis, and music with relaxation for example, because the effect of music alone could not be isolated.

Types of outcome measures

The outcomes of interest were:

1. patient reported pain intensity, or
2. patient reported pain relief, or
3. global improvement as rated by the patient, or
4. analgesic requirement, or
5. medication-related side effects

SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: Pain, Palliative and Supportive Care Group methods used in reviews.

We searched the following electronic databases:
1. The Cochrane Pain, Palliative & Supportive Care Register
2. The Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library retrieved September 14 2004
3. MEDLINE 1966 to October 4 2004
4. EMBASE 1980 to September 15 2004
5. PsycINFO 1985 to September 24 2004
6. LILACS 1982 to September 8 2004

Search terms
For the identification of the studies, we used the following as free text and MeSH / EMTREE terms: music, music therapy, analges*, and pain. In addition, we employed a highly sensitive search strategy for the retrieval of reports of controlled trials (Robinson 2002).

Search history in MEDLINE
#1 music
#2 analges*
#3 pain
#4 (randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh] OR ("clinical trial" [tw]) OR ((singl* [tw] OR doubl* [tw] OR trebl* [tw] OR tripl* [tw]) AND (mask* [tw] OR blind* [tw])) OR placebos [mh] OR placebo* [tw] OR random* [tw] OR research design [mh:noexp] OR comparative study [mh] OR evaluation studies [mh] OR follow-up studies [mh] OR prospective studies [mh] OR control* [tw] OR prospectiv* [tw] OR volunteer* [tw]) (randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh] OR ("clinical trial" [tw]) OR ((singl* [tw] OR doubl* [tw] OR trebl* [tw] OR tripl* [tw]) AND (mask* [tw] OR blind* [tw])) OR placebos [mh] OR placebo* [tw] OR random* [tw] OR research design [mh:noexp] OR comparative study [mh] OR evaluation studies [mh] OR follow-up studies [mh] OR prospective studies [mh] OR control* [tw] OR prospectiv* [tw] OR volunteer* [tw]) NOT (animal [mh] NOT human [mh])
#5 Music therapy
#6 #1 OR #5
#7 #2 OR #3
#8 #4 AND #6 AND #7

For each of the other databases, search strategies were based on the search strategy developed for MEDLINE, but revised appropriately. Bibliographies from all retrieved articles were searched for additional studies. In order to minimize the impact of publication bias, we also screened all conference abstracts from the 2002 World Congress on Pain, of the International Association for the Study of Pain.

No language restriction was applied. Non-English language papers were translated and assessed. We communicated with the authors to secure information not presented in the manuscripts. We considered there was no need to perform any additional hand searching of journals to supplement that routinely undertaken by the Cochrane Pain, Palliative and Supportive Care Group.

METHODS OF THE REVIEW

Study selection
All trials in which the abstract made reference to music and pain or analgesic requirements were retrieved in full. If there was no abstract, the paper was retrieved in full. For a trial to be included, it must have evaluated any of the following outcomes pain intensity, relief, global improvement or opioid requirements.

Data extraction
Data was extracted by two independent review authors. Disagreements were solved by consensus.

From each trial, we extracted:

- study design
- method of randomization
- concealment of randomization
- masking (if present) of study evaluators/outcome assessors
- similarity of baseline characteristics of study groups
- number of subjects in each arm
- whether the losses to follow-up exceeded 20% of the enrolled subject in any treatment arm
- nature of the control group
- demographic characteristics
- type of pain model
- concomitant treatments
- whether the analysis was based on intention to treat or treatment received
- type of music employed
- whether subjects were permitted to select the specific music or type of music, or both
- duration of the music exposure
- how subjects were exposed (e.g., headphones or loudspeakers)

- whether subjects listened a variety of music selections or the same piece repeatedly
- volume of the music
- opioid requirements
- side effects.

We also extracted the method(s) of pain assessment. If the authors described pain intensity using visual analogue scales or numeric rating scales, we obtained the mean and standard deviation of pain intensity in each study arm, then calculated the difference in pain intensity between groups and the corresponding standard error. In addition, we extracted the proportion of subjects who achieved at least 50% of pain relief or a similar outcome (i.e., at least moderate categorical pain relief), along with information on opioid requirements, if reported.

In cases where the studies reported the difference in pain intensity with no measure of dispersion, we estimated the standard error of the difference from the P value and the number of subjects in each arm, as described in the Cochrane manual.

For opioid requirement comparisons, we converted the opioid consumption into morphine equivalents. We considered 1.0 mg of parenteral morphine equivalent to 10 mg of parenteral meperidine and to 0.01 mg of parenteral fentanyl. These potency ratios have been validated in clinical studies (Janssen 1984; Stanley 1996; Woodhouse 1996; Woodhouse 1999).

As included studies evaluated opioid requirements during painful procedures, in the postanesthesia care unit (PACU), or in the 24 hours after surgery, we evaluated opioid requirements separately for these groups.

The unit of analysis was a study. If a study had multiple treatment arms, we abstracted the information on the arms relevant to the present systematic review.

Three trials were crossover randomized controlled trials (Beck 1991; Bo 2000; El Rakshy 1997). Beck 1991 reported the numbers of patients who achieved 50% or greater pain relief, this study is included in the studies that evaluated this outcome. Bo 2000 did not report the difference in pain intensity between the groups and, therefore, this study was not included in the meta-analysis. El Rakshy 1997 reported the mean difference of pain intensity, and that information was included with that of the other parallel RCTs.

Methodological quality

All papers that met inclusion criteria had a quality appraisal. For this purpose, we considered whether the trial was random, double blind, if there was a description of the randomization and the masking process, if withdrawals were 20% or more, if the baseline characteristics of the groups compared were similar, and if the outcomes were analyzed according to the intention-to-treat principle. These factors are considered cornerstones for validity (Guzman 2002).

We evaluated each of these variables separately and also calculated a quality score. We gave an arbitrary subscore of one if method of randomization was described, one if there was concealment of allocation, one if evaluators were blinded, one if patients were blinded, one if the baseline characteristics of the groups were similar, one if outcomes were analyzed according to the intention-to-treat principle and one if there were fewer than 20% of subjects in any single arm lost to follow up. We assumed that the lack of description of the specific quality parameter evaluated meant that it was not present. The maximum score would be seven for a study that described the method of randomization, the randomization was concealed, both investigators and patients were blinded, the groups were similar at baseline, the outcomes were analyzed according to the intention-to-treat principle, and there were less than 20% of losses to follow up.

Measures of treatment effect

For pain outcomes, we calculated the mean difference in pain intensity scores between the groups, the relative risk of having at least 50% pain relief, and the corresponding number needed-to-treat (NNT).

For analgesic requirements, we calculated the mean difference in opioid requirements between the two treatment groups.

Assessment of heterogeneity

We combined the results of trials that had clinical homogeneity. For example, studies that evaluated adults were assessed separately from the studies that assessed children. Studies that evaluated acute postoperative pain, chronic non cancer pain, cancer pain, labor pain, procedural pain, and experimental pain were evaluated separately. As the heterogeneity persisted, we evaluated separately those studies in which patients had selected the music.

To evaluate whether the music effect size was similar in the included studies, we used the Q statistic (Higgins 2003). P values smaller than 0.1 were considered indicative that the studies were not homogeneous.

We used metaregression to assess the extent to which sample size, type of pain evaluated, patient selection of music, type of participants, and study quality explained the heterogeneity observed in treatment effect. As the validity of any quality score to explore heterogeneity is increasingly controversial (Balk 2002), we explored the effect of study quality in two ways. First, we included in one regression model the quality score. Second, in another regression model we included each one of quality variables evaluated. These analyses were performed with the Stata software and the "metareg" command.

Because of the unexplained heterogeneity, we used the random effects model to summarize the data, except when estimating the likelihood of having at least 50% of pain relief, when we used a fixed effects model because of homogeneity.

Assessment of reporting biases - Sensitivity analysis
We investigated the influence of a single study on the overall meta-analysis estimate using the "metainf" command in Stata.

Assessment of agreement between review authors
We calculated the agreement and the concordance correlation coefficient between review authors.

DESCRIPTION OF STUDIES

Sixty-two studies were excluded (Table 1). Of these studies, seventeen evaluated combined therapy (e.g., music and suggestions); sixteen were not randomized; ten did not evaluate pain or opioid requirements; nine were systematic or narrative reviews; five did not evaluate music, three were secondary analysis of studies included in the present review; and in two the active and the control groups assessed music.

We translated studies from French, Spanish, German and Polish. We were unable to acquire two studies: Tufts Library exhausted all the sources (Dobro 1999; Hua 1997).

Fifty-one studies fulfilled inclusion criteria with 1867 subjects exposed to music and 1796 as controls. Eight of these studies evaluated children, including neonates (Arts 1994; Bo 2000; Fowler-Kerry 1987; Gawronska 2002; Joyce 2001; Marchette 1989; Marchette 1991; Megel 1998) for a total of 334 children exposed to music and 296 serving as controls. The median sample size of trials that studied adults were 53, with a range from 11 to 233, the median number of subjects for the trials that evaluated children was 76 with a range from 23 to 130.

Of the 51 studies, 28 studies evaluated pain during a diagnostic or therapeutic procedure such as colonoscopy or lithotripsy, with a total of 1118 subjects exposed to music and 1111 controls (Arts 1994; Bally 2003; Bo 2000; Broscious 1999; Cadigan 2001; Cepeda 1998; Chan 2003; Chlan 2000; Ferguson 2004; Fowler-Kerry 1987; Gawronska 2002; Hasenbring 1999; Haythronthwaite 2001; Jacobson 1999; Joyce 2001; Kliempt 1999; Koch 1998; Kotwal 1998; Kwekkeboom 2003; Lee 2002; Mandle 1990; Marchette 1989; Marchette 1991; Megel 1998; Menegazzi 1991; Schiemann 2002; Uedo 2004; Yilmaz 2003). Fourteen studies, with 510 subjects exposed to music and 493 controls, evaluated postoperative pain (Mullooly 1988; Korunka 1992; Heitz 1992; Blankfield 1995; Good 1995; Good 1998; Good 1999; Laurion 2003; Nilsson 2001Nilsson 2003a; Nilsson 2003b; Migneault 2004; Taylor 1998; Zimmerman 1996). Three studies, with 50 subjects exposed to music and 60 controls, evaluated chronic non-cancer pain (El Rakshy 1997; Le 1998; McCaffrey 2003). Two studies, with 29 subjects exposed to music and 28 controls, evaluated cancer pain (Beck 1991; Reinhardt 1999). Two studies, with 30 subjects exposed to music and 30 controls, evaluated experimental pain (Geden 1989; Heckmat 1993), and two studies, with 67 subjects exposed to music and 74 controls, evaluated labor pain (Durham 1986; Phumdoung 2003).

Nine studies out of the 51 included studies provided insufficient data on pain or opioid requirements to permit inclusion in the meta-analyses (even though they evaluated pain or opioid requirements) (Durham 1986; Gawronska 2002; Geden 1989; Hasenbring 1999; Le 1998; Marchette 1989; Marchette 1989; Megel 1998; Reinhardt 1999). These studies included 179 subjects exposed to music and 179 controls.

Two pediatric studies (Fowler-Kerry 1987; Joyce 2001) evaluated pain intensity using a scale from 0 to three and were not included in the meta-analysis because the remainder of this group of studies evaluated pain using a 0 to ten scale. The study by Fowler-Kerry 1987 evaluated children of five years of age undergoing immunization and the study by Joyce 2001 evaluated neonates.

METHODOLOGICAL QUALITY

The median quality score was three, the highest quality score was six (obtained by only one study), and three studies scored "0" (see Table 3).

RESULTS

The agreement between the evaluators was very high. The agreement for variables that were nominal (see Table Agreement) ranged from 94 to 100%, and for continuous variables it was 100% (concordance correlation coefficient of one).

Pain intensity
Thirty one studies reported mean pain responses. There was considerable variation in the effect of music on pain intensity, indicating statistical heterogeneity, (Chi^2, $P < 0.0001$, $I^2 = 85.3\%$) (Comparison 01). The pooled estimate showed that subjects exposed to music had on average 0.4 units (on a 0 to ten scale) less pain than unexposed subjects, 95% CI: -0.7 to -0.2.

After grouping the studies by type of pain model (acute postoperative, chronic, labor, procedural or experimental pain), the heterogeneity remained, with the exception of the studies that evaluated acute postoperative pain ($P = 0.11$). In this group of studies, patients exposed to music had 0.5 units lower pain intensity than unexposed subjects (95% CI: -0.9 to -0.2) (Comparison 02).

To explore the treatment effect heterogeneity, we separately analyzed studies in which patients selected the type of music. The heterogeneity remained; studies that did not permit patients to select the type of music reported a greater decrease in pain intensity levels (0.5 versus 0.2 units) (Comparison 03).

The metaregressions also failed to elucidate the heterogeneity, none of the variables included explained the heterogeneity observed in the treatment effect.

Consequently, we evaluated the influence of each of the studies on the pooled estimate. A single study (Kwekkeboom 2003), had a great influence on the music treatment effect size, especially if a fixed effects model was used. Inclusion of this single study changed the treatment effect of music from beneficial (0.4 units less pain if exposed to music) to deleterious in terms of pain control (0.3 units more pain than unexposed subjects).

Children

Eight studies evaluated children or neonates (Arts 1994; Bo 2000; Fowler-Kerry 1987; Gawronska 2002; Joyce 2001; Marchette 1989; Marchette 1991). Four studies reported quantitative data, but it was not possible to obtain a pooled estimate because of the diverse methods used to assess pain intensity. The study by Arts 1994 showed a difference of 0.1 units on a 0 to ten scale in favor of the unexposed group (this study was included in the overall estimate). Fowler-Kerry 1987 using a four-point pain scale from 0 to three, found a difference of 0.44 units in favor of the music group, similarly, the study by Joyce 2001 reported a difference of 0.75 units using the same scale. The study by Gawronska 2002, evaluated the proportion of subjects with at least 50% of pain relief, and this study was included in the studies that reported pain relief.

A description of the studies that did not report quantitative data follows: the study by Bo 2000 evaluated neonates and reported that those exposed to music exhibited less pain behavior. In contrast, the two studies by Marchette that also evaluated neonates (Marchette 1989; Marchette 1991), reported no effect of music upon pain behavior. Megel 1998 evaluated children between three and six years of age and found no difference in pain intensity between the music and control groups.

Pain relief

Four studies reported the proportion of subjects who achieved at least 50% pain relief (Beck 1991; Gawronska 2002; Kotwal 1998; Uedo 2004). There was no heterogeneity (P = 0.9) and, therefore, we used a fixed effects method to pool the data. Subjects exposed to music had a 70% greater probability of having at least 50% of pain relief than unexposed subjects (95% CI: 1.21 to 2.37) This is equivalent to a NNT of 5 (95% CI: 4 to 13). (Comparison 04).

Opioid requirements

Thirteen studies evaluated opioid requirements, all in adult patients (Blankfield 1995; Cepeda 1998; Good 1995; Kliempt 1999; Koch 1998; Korunka 1992; Laurion 2003; Mandle 1990; Migneault 2004; Nilsson 2001; Nilsson 2003a; Nilsson 2003b; Schiemann 2002). Five studies evaluated opioid requirements during painful procedures (216 subjects were exposed to music and 220 served as controls). Five studies evaluated opioid requirements for 24 hours after surgery with a total of 153 patients exposed to music and 146 controls), and three studies assessed opioid requirements during the first two hours after surgery (141 patients exposed to music and 140 controls) (Comparison 05).

Only four studies that evaluated requirements during painful procedures showed some heterogeneity (P = 0.06). Studies that evaluated opioid requirements two hours after surgery found that the subjects exposed to music required 1 mg (18.4 %) less of morphine (95% CI: -2.0 to -0.2) than the unexposed subjects. At 24 hours after surgery, the difference in morphine requirements also favored the music group. The latter group required 5.7 mg (15.4%) less morphine than the unexposed group (95% CI: -8.8 to -2.6). Opioid requirements during painful procedures were also lower (-0.7 mg) in the music group (95% CI: -1.8 to 0.4), but this difference did not reach statistical significance.

Side effects

Only four studies evaluated side effects (Cepeda 1998; Laurion 2003; Nilsson 2001; Nilsson 2003a). All of these studies reported no statistically significant difference in the incidence of side effects. The study by Cepeda 1998 reported a 7.4 % incidence of nausea in the music group versus 9.1% in the control group and the study by Laurion 2003 found that 35% of subjects in the music group had nausea versus 53% in the control group. The studies by Nilsson 2001 and Nilsson 2003a evaluated nausea on a one to four scale and found no difference in the incidence of this side effect. Nausea was reported as a mean and standard deviation: 1.6 ± 0.9 in the music group versus 1.7 ± 0.9 in the control group (Nilsson 2001).

DISCUSSION

Of the modest number of studies that evaluated the effect of music on pain intensity or opioid requirements, half were of low quality (score of less than three of a possible seven) and only 13 of the studies (25 %) scored four to six in the quality scale. In addition, there was heterogeneity in the effect of music upon pain intensity that had no obvious explanation.

The pooling of the studies with clinical and statistical homogeneity shows that music reduced postoperative pain intensity levels. The maximal reduction in pain intensity levels is 0.9 units on a zero to ten scale; although this difference reaches statistical significance, its clinical importance is unclear. The minimal reduction in pain intensity levels on a zero to ten scale that is normally perceptible to patients is one unit, but if pain is severe the decrease must be two units or greater to be perceptible (Cepeda 2003). Nonetheless, treatments that produce similar reductions in pain intensity are clinically used, such as neurolytic celiac plexus block (Wong 2004).

Although patient selection of the type of music has been advocated (Heckmat 1993), this systematic review found that the decline in pain intensity was similar in studies in which patients selected the type of music and in those in which patients did not choose the type of music.

In addition to analyzing absolute changes in pain intensity, we estimated the number of patients reporting a specific degree of pain relief, as recommended in the literature (Dworkin 2005; Farrar

2000). The NNT of music is five, meaning that of five patients exposed to music, one will exhibit a 50% or greater pain relief who would have not experienced it if they had not been listening to music. This NNT is similar to the NNT of a single dose of 325 mg of paracetamol (Barden 2004). Yet only four studies (13%) evaluated this outcome and the quality of three of the studies was low, therefore, we advise caution when interpreting these results

Music reduces opioid requirements. However, the music-related decrease in morphine equivalents consumed is 1 mg in two hours (18.4% reduction) and 5.7 mg in 24 hours (15.4% reduction) after surgery. It is difficult to assign clinical significance to these differences. If these reductions are compared with pharmacological treatments that have opioid sparing effects, such as nonsteroidal antiinflammatory drugs (NSAIDs), the decrement in opioid requirements produced by listening to music is comparatively minor. Adding ketorolac to an opioid regimen would be expected to produce a 58.5% decrease (6.5 mg) in morphine needs in the first two postoperative hours (Cepeda 2005), and of 30% to 50% in a 24 hour time span (Marret 2005). Adding a weaker analgesic such as paracetamol to a patient controlled analgesic (PCA) morphine regimen also produces a greater opioid sparing effect than music: opioid requirements during the first 24 hours after surgery in patients receiving paracetamol instead of placebo are 20% lower (a difference of 9 mg of morphine) (Remy 2005). Thus, the magnitude of the opioid sparing effect of music is lower than the that produced by the use of paracetamol or NSAIDs.

The reduction in opioid requirements is only important if it lowers the risk of opioid related side effects, and very few studies evaluated side effects. Nonetheless, it seems unlikely that the magnitude of the music opioid sparing effect could reduce the incidence of opioid related side effects. A meta-analysis of seven RCTs that evaluated the effect of adding paracetamol to an opioid regimen found that opioid-related side effects were similar in the paracetamol and placebo groups despite the 20% reduction in morphine requirements in 24 hours in the paracetamol group (Remy 2005). Reductions of at least 30% seem to be necessary to lower the incidence of opioid related side effects. For example, a 50% decrement in opioid requirements two hours after surgery (obtained with the concomitant use of morphine and ketorolac) is associated with an 11% decrease in adverse events and decrements around 30% to 50% are associated with a 12% to 30% reduction in the incidence of opioid-related side effects 24 hours after surgery (Marret 2005).

AUTHORS' CONCLUSIONS

Implications for practice

Music should not be considered as a primary method for pain relief. Clinicians should be aware of the limited utility of music to decrease pain or analgesic requirements.

Implications for research

This systematic review assesses only the effect of music on pain and opioid requirements. The effect of music on other outcomes such as anxiety needs to be investigated as well.

The combination of music and other nonpharmacologic therapies could have a synergistic effect to produce clinically important benefits upon pain intensity or analgesic requirements and hence deserves further evaluation.

Listening to music reduces pain intensity levels and opioid requirements, but the magnitude of these benefits is small and, therefore, its clinical importance unclear.

POTENTIAL CONFLICT OF INTEREST

None known.

ACKNOWLEDGEMENTS

- The Saltonstall Fund for Pain Research, the Javeriana University School of Medicine, the Ibero-American Cochrane Center, and the INCLEN's grant (RCB-2003) made possible the performance of this review.
- We thank Frances Fairman formerly of the PaPaS group for running the EMBASE search.

SOURCES OF SUPPORT

External sources of support

- No sources of support supplied

Internal sources of support

- Prof Daniel B Carr, Professor of Pain Research, New England Medical Center, Boston USA

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TABLES

Characteristics of included studies

Study	**Arts 1994**
Methods	RCT. Allocation concealment was not described. Patients or evaluators were not blinded.
Participants	Children between 4 to 16 years old. Music group = 60 patients. Control group = 60 patients. Evaluated pain secondary to intravenous cannulation.
Interventions	One group exposed to music, the control group exposed to a placebo cream and the third group exposed to EMLA. Exposure before the IV cannulation. Subject did not select the type of music.
Outcomes	Procedural pain (IV cannulation). Pain evaluated with a VAS. Music group mean pain 4.5 and the control group 4.33.
Notes	Analysis based on treatment received not intention to treat. We included in the analyses the group exposed to music and the group that received placebo cream. Treatment groups were similar.
Allocation concealment	D

Characteristics of included studies (*Continued*)

Study	**Bally 2003**
Methods	RCT. Patients or evaluators were not blinded.
Participants	Adults. Music group = 56 patients. Control group = 51 patients. Evaluated pain secondary to coronary angiography.
Interventions	One group exposed to music, the control group received standard care. Exposure before, during and after the procedure. Subjects selected the type of music.
Outcomes	Procedural pain (coronary angiography). Pain evaluated with VAS. Mean pain after procedure. Music group 0.4 ± 1.0. Control group 0.5 ± 1.2. 43/51 in the music group and 52/56 in the control group had mild or no pain during the procedure.
Notes	Analysis based on treatment received not intention to treat. Treatment groups were similar.
Allocation concealment	D

Study	**Beck 1991**
Methods	Randomized cross over study. Method of randomization or allocation concealment were not described.
Participants	Adults with cancer pain. Music group = 15 patients. Control group = 14 patients.
Interventions	One group exposed to music, the control group received a 60 cycle hum. Subject selected the type of music.
Outcomes	Pain evaluated with VAS. 3/15 subjects in the music group and 1/14 in the control group had at least 50% of pain relief.
Notes	Analysis based on treatment received not intention to treat. Treatment groups were similar.
Allocation concealment	D

Study	**Blankfield 1995**
Methods	RCT. Patients or evaluators were not blinded. Method of randomization not described. Allocation concealment was not described.
Participants	Adults with acute postoperative pain (coronary bypass). Music group = 32 patients. Control group = 29 patients.
Interventions	Three groups. We included the music group and the control group had a blank tape during surgery and no tape in the postoperative period. The group that was not included had suggestion tapes. Exposure before, during and after the procedure

Characteristics of included studies (*Continued*)

Outcomes	Evaluates only opioid requirements. Morphine requirements in the postoperative period (24 hours) (mg). Music group 20.3 ± 16.6. Control group 26.4 ± 34.5.
Notes	Analysis based on treatment received not intention to treat. Treatment groups similar.
Allocation concealment	D

Study	**Bo 2000**
Methods	Randomized cross over study. Evaluators were not blinded. Method of randomization or allocation concealment were not described.
Participants	Neonates with procedural pain (heel stick). Music group = 27 patients. Control group = 27 patients.
Interventions	One group exposed to music, the control group received standard care. 27 neonates in each group.
Outcomes	Pain evaluated with the neonatal infant pain scale.
Notes	Authors did not provide data, only a statement that the group exposed to music had less pain behavior than the control group.
Allocation concealment	D

Study	**Broscious 1999**
Methods	RCT. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (chest tube removal). Music group = 68 patients. Control group = 47 patients.
Interventions	One group exposed to music, the control group received standard care. Exposure before and during the procedure. Subject selected the type of music.
Outcomes	Pain evaluated with numerical rating scale after removal of chest tube. Music group 5.86 ± 2.78. Control group 5.43 ± 2.63.
Notes	No information to determine if the analysis was on intention to treat or treatment received. Treatment groups were similar.
Allocation concealment	D

Study	**Cadigan 2001**
Methods	RCT. Patients or evaluators were not blinded. Allocation concealment was not described.
Participants	Adults with procedural pain (percutaneous coronary interventions). Music group = 75 patients. Control group = 65 patients.
Interventions	One group exposed to music, the control group received standard care. Exposure during the procedure. Subject did not select the type of music.

Characteristics of included studies (*Continued*)

Outcomes	Pain evaluated with VAS Music group 1.1 ± 1.9 Control group 0.88 ± 1.15
Notes	Analysis based on treatment received not intention to treat Treatment groups were similar
Allocation concealment	D

Study	**Cepeda 1998**
Methods	RCT. Investigators were blinded.
Participants	Adults with procedural pain (lithotripsy). Music group = 97 patients. Control group = 96 patients.
Interventions	One group exposed to music, the control group had headphones and no music). Exposure before and during the procedure. Subjects selected the type of music.
Outcomes	Pain evaluated with numerical rating scale. Music group 4.2 ± 2.4. Control group 4.1 ± 2.7. Morphine equivalent requirements during the procedure. Music group 5.76 ± 3.6. Control group 6.4 ± 3.6.
Notes	Analysis based on intention to treat. Treatment groups were similar.
Allocation concealment	A

Study	**Chan 2003**
Methods	RCT. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (colposcopy). Music group = 112 patients. Control group = 108 patients.
Interventions	One group exposed to music, the control group received standard care. Exposure during the procedure. Subject did not select the type of music.
Outcomes	Pain evaluated with VAS. Music group 3.32 ± 2.45. Control group 5.03 ± 2.57.
Notes	Analysis based on intention to treat. Treatment groups were similar.
Allocation concealment	D

Study	**Chlan 2000**
Methods	RCT. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (flexible sigmoidoscopy). Music group = 30 patients. Control group = 34 patients.
Interventions	One group exposed to music, the control group no music. Subjects selected the type of music.

Characteristics of included studies (*Continued*)

Outcomes	Pain evaluated with numerical rating scale. Music group 4.3 ± 2.1. Control group 5.2 ± 1.7.
Notes	No information to determine if the analysis was on intention to treat or treatment received. Treatment groups were similar.
Allocation concealment	D

Study	**Durham 1986**
Methods	RCT. Allocation concealment was not described. Patients or evaluators were not blinded.
Participants	Women with labor pain. Music group = 12 patients. Control group = 19 patients.
Interventions	Subjects selected the type of music. One group exposed to music, the control group no music. Exposure before and during the procedure.
Outcomes	Pain evaluation instrument was not described. Type of analgesic evaluated was not described.
Notes	No information to determine if the analysis was on intention to treat or treatment received. Author concluded "the value of music is not demonstrated". No information to determine if the treatment groups were similar.
Allocation concealment	D

Study	**El Rakshy 1997**
Methods	Randomized cross over study. Evaluators were not blinded.
Participants	Adults with chronic pain. Music group = 17 patients. Control group = 27 patients.
Interventions	One group exposed to music, the control group received standard care. Subjects selected the type of music.
Outcomes	Pain evaluated with VAS. Music group 6.47 ± 2.5. Control group 6.52 ± 1.87.
Notes	Analysis based on treatment received. More than 19% of losses. No information to determine if the treatment groups were similar.
Allocation concealment	D

Study	**Ferguson 2004**
Methods	RCT. Allocation concealment was not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (range of motion in patients with burns). Music group = 5 patients. Control group = 6 patients.
Interventions	One group exposed to music, the control group received standard care. Subjects did not select the type of music.

Characteristics of included studies (*Continued*)

	Exposure during the procedure.
Outcomes	Pain evaluated with VAS. Music group 5 Control group 5. Dispersion was obtain from the P value.
Notes	Groups were not similar at baseline. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Fowler-Kerry 1987**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded. Investigators were blinded.
Participants	Children with procedural pain secondary to immunization. Music group = 40 patients. Control group = 80 patients.
Interventions	One group exposed to music, the control group the control had no music. Subjects did not select the type of music. Exposure before and during the procedure.
Outcomes	Pain evaluated with VAS. Music group 4.02 ± 3.42. Control group 5.34 ± 3.42.
Notes	No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Gawronska 2002**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (oral surgery). Music group = 100 patients. Control group = 30 patients.
Interventions	One group exposed to music, the control had no music. Subjects selected the type of music. Exposure before and during procedure.
Outcomes	Pain evaluated with adjectives 64/100 patients in the music groups had at least moderate pain relief versus 12/30 in the control group.
Notes	Treatment groups were similar. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Geden 1989**
Methods	RCT. Subjects or evaluators were not blinded.
Participants	Adults (experimental pain). Music group = 10 patients.

Characteristics of included studies (*Continued*)

	Control group = 10 patients.
Interventions	Five treatment arms. For the purposes of the review we selected the groups that have self selected music and the no treatment group. Exposure before and during procedure.
Outcomes	Pain evaluated with numerical rating scale. Authors did not provide data on pain intensity or opioid requirements. No difference in pain intensity between the groups.
Notes	No information to determine if the analysis was on intention to treat or treatment received. No information to determine if the groups were similar at baseline.
Allocation concealment	D

Study	**Good 1995**
Methods	RCT. Method of randomization was not described. Patients or evaluators were not blinded.
Participants	Adults with postoperative pain. Music group = 21 patients. Control group = 21 patients.
Interventions	One group exposed to music, the control group the control had no music. Subjects selected the type of music. Exposure after surgery.
Outcomes	Pain evaluated with VAS while walking. Music group 6.58 ± 2.26. Control group 5.23 ± 2.52. Morphine requirements in 24 hours. Music 33.81 ± 20.68. Control group 34.6 ± 26.52.
Notes	Treatment groups were similar. Analysis based on treatment received.
Allocation concealment	D

Study	**Good 1998**
Methods	RCT. Method of randomization was not described. Patients or evaluators were not blinded.
Participants	Adults with postoperative pain Music group = 16 patients. Control group = 19 patients.
Interventions	One group exposed to music, the control group had no music. Subjects selected the type of music. Exposure before and after surgery for two days, sessions of 15 minutes.
Outcomes	Pain evaluated with VAS. Music group 4.1 ± 2.1. Control group 4.2 ± 2.6.
Notes	Treatment groups were similar. Analysis based on treatment received. More than 19% of losses.

	Data from the first day was extracted.
Allocation concealment	D

Study	**Good 1999**
Methods	RCT. Allocation concealment was not described. Patients or evaluators were not blinded.
Participants	Adults with postoperative pain. Music group = 122 patients. Control group = 111 patients.
Interventions	One group exposed to music, the control had no music Subjects selected the type of music Exposure during and after surgery
Outcomes	Pain evaluated with VAS Music group 3.3 ± 2.6 Control group 3.9 ± 2.6 No difference in opioid requirements but data was not presented
Notes	Study had 4 arms For the study we chose the group that was exposed only to music and the control group Treatment groups were similar Analysis based on treatment received Data from the first day was extracted
Allocation concealment	D

Study	**Hasenbring 1999**
Methods	RCT Allocation concealment was not described Patients or evaluators were not blinded
Participants	Adults with bone from bone marrow transplantation Music group =21 patients Control group=22
Interventions	One group exposed to music, the control exposed to psychological support
Outcomes	Pain and opioid requirements were evaluated but author do not provide data Authors concluded that music therapy did not affect pain or opioid requirements
Notes	Reported in abstract form Three arm groups No information to determine if the analysis was on intention to treat or treatment received
Allocation concealment	D

Study	**Haythronthwaite 2001**
Methods	Method of randomization was not described

Characteristics of included studies (*Continued*)

	Patients or evaluators were not blinded
Participants	Adults with procedural pain (burn dressing change) Music group =14 patients Control group=14
Interventions	One group exposed to music, the control to usual care. Subjects selected the type of music. Exposure during procedure.
Outcomes	Pain evaluated with VAS. Music group 4.5 ± 2.1. Control group 4.8 ± 2.5.
Notes	Three arms, the sensory focusing was not used for the present review. Authors were contacted and provided the number of patients in each group. No information to determine if the groups were similar at baseline. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Heckmat 1993**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults (experimental pain). Music group = 20 patients. Control group = 20
Interventions	One group exposed to music, the control group had no music. Subjects selected the type of music. Exposure during procedure.
Outcomes	Pain evaluated with numerical rating scale. Music group 5.2 ± 2.2. Control group 6.1 ± 2.0.
Notes	Four treatment arms. For the analysis the group that listened to the preferred music and the group that received no music were used. Analysis based on treatment received. No information to determine if the groups were similar at baseline.
Allocation concealment	D

Study	**Heitz 1992**
Methods	RCT. Method of randomization was not described. Evaluators were blinded.
Participants	Adults with postoperative pain. Music group = 20 patients. Control group = 20 patients.
Interventions	One group exposed to music, the control group had headphones but no music. Subjects selected the type of music. Exposure after procedure.
Outcomes	Pain evaluated with VAS.

	Music group 5.6 ± 2.2. Control group 6.0 ± 1.7. Morphine requirements during the first 90 minutes. Authors did not reported measure of variation or exact P value. Only "no difference in opioid requirements". Music group 107.5 mg. Control group 140.5 mg.
Notes	Three arms. Treatment groups were similar. The arm not included in the analysis was the control not wearing headphone. Analysis based on treatment received.
Allocation concealment	D

Study	**Jacobson 1999**
Methods	RCT. Allocation concealment was not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (IV catheter insertion). Music group = 36 patients. Control group = 36 patients.
Interventions	One group exposed to music, the control group had no music. Subjects selected the type of music. Exposure before and during procedure.
Outcomes	Pain evaluated with VAS. Music group 2.0 ± 2.2. Control group 2.2 ± 2.7.
Notes	Treatment groups were similar. Analysis based on intention to treat.
Allocation concealment	D

Study	**Joyce 2001**
Methods	RCT. Allocation concealment was not described. Evaluators were blinded.
Participants	Neonates with procedural pain (circumcision). Music group = 12 patients. Control group = 11 patients.
Interventions	One group exposed to music, the control group received standard treatment. Exposure before and after procedure.
Outcomes	Pain evaluated with Riley Infant Pain Scale (zero to three). Music group 1.25. Control group 2.0.
Notes	Treatment groups were similar. No dispersion data. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Kliempt 1999**
Methods	RCT. Evaluators were blinded.
Participants	Adults with procedural pain (surgery). Music group = 25 patients. Control group = 26

Characteristics of included studies (*Continued*)

	patients.
Interventions	One group exposed to music, the control group had a blank tape. Exposure during procedure.
Outcomes	Intraoperative fentanyl requirements. Morphine equivalent (mg). Music group 12.4 ± 6.6. Control group 12.6 ± 6.5.
Notes	Treatment groups were similar. Analysis based on treatment received.
Allocation concealment	D

Study	**Koch 1998**
Methods	RCT. Evaluators were blinded allocation concealment was not described.
Participants	Adults with procedural pain (lithotripsy). Music group = 21 patients. Control group = 22 patients.
Interventions	One group exposed to music, the control group no music. Exposure during procedure.
Outcomes	Pain evaluated with VAS. Pain during procedure. Music group 3 ± 3. Control group 3 ± 2. Intraoperative alfentanil requirements Morphine equivalent (mg) Music group 7.98 ± 5.63 Control group 14.54 ± 8.55
Notes	Analysis based on treatment received. Treatment groups at baseline were not similar.
Allocation concealment	D

Study	**Korunka 1992**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with postoperative pain. Music group = 55 patients. Control group = 53 patients.
Interventions	One group exposed to music, the control group no music. Exposure during procedure and pain evaluated after surgery.
Outcomes	Pain evaluated with VAS. Authors provided only data in a graph form and it was not possible to obtain average pain intensity levels. Opioid requirements in PACU Morphine equivalent (mg). Music group 12.8 ± 8.9. Control group 18.9 ± 11.3.
Notes	Analysis based on treatment received. No information to determine if the groups were similar at baseline. Translated from German. More than 19% of losses.

Allocation concealment	D

Study	**Kotwal 1998**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (gastroscopy). Music group = 54 patients. Control group = 54 patients.
Interventions	One group exposed to music, the control group no music. Exposure before and during procedure. Subjects did not select the type of music.
Outcomes	Outcome: number of patients with no discomfort or slight discomfort. 23/54 patients in the music group had no pain or slight discomfort versus 15/54 in the control group.
Notes	No information to determine if the groups were similar at baseline. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Kwekkeboom 2003**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (biopsy, line removal). Music group = 24 patients. Control group = 20 patients.
Interventions	One group exposed to music, the control group to usual treatment. Exposure during procedure. Subjects selected the type of music.
Outcomes	Pain evaluated with numerical rating scale. Mean pain during procedure. Music group 2.33 ± 0.37. Control group 1.47 ± 0.4.
Notes	Analysis based on treatment received. Treatment groups were similar.
Allocation concealment	D

Study	**Laurion 2003**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with acute postoperative pain. Music group = 28 patients. Control group = 28 patients.
Interventions	One group exposed to music, the control group to usual treatment. Subjects selected the type of music. Exposure before, during and after procedure.
Outcomes	Pain evaluated with numerical rating scale in PACU one hour after surgery. Music group 2.1 ± 2.4. Control group 3.5 ± 2.6. Morphine requirements in PACU

	Music group 7.0 ±7.7 Control group 9.8± 8.2
Notes	No information to determine if the analysis was on intention to treat or treatment received. Treatment groups were similar. Authors replied with the number of subjects in each group.
Allocation concealment	D

Study	**Le 1998**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with chronic pain (back pain) during physiotherapy. Music group = 15 patients. Control group = 15 patients.
Interventions	One group exposed to music, the control group to no music. Subjects did not select the type of music. Exposure during physiotherapy.
Outcomes	Pain evaluated with McGill questionnaire. Authors did not provide data on pain intensity. They state “experimental group has less pain than the control group”.
Notes	Treatment groups were similar. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Lee 2002**
Methods	RCT. Allocation concealment was not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (colonoscopy). Music group = 55 patients. Control group = 55 patients.
Interventions	One group exposed to music, the control group to usual treatment. Subjects selected the type of music. Exposure during procedure.
Outcomes	Pain evaluated with VAS. Music group 4.9 ± 2.8. Control group 5.9 ± 2.9.
Notes	Treatment groups were similar. Analysis based on intention to treat.
Allocation concealment	D

Study	**Mandle 1990**
Methods	RCT. Method of randomization or allocation concealment were not described. Evaluators were not blinded.
Participants	Adults with procedural pain (femoral angiography). Music group = 14 patients. Control group = 16 patients.
Interventions	One group exposed to music, the control group to a blank tape. Exposure before and during procedure.

	Subjects did not select the type of music.
Outcomes	Pain evaluated with McGill questionnaire. Music group 3.0 ± 1.0. Control group 3.3 ± 1.0. Requirements of equivalent morphine (mg). Music group 4.0 ± 3.96. Control group 4.53 ± 4.38.
Notes	No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Marchette 1989**
Methods	RCT. Method of randomization or allocation concealment were not described. Evaluators were blinded.
Participants	Neonates with procedural pain (circumcision). Music group = 25 patients. Control group = 18 patients.
Interventions	One group exposed to music, the control group to routine care. Exposure during procedure. Subjects did not select the type of music.
Outcomes	Pain evaluates using facial expressions. Authors do not provide quantitative description. “Both groups had pain. Infants cried during almost every step”.
Notes	More than 19% of losses. Treatment groups were similar. Analysis based on treatment received.
Allocation concealment	D

Study	**Marchette 1991**
Methods	RCT. Method of randomization or allocation concealment were not described. Evaluators were not blinded.
Participants	Neonates with procedural pain (circumcision). Music group = 20 patients. Control group = 21 patients.
Interventions	One group exposed to music, the control group to routine care. Exposure during procedure. Subjects did not select the type of music.
Outcomes	Pain evaluates using the Brazeton scale. Authors do not provide data. Infants in both groups cried during almost every step.
Notes	Treatment groups were similar. Analysis based on treatment received.
Allocation concealment	D

Study	**McCaffrey 2003**
Methods	RCT.

	Patients or evaluators were not blinded.
Participants	Adult patients with chronic pain. Music group = 33 patients. Control group = 33 patients.
Interventions	One group exposed to music, the control group to routine care. Subjects did not select the type of music.
Outcomes	Pain evaluated with VAS. Authors reported difference in pain intensity between group.
Notes	Authors followed patients for 14 days. We used data from the first 24 hours to be able to pool results. Treatment groups were similar. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Megel 1998**
Methods	RCT. Patients or evaluators were not blinded.
Participants	Children with procedural pain (vaccination). Music group = 50 patients. Control group = 49 patients.
Interventions	One group exposed to music, the control group to routine care. Exposure during procedure. Subjects selected the type of music.
Outcomes	Pain evaluated Oucher scale (zero to five). Median pain levels in the Music group 3/5 and 4/5 in the control group. Authors report no difference in pain intensity between the two groups.
Notes	Analysis based on treatment received. No information to determine if the treatment groups were similar. Authors contacted, but they could not provide an estimate of dispersion data.
Allocation concealment	D

Study	**Menegazzi 1991**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients or evaluators were not blinded.
Participants	Adults with procedural pain (laceration repair). Music group = 19 patients. Control group = 19 patients.
Interventions	One group exposed to music, the control group no music. Exposure during procedure. Subjects selected the type of music.
Outcomes	Pain evaluated with VAS. Music group 2.1 ± 0.9. Control group 3.3 ± 1.24.
Notes	Analysis based on treatment received. Treatment groups were similar.
Allocation concealment	D

Characteristics of included studies (*Continued*)

Study	**Migneault 2004**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients and evaluators were blinded.
Participants	Adults with acute postoperative pain. Music group = 15 patients. Control group = 15 patients.
Interventions	One group exposed to music, the control group no music. Exposure while receiving general anesthesia for surgical procedure. Subjects selected the type of music.
Outcomes	Morphine requirements during the first 24 hours after surgery (mg). Music group 85.8 ± 40.0. Control group 69.4 ± 30.9.
Notes	Treatment groups were simila. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Mullooly 1988**
Methods	RCT. Method of randomization was not described. Patients and evaluators were not blinded.
Participants	Adults with acute postoperative pain. Music group = 6 patients. Control group = 5 patients.
Interventions	One group exposed to music, the control group no music. Exposure after procedure. Subjects did not select the type of music.
Outcomes	Pain evaluated with VAS. Mean pain intensity levels during the first postoperative day. Music group 6.4 ± 3.5. Control group 8.7 ± 2.1.
Notes	Analysis based on treatment received. Treatment groups were similar.
Allocation concealment	D

Study	**Nilsson 2001**
Methods	RCT. Allocation concealment was not described. Patients and evaluators were blinded.
Participants	Adults with acute postoperative pain. Music group = 30 patients. Control group = 28 patients.
Interventions	One group exposed to music, the control group to operating room sounds. Exposure during anesthesia and surgery. Subjects did not select the type of music.
Outcomes	Pain evaluated with VAS. Mean pain intensity levels during the first postoperative day. Music group 2.0 ± 1.7. Control group 2.0 ± 1.2. Morphine requirements during the first postoperative day (mg) Music group 2.8.4 ± 15.2.

	Control group 35.3 ± 12.0.
Notes	Treatment groups were similar. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Nilsson 2003a**
Methods	RCT. Allocation concealment was not described. Evaluators were blinded.
Participants	Adults with acute postoperative pain. Music group = 62 patients. Control group = 63 patients.
Interventions	One group exposed to music, the control group to a blank tape. Subjects did not select the type of music. Exposure after procedure.
Outcomes	Pain evaluated with VAS. Mean pain intensity levels during the first postoperative day. Music group 2.1 ± 1.4. Control group 2.9 ± 1.6. Morphine requirements during the two hours after surgery (mg). Music group 2.6. ± 3.2. Control group 3.4 ± 3.9.
Notes	Treatment groups were similar. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Nilsson 2003b**
Methods	RCT. Allocation concealment was not described. Evaluators were blinded.
Participants	Adults with acute postoperative pain. Music group = 51 patients. Control group = 49 patients.
Interventions	One group exposed to music, the control group to a blank CD. Exposure after procedure. Subjects did not select the type of music.
Outcomes	Pain evaluated with numerical rating scale. Mean pain intensity levels during the first hour after surgery. Music group 2.7 ± 1.6. Control group 3.6 ± 1.7. Morphine requirements in PACU. Music group 1.9 ± 2.8. Control group 3.1 ± 3.6.
Notes	Treatment groups were similar. Analysis was based on treatment received.
Allocation concealment	D

Study	**Phumdoung 2003**
Methods	RCT.

Characteristics of included studies (*Continued*)

	Allocation concealment was not described. Evaluators were not blinded.
Participants	Women in labor pain. Music group = 55 patients. Control group = 55 patients.
Interventions	One group exposed to music, the control no music. Exposure during active phase of labor. Subjects selected the type of music.
Outcomes	Pain evaluated with VAS. Music group 7.8 ± 1.8. Control group 8.8 ± 1.1.
Notes	Treatment groups were similar. More than 19% of losses. Analysis was based on treatment received.
Allocation concealment	D

Study	**Reinhardt 1999**
Methods	RCT. Method of randomization was not described. Patients and evaluators were not blinded.
Participants	Adult patients with cancer pain. Music group = 14 patients. Control group = 14 patients.
Interventions	One group exposed to music, the control no music. Subjects did not select the type of music.
Outcomes	Pain evaluated in a scale from zero to six. Data in graphs not possible to obtain mean data. No difference in pain intensity between the groups, but difference in analgesic requirements but there is no description of type or doses.
Notes	Translated from German. Analysis was based on treatment received.
Allocation concealment	A

Study	**Schiemann 2002**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients and evaluators were not blinded.
Participants	Adults with procedural pain (colonoscopy). Music group = 59 patients. Control group = 60 patients.
Interventions	Subjects selected the type of music. One group exposed to music, the control no music. Exposure during procedure.
Outcomes	Requirements of morphine equivalent during procedure. Music group 2.7 ± 1.1. Control group 2.8 ± 1.3.
Notes	Treatment groups were similar. More than 19% of losses. Analysis was based on treatment received.
Allocation concealment	D

Characteristics of included studies (*Continued*)

Study	**Taylor 1998**
Methods	RCT. Patients and evaluators were not blinded.
Participants	Adults with acute postoperative pain. Music group = 20 patients. Control group = 20 patients.
Interventions	One group exposed to music, the control no music. Subjects selected the type of music. Exposure after procedure.
Outcomes	Pain evaluated with numerical rating scale. Music group 5.8 ± 1.6. Control group 5.8 ± 1.8.
Notes	Treatment groups were similar. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Study	**Uedo 2004**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients and evaluators were not blinded.
Participants	Adults with procedural pain (colonoscopy). Music group = 14 patients. Control group = 15 patients.
Interventions	One group exposed to music, the control no music. Subjects did not select the type of music. Exposure during procedure.
Outcomes	Pain evaluated with adjectives. Six out of 14 patients in the Music group and 2/15 in the control group had no pain during the colonoscopy.
Notes	Treatment groups were similar. Analysis was based on treatment received.
Allocation concealment	D

Study	**Yilmaz 2003**
Methods	RCT. Method of randomization or allocation concealment were not described. Evaluators were blinded.
Participants	Adults with procedural pain (lithotripsy). Music group = 48 patients. Control group = 50 patients.
Interventions	One group exposed to music, the control received midazolam. Subjects selected the type of music. Exposure during procedure.
Outcomes	Pain evaluated with VAS. Music group 2.8 ± 4.0. Control group 2.8 ± 4.1.
Notes	Treatment groups were similar. Analysis was based on intention to treat.
Allocation concealment	D

Characteristics of included studies (*Continued*)

Study	**Zimmerman 1996**
Methods	RCT. Method of randomization or allocation concealment were not described. Patients and evaluators were not blinded.
Participants	Adults with acute postoperative pain. Music group = 32 patients. Control group = 32 patients.
Interventions	One group exposed to music the control group scheduled rest. Subjects selected the type of music. Exposure after procedure.
Outcomes	Pain evaluated with numerical rating scale. Pain intensity levels the first postoperative day. Music group 0.9 ± 1.7. Control group 1.79 ± 2.3.
Notes	Treatment groups were not similar at baseline. No information to determine if the analysis was on intention to treat or treatment received.
Allocation concealment	D

Characteristics of excluded studies

Aitken 2002	Not randomized
Albert 2002	Combined therapy (music and guided imagery)
Almeida 2003	Combined therapy (music and guided imagery)
Baghdadi 2000	Not randomized
Bailey 1983	Both experimental arms had music
Bailey 1986	Narrative review
Bellan 2002	Pain or opioid requirements were not evaluated
Bertucci 1993	Evaluated only NSAIDs (translated from Spanish)
Binek 2003	Not randomized
Bowers 1996	Not music
Buffum 2003	Pain or opioid requirements were not evaluated
Carroll 1998	Systematic review
Chesky 1997	Both experimental arms had music
Diette 2003	Combined therapy (video and natural sounds)
Elliott 1994	Combined therapy (music and relaxation)
Elsbery 1992	Not randomized
Evans 2002	Systematic review
Fauerbach 2002	Results reported previously in Pain
Fratianne 2001	Combined therapy (music and relaxation)
Frid 1981	Combined therapy (music and suggestion) (translated from Russian)
Goff 1997	Pain or opioid requirements were not evaluated
Good 1996	Results reported previously
Good 2001	Narrative review
Good 2002	Results reported previously

Characteristics of excluded studies (*Continued*)

Guetin 2003	Not randomized (translated from French)
Heiser 1997	Not randomized
Hekmat 1993	Combined therapy (music and eye movement desensitization)
Hilliard 2003	Pain or opioid requirements were not evaluated
Howitt 1967	Pain or opioid requirements were not evaluated
Kaden 1999	Narrative review
Kain 2001	Not music
Kleiber 1999	Systematic review
Krout 2001	Not randomized
Kullich 2003	Combined therapy (music and relaxation)
Kumar 1992	Pain or opioid requirements were not evaluated
Lee 2004	Combined therapy (music and video)
Lepage 2001	Pain or opioid requirements were not evaluated
Lewis 2004	Combined therapy (music and suggestions)
Locsin 1988	Narrative review
Miller 1992	Combined therapy (music and video)
Moore 1965	Not music
Muller-Busch 1997	Not randomized
Neander 2004	Not randomized (translated from German)
Pan 2000	Systematic review
Reilly 2000	Pain or opioid requirements were not evaluated
Renzi 2000	Combined therapy (music and guided imagery)
Rickert 1994	Combined therapy (music and video)
Rider 1987	Not randomized
Shertzer 2001	Not randomized
Shinoda 1992	Not randomized
Sidorenko 2000	Not randomized
Smith 1994	Systematic review
Tanabe 2001	Not randomized
Trinka 2002	Not music
Tusek 1997a	Combined therapy (music and guided imagery)
Tusek 1997b	Not music
Tusek 1999	Combined therapy (music and guided imagery)
Updike 1990	Not randomized
Wang 2002	Pain or opioid requirements were not evaluated
Whipple 1992	Not randomized
Wilkinson 2002	Combined therapy (music and healing touch)
Zimmerman 1989	Combined therapy (music and suggestions)

ADDITIONAL TABLES

Table 03. Quality of studies that met inclusion criteria

Trial	Descrip meth random	Conceal. allocation	Evaluators blinded	Patients blinded	Groups similar	Intention-to-treat	<20% lost	Total score
Arts(1994)	yes	No	No	No	yes	No	yes	3
Bally(2003)	yes	No	No	No	yes	No	yes	3 Beck(1991)
Beck(1991)	No	No	yes	yes	yes	No	yes	4
Blank-field(1994)	No	No	No	No	yes	No	yes	2
Bo(2000)	No	No	No	No	yes	yes	yes	3
Broscious(1999)	yes	No	No	No	yes	No	yes	3
Cadi-gan(2001)	yes	No	No	No	yes	No	yes	3
Cepeda(1998)	yes	yes	yes	No	yes	yes	yes	6
Chan(2003)	yes	No	No	No	yes	yes	yes	4
Chlan(2000)	yes	No	No	No	yes	No	yes	3
Durham(1986)	yes	No	No	No	No	No	No	1
El rak-shy(1997)	yes	No	No	No	No	No	No	1
Fergus-son(2004)	No	No	No	No	No	No	yes	1
Fowler(1987)	No	No	yes	No	yes	No	yes	3
Gawron-ska(2002)	No	No	No	No	yes	No	No	1
Geden(1989)	yes	No	No	No	No	No	yes	2
Good(1995)	No	yes	No	No	yes	No	yes	3
Good(1998)	yes	No	No	No	yes	No	No	2
Good(1999)	yes	No	No	No	yes	No	yes	3
Hasen-bring(1999)	No	No	No	No	No	No	No	0
Haythorn-th-waite(2001)	No	No	No	No	No	No	No	0
Heitz(1992)	No	No	yes	No	No	No	yes	2
Hek-mat(1993)	No	No	No	No	No	No	yes	1

Table 03. Quality of studies that met inclusion criteria (*Continued*)

Trial	Descrip meth random	Conceal. allocation	Evaluators blinded	Patients blinded	Groups similar	Intention-to-treat	<20% lost	Total score
Jacob-son(1999)	yes	No	No	No	yes	yes	yes	4
Joyce(2001)	yes	No	yes	No	yes	No	yes	4
Kliempt(1999)	yes	No	yes	No	yes	No	yes	4
Koch(1998)	No	No	No	No	No	No	yes	1
Ko-runka(1992)	No	No	yes	yes	No	No	No	2
Kot-wal(1998)	No	No	No	No	No	No	yes	1
Kwekkboom(2003)	No	No	No	yes	No	No	yes	2
Lau-rion(2003)	No	No	No	No	yes	No	yes	2
Lee(2002)	yes	No	No	No	yes	yes	yes	4
Ler-oux(1998)	No	No	No	No	yes	No	yes	2
Man-dle(1990)	No	No	yes	No	yes	yes	yes	4
Marchette(1989)	No	No	yes	yes	yes	No	No	3
Marchette(1991)	No	No	No	yes	yes	No	yes	3
Mccaf-frey(2003)	yes	No	No	No	yes	No	yes	3
Megel(1998)	yes	No	No	No	No	No	yes	2
Menegazzi(1991)	No	No	No	No	yes	No	yes	2
Migneault(2004)	No	No	yes	yes	yes	No	yes	4
Mul-looly(1998)	No	No	No	No	yes	No	No	1
Nils-son(2001)	yes	No	yes	yes	yes	No	yes	5
Nils-son(2003)	yes	No	yes	No	yes	No	yes	4
Nils-son(2003)b	yes	No	yes	No	yes	No	yes	4
Phum-doung(2003)	yes	No	No	No	yes	No	No	2
Rein-	No	yes	No	No	No	No	yes	2

Table 03. Quality of studies that met inclusion criteria (*Continued*)

Trial	Descrip meth random	Conceal. allocation	Evaluators blinded	Patients blinded	Groups similar	Intention-to-treat	<20% lost	Total score
hardt(1999)								
Schie-mann(2002)	No	No	No	No	yes	No	No	1
Tay-lor(1998)	yes	No	No	No	yes	No	yes	3
Uedo(2004)	No	No	No	No	yes	No	yes	2
Yil-maz(2003)	No	No	yes	No	yes	yes	yes	4
Zimmer-man(1996)	No	No	No	No	No	No	No	0

ANALYSES

Comparison 01. Effect of music on pain intensity levels by age group

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Difference in pain intensity on a 0-10 scale	31		Mean difference (Random) 95% CI	-0.43 [-0.69, -0.16]

Comparison 02. Effect of music on pain intensity levels by type of pain evaluated

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Difference in pain intensity on a 0-10 scale	30		Mean difference (Random) 95% CI	-0.46 [-0.75, -0.17]

Comparison 03. Effect of music on pain intensity levels by who selected the type of music

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Difference in pain intensity on a 0-10 scale	30		Mean difference (Random) 95% CI	-0.46 [-0.75, -0.17]

Comparison 04. Effect of music on global pain relief (risk of having at least 50% of pain relief)

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Risk of having at least 50% of pain relief	4	297	Relative Risk (Fixed) 95% CI	1.70 [1.21, 2.37]

Comparison 05. Effect of music on morphine requirements by time (2 and 24 hours after surgery, and during painful procedures)

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Difference in morphine requirements	13		Mean difference (Random) 95% CI	-1.29 [-2.22, -0.37]

COVER SHEET

Title	Music for pain relief
Authors	Cepeda MS, Carr DB, Lau J, Alvarez H
Contribution of author(s)	M Soledad Cepeda: conceived and co-designed the study, performed the literature search and the data collection. Also appraised the clinical reports, contacted the authors of original clinical trials, and wrote the first version of the manuscript. Joseph Lau: co-designed the study, provided methodological guidance, and revised the manuscript. Hernando Alvarez: co-designed the study, appraised the clinical reports, and revised the manuscript. Daniel B Carr: co-designed the study and wrote final version of the manuscript.
Issue protocol first published	2004/3
Review first published	2006/2
Date of most recent amendment	14 February 2006
Date of most recent SUBSTANTIVE amendment	10 February 2006
What's New	Information not supplied by author
Date new studies sought but none found	Information not supplied by author
Date new studies found but not yet included/excluded	Information not supplied by author
Date new studies found and included/excluded	Information not supplied by author
Date authors' conclusions section amended	Information not supplied by author
Contact address	Dr M. Soledad Cepeda Professor Department of Anesthesia Javeriana University School of Medicine Cra 4- 70 -69 Bogota COLOMBIA E-mail: scepeda@javeriana.edu.co Tel: 011 571 5946161 Fax: 011 571 3406793
DOI	10.1002/14651858.CD004843.pub2

Cochrane Library number	CD004843
Editorial group	Cochrane Pain, Palliative and Supportive Care Group
Editorial group code	HM-SYMPT

GRAPHS AND OTHER TABLES

Figure 01.

Table Agreement between evaluators

	Agreement (%)
Nominal variables	
Include	99.1
Study design	100
Method of randomization	94.0
Concealment of randomization	98.8
Blinding of investigators	100
Blinding of patients	98
Groups baseline similitude	96
Type of analysis	100
Losses to follow up	100
Type of participants	100
Type of pain	100
Continuous variables	**Concordance correlation coefficient**
Mean pain intensity in the music group	1
Mean pain intensity in the control group	1
Number of patients with at least 50% of pain relief in the music group	1
Number of patients with at least 50% of pain relief in the control group	1
Morphine requirements in the music group	1
Morphine requirements in the control group	1

Analysis 01.01. Comparison 01 Effect of music on pain intensity levels by age group, Outcome 01 Difference in pain intensity on a 0-10 scale

Review: Music for pain relief

Comparison: 01 Effect of music on pain intensity levels by age group

Outcome: 01 Difference in pain intensity on a 0-10 scale

Study	Mean difference (SE)	Mean difference (Random) 95% CI	Weight (%)	Mean difference (Random) 95% CI
01 Adults				
Bally 2003	-0.10 (0.23)		4.4	-0.10 [-0.55, 0.35]
Broscious 1999	0.40 (0.51)		2.9	0.40 [-0.60, 1.40]
Cadigan 2001	0.22 (0.29)		4.1	0.22 [-0.35, 0.79]
Cepeda 1998	0.10 (0.37)		3.7	0.10 [-0.62, 0.82]
Chan 2003	-1.71 (0.34)		3.8	-1.71 [-2.37, -1.05]
Chlan 2000	-0.90 (0.47)		3.1	-0.90 [-1.82, 0.02]
El Rakshy 1997	-0.50 (0.55)		2.8	-0.50 [-1.57, 0.57]
Ferguson 2004	0.05 (0.05)		5.0	0.05 [-0.05, 0.15]
Good 1995	1.35 (0.74)		2.0	1.35 [-0.10, 2.80]
Good 1998	-0.12 (0.83)		1.7	-0.12 [-1.75, 1.51]
Good 1999	-0.60 (0.34)		3.8	-0.60 [-1.27, 0.07]
Haythronthwaite 2001	-0.30 (0.87)		1.6	-0.30 [-2.01, 1.41]
Heckmat 1993	-0.90 (0.68)		2.2	-0.90 [-2.22, 0.42]
Heitz 1992	-0.40 (0.63)		2.4	-0.40 [-1.63, 0.83]
Jacobson 1999	-0.20 (0.58)		2.6	-0.20 [-1.34, 0.94]
Koch 1998	0.00 (0.60)		2.5	0.00 [-1.18, 1.18]
Kwekkeboom 2003	0.86 (0.11)		4.9	0.86 [0.64, 1.08]
Laurion 2003	-1.40 (0.66)		2.3	-1.40 [-2.69, -0.11]
Lee 2002	-1.00 (0.54)		2.8	-1.00 [-2.06, 0.06]
Mandle 1990	-0.30 (0.37)		3.7	-0.30 [-1.02, 0.42]
McCaffrey 2003	-2.34 (0.36)		3.7	-2.34 [-3.05, -1.63]
Menegazzi 1991	-1.20 (0.35)		3.8	-1.20 [-1.89, -0.51]
Mullooly 1988	-2.34 (1.80)		0.5	-2.34 [-5.87, 1.19]
Nilsson 2001	0.00 (0.38)		3.6	0.00 [-0.74, 0.74]
Nilsson 2003a	-0.80 (0.27)		4.2	-0.80 [-1.33, -0.27]

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Study	Mean difference (SE)	Mean difference (Random) 95% CI	Weight (%)	Mean difference (Random) 95% CI
Nilsson 2003b	-0.90 (0.33)		3.9	-0.90 [-1.55, -0.25]
Phumdoung 2003	-1.01 (0.30)		4.1	-1.01 [-1.59, -0.43]
Taylor 1998	0.00 (0.50)		3.0	0.00 [-0.98, 0.98]
Yilmaz 2003	-0.01 (0.57)		2.7	-0.01 [-1.13, 1.11]
Zimmerman 1996	-0.89 (0.50)		3.0	-0.89 [-1.87, 0.09]
Subtotal (95% CI)			95.2	-0.01 [-0.09, 0.07]
Test for heterogeneity chi-square=197.86 df=29 p=<0.0001 I?? =85.3%				
Test for overall effect z=0.21 p=0.8				
02 Children				
Arts 1994	0.11 (0.13)		4.8	0.11 [-0.14, 0.36]
Subtotal (95% CI)			4.8	0.11 [-0.14, 0.36]
Test for heterogeneity: not applicable				
Test for overall effect z=0.85 p=0.4				
Total (95% CI)			100.0	0.00 [-0.07, 0.08]
Test for heterogeneity chi-square=198.62 df=30 p=<0.0001 I?? =84.9%				
Test for overall effect z=0.04 p=1				

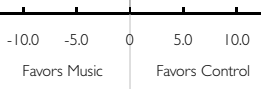
Analysis 02.01. Comparison 02 Effect of music on pain intensity levels by type of pain evaluated, Outcome 01 Difference in pain intensity on a 0-10 scale

Review: Music for pain relief

Comparison: 02 Effect of music on pain intensity levels by type of pain evaluated

Outcome: 01 Difference in pain intensity on a 0-10 scale

Study	Mean difference (SE)	Mean difference (Random) 95% CI	Weight (%)	Mean difference (Random) 95% CI
01 Acute pain				
Good 1995	1.35 (0.74)		2.2	1.35 [-0.10, 2.80]
Good 1998	-0.12 (0.83)		2.0	-0.12 [-1.75, 1.51]
Good 1999	-0.60 (0.34)		4.0	-0.60 [-1.27, 0.07]
Heitz 1992	-0.40 (0.63)		2.6	-0.40 [-1.63, 0.83]
Laurion 2003	-1.40 (0.66)		2.5	-1.40 [-2.69, -0.11]
Mullooly 1988	-2.34 (1.80)		0.6	-2.34 [-5.87, 1.19]
Nilsson 2001	0.00 (0.38)		3.8	0.00 [-0.74, 0.74]
Nilsson 2003a	-0.80 (0.27)		4.3	-0.80 [-1.33, -0.27]
Nilsson 2003b	-0.90 (0.33)		4.0	-0.90 [-1.55, -0.25]
Taylor 1998	0.00 (0.50)		3.2	0.00 [-0.98, 0.98]
Zimmerman 1996	-0.89 (0.50)		3.2	-0.89 [-1.87, 0.09]
Subtotal (95% CI)			32.4	-0.56 [-0.82, -0.29]
Test for heterogeneity chi-square=15.37 df=10 p=0.12 I?? =34.9%				
Test for overall effect z=4.13 p=0.00004				
02 Chronic pain				
El Rakshy 1997	-0.50 (0.55)		3.0	-0.50 [-1.57, 0.57]
McCaffrey 2003	-2.34 (0.36)		3.9	-2.34 [-3.05, -1.63]
Subtotal (95% CI)			6.9	-1.78 [-2.37, -1.19]
Test for heterogeneity chi-square=7.92 df=1 p=0.005 I?? =87.4%				
Test for overall effect z=5.93 p<0.00001				
03 Procedural pain				
Bally 2003	-0.10 (0.23)		4.5	-0.10 [-0.55, 0.35]
Broscious 1999	0.40 (0.51)		3.2	0.40 [-0.60, 1.40]
Cadigan 2001	0.22 (0.29)		4.2	0.22 [-0.35, 0.79]
Cepeda 1998	0.10 (0.37)		3.8	0.10 [-0.62, 0.82]
Chan 2003	-1.71 (0.34)		4.0	-1.71 [-2.37, -1.05]
Chlan 2000	-0.90 (0.47)		3.3	-0.90 [-1.82, 0.02]



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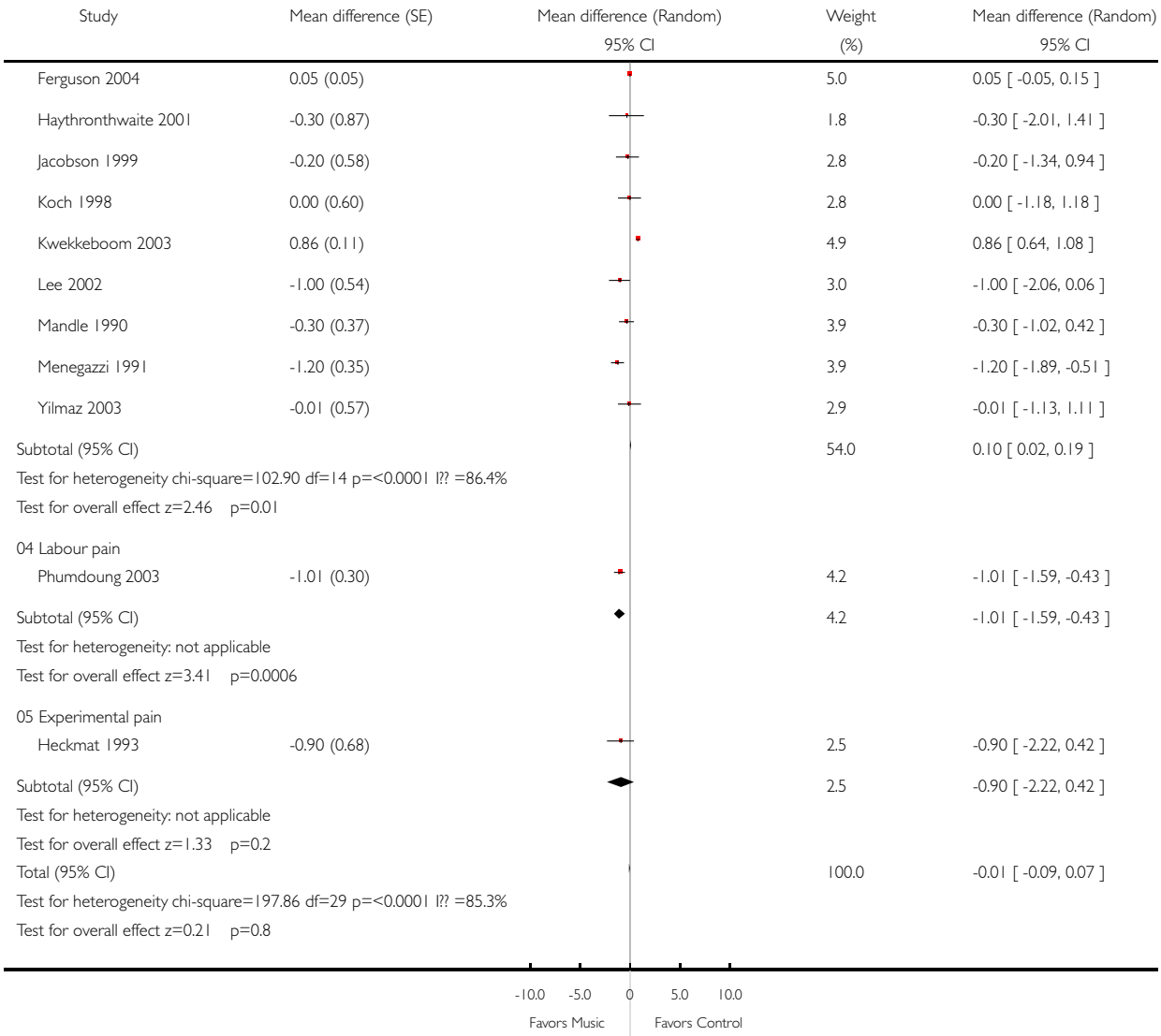


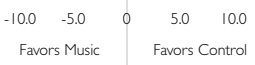
Analysis 03.01. Comparison 03 Effect of music on pain intensity levels by who selected the type of music, Outcome 01 Difference in pain intensity on a 0-10 scale

Review: Music for pain relief

Comparison: 03 Effect of music on pain intensity levels by who selected the type of music

Outcome: 01 Difference in pain intensity on a 0-10 scale

Study	Mean difference (SE)	Mean difference (Random) 95% CI	Weight (%)	Mean difference (Random) 95% CI
01 Selected				
Bally 2003	-0.10 (0.23)		4.5	-0.10 [-0.55, 0.35]
Broscious 1999	0.40 (0.51)		3.2	0.40 [-0.60, 1.40]
Cepeda 1998	0.10 (0.37)		3.8	0.10 [-0.62, 0.82]
Chlan 2000	-0.90 (0.47)		3.3	-0.90 [-1.82, 0.02]
Good 1995	1.35 (0.74)		2.2	1.35 [-0.10, 2.80]
Good 1998	-0.12 (0.83)		2.0	-0.12 [-1.75, 1.51]
Good 1999	-0.60 (0.34)		4.0	-0.60 [-1.27, 0.07]
Haythronthwaite 2001	-0.30 (0.87)		1.8	-0.30 [-2.01, 1.41]
Heitz 1992	-0.40 (0.63)		2.6	-0.40 [-1.63, 0.83]
Jacobson 1999	-0.20 (0.58)		2.8	-0.20 [-1.34, 0.94]
Koch 1998	0.00 (0.60)		2.8	0.00 [-1.18, 1.18]
Kwekkeboom 2003	0.86 (0.11)		4.9	0.86 [0.64, 1.08]
Lee 2002	-1.00 (0.54)		3.0	-1.00 [-2.06, 0.06]
Menegazzi 1991	-1.20 (0.35)		3.9	-1.20 [-1.89, -0.51]
Phumdoung 2003	-1.01 (0.30)		4.2	-1.01 [-1.59, -0.43]
Taylor 1998	0.00 (0.50)		3.2	0.00 [-0.98, 0.98]
Yilmaz 2003	-0.01 (0.57)		2.9	-0.01 [-1.13, 1.11]
Zimmerman 1996	-0.89 (0.50)		3.2	-0.89 [-1.87, 0.09]
Subtotal (95% CI)			58.4	0.20 [0.05, 0.35]
Test for heterogeneity chi-square=96.04 df=17 p=<0.0001 I?? =82.3%				
Test for overall effect z=2.60 p=0.009				
02 No				
Cadigan 2001	0.22 (0.29)		4.2	0.22 [-0.35, 0.79]
Chan 2003	-1.71 (0.34)		4.0	-1.71 [-2.37, -1.05]
El Rakshy 1997	-0.50 (0.55)		3.0	-0.50 [-1.57, 0.57]
Ferguson 2004	0.05 (0.05)		5.0	0.05 [-0.05, 0.15]



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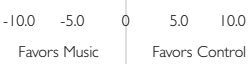
Study	Mean difference (SE)	Mean difference (Random) 95% CI	Weight (%)	Mean difference (Random) 95% CI
Heckmat 1993	-0.90 (0.68)		2.5	-0.90 [-2.22, 0.42]
Laurion 2003	-1.40 (0.66)		2.5	-1.40 [-2.69, -0.11]
Mandle 1990	-0.30 (0.37)		3.9	-0.30 [-1.02, 0.42]
McCaffrey 2003	-2.34 (0.36)		3.9	-2.34 [-3.05, -1.63]
Mullooly 1988	-2.34 (1.80)		0.6	-2.34 [-5.87, 1.19]
Nilsson 2001	0.00 (0.38)		3.8	0.00 [-0.74, 0.74]
Nilsson 2003a	-0.80 (0.27)		4.3	-0.80 [-1.33, -0.27]
Nilsson 2003b	-0.90 (0.33)		4.0	-0.90 [-1.55, -0.25]
Subtotal (95% CI)			41.6	-0.08 [-0.17, 0.01]
Test for heterogeneity chi-square=91.82 df=11 p=<0.0001 I?? =88.0%				
Test for overall effect z=1.81 p=0.07				
Total (95% CI)			100.0	-0.01 [-0.09, 0.07]
Test for heterogeneity chi-square=197.86 df=29 p=<0.0001 I?? =85.3%				
Test for overall effect z=0.21 p=0.8				



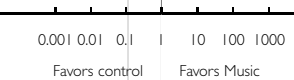
Analysis 04.01. Comparison 04 Effect of music on global pain relief (risk of having at least 50% of pain relief), Outcome 01 Risk of having at least 50% of pain relief

Review: Music for pain relief

Comparison: 04 Effect of music on global pain relief (risk of having at least 50% of pain relief)

Outcome: 01 Risk of having at least 50% of pain relief

Study	Music n/N	Control n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Beck 1991	3/15	1/15		2.7	3.00 [0.35, 25.68]
Gawronska 2002	64/100	12/30		50.7	1.60 [1.01, 2.54]
Kotwal 1998	23/54	15/54		41.2	1.53 [0.90, 2.60]
Uedo 2004	6/14	2/15		5.3	3.21 [0.77, 13.36]
Total (95% CI)	183	114		100.0	1.70 [1.21, 2.37]
Total events: 96 (Music), 30 (Control)					
Test for heterogeneity chi-square=1.25 df=3 p=0.74 I?? =0.0%					
Test for overall effect z=3.10 p=0.002					



Analysis 05.01. Comparison 05 Effect of music on morphine requirements by time (2 and 24 hours after surgery, and during painful procedures), Outcome 01 Difference in morphine requirements

Review: Music for pain relief

Comparison: 05 Effect of music on morphine requirements by time (2 and 24 hours after surgery, and during painful procedures)

Outcome: 01 Difference in morphine requirements

Study	Mean difference (SE)	Mean difference (Random) 95% CI	Weight (%)	Mean difference (Random) 95% CI
01 2 hours				
Laurion 2003	-2.80 (2.12)		4.1	-2.80 [-6.96, 1.36]
Nilsson 2003a	-0.80 (0.64)		16.3	-0.80 [-2.05, 0.45]
Nilsson 2003b	-1.20 (0.64)		16.3	-1.20 [-2.45, 0.05]
Subtotal (95% CI)			36.6	-1.08 [-1.95, -0.21]
Test for heterogeneity chi-square=0.88 df=2 p=0.64 I?? =0.0%				
Test for overall effect z=2.44 p=0.01				
02 24 hours				
Blankfield 1995	-6.10 (6.82)		0.5	-6.10 [-19.47, 7.27]
Good 1995	-0.86 (7.33)		0.4	-0.86 [-15.23, 13.51]
Korunka 1992	-6.10 (1.90)		4.9	-6.10 [-9.82, -2.38]
Migneault 2004	16.40 (13.05)		0.1	16.40 [-9.18, 41.98]
Nilsson 2001	-6.90 (3.60)		1.6	-6.90 [-13.96, 0.16]
Subtotal (95% CI)			7.5	-5.68 [-8.78, -2.58]
Test for heterogeneity chi-square=3.46 df=4 p=0.48 I?? =0.0%				
Test for overall effect z=3.59 p=0.0003				
03 During painful procedure				
Cepeda 1998	-0.64 (0.52)		18.1	-0.64 [-1.66, 0.38]
Kliempt 1999	-0.20 (1.83)		5.2	-0.20 [-3.79, 3.39]
Koch 1998	-6.56 (2.21)		3.8	-6.56 [-10.89, -2.23]
Mandle 1990	-0.49 (1.53)		6.8	-0.49 [-3.49, 2.51]
Schiemann 2002	-0.11 (0.23)		22.0	-0.11 [-0.57, 0.35]
Subtotal (95% CI)			55.9	-0.26 [-0.67, 0.15]
Test for heterogeneity chi-square=9.10 df=4 p=0.06 I?? =56.0%				
Test for overall effect z=1.25 p=0.2				
Total (95% CI)			100.0	-0.48 [-0.85, -0.12]
Test for heterogeneity chi-square=27.18 df=12 p=0.007 I?? =55.9%				
Test for overall effect z=2.59 p=0.01