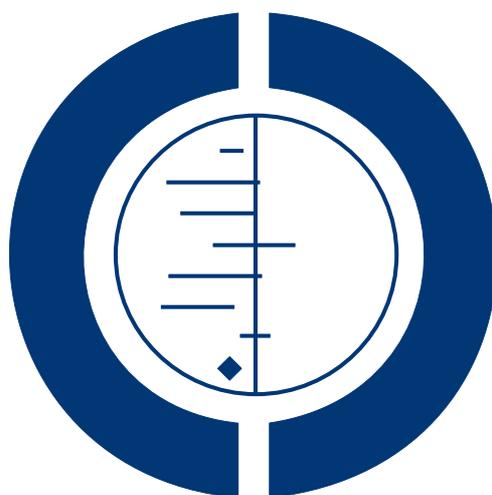


Music interventions for improving psychological and physical outcomes in cancer patients (Review)

Bradt J, Dileo C, Grocke D, Magill L



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[Intervention Review]

Music interventions for improving psychological and physical outcomes in cancer patients

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Editorial group: Cochrane Gynaecological Cancer Group.

Publication status and date: New, published in Issue 8, 2011.

Review content assessed as up-to-date: 25 June 2011.

Citation: Bradt J, Dileo C, Grocke D, Magill L. Music interventions for improving psychological and physical outcomes in cancer patients. *Cochrane Database of Systematic Reviews* 2011, Issue 8. Art. No.: CD006911. DOI: 10.1002/14651858.CD006911.pub2.

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ABSTRACT

Background

Having cancer may result in extensive emotional, physical and social suffering. Music interventions have been used to alleviate symptoms and treatment side effects in cancer patients.

Objectives

To compare the effects of music therapy or music medicine interventions and standard care with standard care alone, or standard care and other interventions in patients with cancer.

Search strategy

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2010, Issue 10), MEDLINE, EMBASE, CINAHL, PsycINFO, LILACS, Science Citation Index, CancerLit, www.musictherapyworld.net, CAIRSS, Proquest Digital Dissertations, ClinicalTrials.gov, Current Controlled Trials, and the National Research Register. All databases were searched from their start date to September 2010. We handsearched music therapy journals and reference lists and contacted experts. There was no language restriction.

Selection criteria

We included all randomized controlled trials (RCTs) and quasi-randomized trials of music interventions for improving psychological and physical outcomes in patients with cancer. Participants undergoing biopsy and aspiration for diagnostic purposes were excluded.

Data collection and analysis

Two review authors independently extracted the data and assessed the risk of bias. Where possible, results were presented in meta analyses using mean differences and standardized mean differences. Post-test scores were used. In cases of significant baseline difference, we used change scores.

Main results

We included 30 trials with a total of 1891 participants. We included music therapy interventions, offered by trained music therapists, as well as listening to pre-recorded music, offered by medical staff. The results suggest that music interventions may have a beneficial effect on anxiety in people with cancer, with a reported average anxiety reduction of 11.20 units (95% confidence interval (CI) -19.59 to -2.82, $P = 0.009$) on the STAI-S scale and -0.61 standardized units (95% CI -0.97 to -0.26, $P = 0.0007$) on other anxiety scales. Results also suggested a positive impact on mood (standardised mean difference (SMD) = 0.42, 95% CI 0.03 to 0.81, $P = 0.03$), but no support was found for depression.

Music interventions may lead to small reductions in heart rate, respiratory rate, and blood pressure. A moderate pain-reducing effect was found (SMD = -0.59, 95% CI -0.92 to -0.27, $P = 0.0003$), but no strong evidence was found for enhancement of fatigue or physical status. The pooled estimate of two trials suggested a beneficial effect of music therapy on patients' quality of life (QoL) (SMD = 1.02, 95% CI 0.58 to 1.47, $P = 0.00001$).

No conclusions could be drawn regarding the effect of music interventions on distress, body image, oxygen saturation level, immunologic functioning, spirituality, and communication outcomes.

Seventeen trials used listening to pre-recorded music and 13 trials used music therapy interventions that actively engaged the patients. Not all studies included the same outcomes and due to the small number of studies per outcome, we could not compare the effectiveness of music medicine interventions with that of music therapy interventions.

Authors' conclusions

This systematic review indicates that music interventions may have beneficial effects on anxiety, pain, mood, and QoL in people with cancer. Furthermore, music may have a small effect on heart rate, respiratory rate, and blood pressure. Most trials were at high risk of bias and, therefore, these results need to be interpreted with caution.

PLAIN LANGUAGE SUMMARY

Can music interventions benefit cancer patients?

Having cancer may result in intense emotional, physical and social suffering. Music therapy and music medicine interventions have been used to alleviate symptoms and treatment side effects in cancer patients. In music medicine interventions, the patient simply listens to pre-recorded music that is offered by a medical professional. Music therapy requires the implementation of a music intervention by a trained music therapist, the presence of a therapeutic process, and the use of personally tailored music experiences.

This review included 30 trials with a total of 1891 participants. The findings suggest that music therapy and music medicine interventions may have a beneficial effect on anxiety, pain, mood, quality of life, heart rate, respiratory rate, and blood pressure in cancer patients. Most trials were at high risk of bias and, therefore, these results need to be interpreted with caution.

No evidence of a difference between music therapy or music medicine and control was found for depression, fatigue, or physical status. However, only a small number of trials investigated the effect of music on these outcomes. We could not draw any conclusions about the effect of music interventions on distress, body image, oxygen saturation level, immunologic functioning, spirituality, and communication outcomes because there were not enough trials looking at these aspects. Therefore, more research is needed.

The limited number of trials in this review prevented a comparison being made between music therapy interventions and pre-recorded music listening offered by medical personnel.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Music interventions versus standard care for cancer patients						
Patient or population: cancer patients Settings: Intervention: music interventions versus standard care						
Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Music interventions versus standard care				
Anxiety (STAI) Scale from: 20 to 80.		The mean Anxiety (STAI) in the intervention groups was 11.20 lower (19.59 to 2.82 lower)		430 (7 studies)	⊕⊕○○ low ^{1,2,3,4}	
Anxiety (non-STAI (full version) measures)		The mean Anxiety (non-STAI (full version) measures) in the intervention groups was 0.61 standard deviations lower (0.97 to 0.26 lower)		469 (6 studies)	⊕○○○ very low ^{1,3,5}	SMD -0.61 (-0.97 to -0.26)
Pain		The mean Pain in the intervention groups was 0.59 standard deviations lower (0.92 to 0.27 lower)		391 (5 studies)	⊕⊕○○ low ^{3,6}	SMD -0.59 (-0.92 to -0.27)

Heart rate	The mean Heart rate in the intervention groups was 3.78 lower (6.5 to 1.06 lower)	235 (5 studies)	⊕⊕○○ low ^{3,7}	
Systolic blood pressure	The mean Systolic blood pressure in the intervention groups was 3.37 lower (7.52 lower to 0.77 higher)	205 (3 studies)	⊕○○○ very low ^{1,3}	
Diastolic blood pressure	The mean Diastolic blood pressure in the intervention groups was 1.22 lower (7.28 lower to 4.84 higher)	205 (3 studies)	⊕○○○ very low ^{1,3}	
Quality of Life	The mean Quality of Life in the intervention groups was 1.02 standard deviations higher (0.58 to 1.47 higher)	88 (3 studies ⁸)	⊕○○○ very low ^{1,3}	SMD 1.02 (0.58 to 1.47)

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: Confidence interval

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

¹ The majority of the trials were assessed as high risk of bias studies.

- ² All point estimates favor music although the magnitude of the effect differs across studies.
- ³ Wide confidence interval, however, this is due to the fact that some studies reported very large beneficial effects of music on anxiety.
- ⁴ Large reduction in anxiety as evidenced by MD of 11.20.
- ⁵ All but one study agreed on the direction of the point estimate. High heterogeneity resulted from the fact that some studies reported very large beneficial effects of music on anxiety.
- ⁶ Two studies have been assessed as low risk of bias, three studies as high risk, and three studies could not be included.
- ⁷ Two studies were assessed as low risk of bias, three studies as high risk of bias.
- ⁸ Only two of the four studies were included in the analysis.

BACKGROUND

Description of the condition

The lifetime risk of developing any type of cancer is 44% for men and 38% for women (NCI 2010) and a diagnosis of cancer may result in extensive emotional, physical and social suffering. Many symptoms and treatment side effects impact on the physical well-being as well as the quality of life (QoL) of the cancer patient, including appetite disturbance, difficulty swallowing, nausea, vomiting, constipation, diarrhea, dyspnea or difficulty breathing, fatigue, insomnia, muscle weakness and numbness (King 2003). In addition, study findings clearly indicate that cancer patients experience elevated levels of psychological distress (Duivenvoorden 1997; Norton 2004; Sellick 1999) and depression (Massie 2004; Parle 1996; Raison 2003) in response to diagnosis and treatment. The actual experience of chemotherapy-induced side effects, such as nausea and vomiting, and their influence on psychological well-being varies widely in patients receiving the same cytotoxic agents. This suggests that non-pharmacological factors possibly play an important role in how patients experience or interpret physical symptoms during the treatment phase (Montgomery 2000; Thune-Boyle 2006).

Description of the intervention

It is therefore important that the care of cancer patients incorporates services that help meet patients' psychological, social and spiritual needs. Music has been used in different medical fields to meet such needs. Research on the effects of music and music therapy for medical patients has burgeoned during the past 20 years and has included a variety of outcome measures in a wide range of specialty areas (Dileo 2005). For adult, as well as pediatric cancer patients, music has been used to decrease anxiety prior to or during surgical procedures (Burns 1999; Haun 2001; Pfaff 1989), to decrease tension during chemotherapy or radiation therapy (Clark 2006; Weber 1996), to lessen treatment side effects (Bozcuk 2006; Ezzone 1998; Frank 1985), to improve mood (Bailey 1983; Barrera 2002; Burns 2001; Cassileth 2003), to enhance pain management (Akombo 2006; Beck 1989), to improve immune system functioning (Burns 2001; Camprubi 1999) and to improve quality of life (QoL) (Burns 2001; Hilliard 2003).

When examining the efficacy of music interventions with cancer patients, it is important to make a clear distinction between music interventions administered by medical or health care professionals (music medicine) and those implemented by trained music therapists (music therapy). A substantive set of data (Dileo 2005) indicates that music therapy interventions with medical populations are significantly more effective than music medicine interventions for a wide variety of outcomes. This difference might be attributed to the fact that music therapists individualize their interventions to meet patients' specific needs, more actively engage

the patients in the music making, and employ a systematic therapeutic process including assessment, treatment and evaluation. As defined by Dileo (Dileo 1999), interventions are categorized as music medicine when passive listening to pre-recorded music is offered by medical personnel. For example, a CD may be offered to a patient for relaxation or distraction; however, no systematic therapeutic process is present, nor is there a systematic assessment of the elements and suitability of the music stimulus. In contrast, music therapy requires the implementation of a music intervention by a trained music therapist, the presence of a therapeutic process, and the use of personally tailored music experiences.

These music experiences include:

- listening to live, improvised or pre-recorded music;
- performing music on an instrument;
- improvising music spontaneously using voice and/or instruments;
- composing music;
- music combined with other modalities (e.g. movement, imagery, art) (Dileo 2007).

Why it is important to do this review

Several research studies on the use of music with cancer patients have reported positive results (Beck 1989; Cassileth 2003; Harper 2001; Hilliard 2003; Robb 2008). The majority of these studies, however, are compromised by small sample size and lack statistical power. In addition, differences in factors such as study designs, methods of interventions and type and intensity of treatment have led to varying results. A systematic review is needed to more accurately gauge the efficacy of music interventions for cancer patients as well as to identify variables that may moderate its effects.

OBJECTIVES

1. To examine the effects of music therapy or music medicine interventions (as defined by the authors in the [Background](#) section) on psychological and physical outcomes in patients with cancer.
2. To compare the effects of music therapy versus music medicine interventions (as defined by the authors).

METHODS

Criteria for considering studies for this review

Types of studies

All RCTs and quasi-randomized trials were eligible for entry.

Types of participants

This review included patients diagnosed with any type of cancer. There were no restrictions as to age, gender, ethnicity or type of setting. Participants undergoing biopsy, bone marrow biopsy and aspiration for diagnostic purposes were excluded from this review.

Types of interventions

The review included all trials in which standard treatment combined with music therapy or music medicine interventions was compared with:

- (a) standard care alone;
- (b) standard care combined with other therapies;
- (c) standard care with placebo.

Placebo treatment can involve the use of headphones for the patient wherein no music stimuli is provided or another type of auditory stimulus is provided (e.g. white noise (hiss), pink noise (sound of ocean waves) or nature sounds).

Types of outcome measures

Primary outcomes

1. Psychological outcomes (e.g. depression, anxiety, anger, hopelessness, helplessness).
2. Physical symptoms (e.g. fatigue, nausea, pain).

Secondary outcomes

1. Physiological outcomes (e.g. cortisol levels, immunoglobulin A (IgA) levels).
2. Social and spiritual support (e.g. family support, spirituality, social activity, isolation).
3. Communication (e.g. verbalization, facial affect, gestures).
4. Quality of life (QoL)

Search methods for identification of studies

There were no language restrictions for either searching or trial inclusion.

Electronic searches

We searched the following electronic databases and trials registers:

1. Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2010, issue 10) (Appendix 1);
2. MEDLINE (OvidSp) (1950 to September 2010) (Appendix 2);
3. EMBASE (OvidSp) (1980 to September 2010) (Appendix 3);

4. CINAHL (EbscoHost)(1982 to September 2010) (Appendix 4);
5. PsycINFO (OvidSp) (1967 to September 2010) (Appendix 5);
6. LILACS (Virtual Health Library) (1982 to September 2010) (Appendix 6);
7. The Science Citation Index (ISI) (to September 2010) (Appendix 7);
8. CancerLit (1983 to 2003) (<http://www.cancer.gov>) (Appendix 8);
9. CAIRSS for Music (September 2010) (<http://ucairss.utsa.edu/>) (Appendix 9);
10. Proquest Digital Dissertations (Proquest) (September 2010) (Appendix 10);
11. ClinicalTrials.gov (<http://www.clinicaltrials.gov/>) (September 2010) (Appendix 11);
12. Current Controlled Trials (<http://www.controlled-trials.com/>) (September 2010) (Appendix 12);
13. National Research Register (<http://www.update-software.com/National/>) (September 2010) (Appendix 13);
14. musictherapyworld.de (database is no longer functional) (March 2008) (Appendix 14);
15. RILM Abstracts of Music Literature (EbscoHost) (1969 to April 2011) (Appendix 15).

Searching other resources

We handsearched the following journals from first available date until September 2010:

- Australian Journal of Music Therapy;
- Australian Music Therapy Association Bulletin;
- Canadian Journal of Music Therapy;
- The International Journal of the Arts in Medicine;
- Journal of Music Therapy;
- Musik-,Tanz-, und Kunsttherapie (Journal for Art Therapies in Education, Welfare and Health Care);
- Musiktherapeutische Umschau;
- Music Therapy;
- Music Therapy Perspectives;
- Nordic Journal of Music Therapy;
- Music Therapy Today (online journal of music therapy);
- Voices (online international journal of music therapy);
- New Zealand Journal of Music Therapy;
- The Arts in Psychotherapy;
- British Journal of Music Therapy.

In an effort to identify further published, unpublished and ongoing trials, we searched the bibliographies of relevant trials and reviews, contacted experts in the field, and searched available proceedings of music therapy conferences. We consulted music therapy association websites to help identify music therapy practitioners and conference information (e.g. American Music Therapy Association (<http://www.musictherapy.org>), The British Society for Music Therapy (<http://www.bsmt.org/>), The Association of

Professional Music Therapists (APMT) (<http://www.apmt.org/>), Music Therapy World (<http://musictherapyworld.net>). We also handsearched the website of the Deutsches Zentrum für Musiktherapieforschung (http://dzm.fh-heidelberg.de/v2/dzm/03_forschung_1_ergebnisse_publicationen.htm).

Data collection and analysis

Selection of studies

We divided the responsibility of the searches, as outlined in the search strategy, amongst all review authors. JB and a research assistant scanned titles and abstracts of each record retrieved from the search and deleted obviously irrelevant references. When a title or abstract could not be rejected with certainty, the other review authors were consulted. We used an inclusion criteria form (Appendix 16) to assess the trial's eligibility for inclusion. We kept a record of all excluded trials that appeared eligible at first and the reason for exclusion.

Data extraction and management

JB and a research assistant independently extracted data from the selected trials using a standardized coding form. Differences in data extraction were discussed and the input of a third review author (CD) was sought when needed. We extracted the following data:

General information

- Author;
- Year of publication;
- Title;
- Journal (title, volume, pages);
- If unpublished, source;
- Duplicate publications;
- Country;
- Language of publication.

Intervention information

- Type of intervention (e.g. singing, song-writing, music listening, music improvisation);
- Music selection (detailed information on music selection in case of music listening);
- Music preference (patient-preferred versus researcher-selected in case of music listening);
- Level of intervention (music therapy versus music medicine as defined by the authors in the background section);
- Length of intervention;
- Frequency of intervention;
- Comparison intervention.

Participants information

- Total sample size;
- Number of experimental group;
- Number of control group;
- Gender;
- Age;
- Ethnicity;
- Diagnosis;
- Illness stage;
- Setting;
- Inclusion criteria.

Outcomes

Pre-test means, post-test means, standard deviations, and sample sizes were extracted for the treatment group and the control group for the following outcomes (if applicable). For some trials only change scores, instead of post-test scores, were available.

- Psychological outcomes (e.g. depression, anxiety, anger, hopelessness, helplessness);
- Physical symptoms (e.g. fatigue, nausea, pain);
- Physiological outcomes (e.g. cortisol levels, IgA levels);
- Relationship and social support (e.g. family support, social activity, isolation);
- Communication (e.g. verbalization, facial affect, gestures);
- QoL.

Assessment of risk of bias in included studies

Two review authors (JB and CD) assessed all included trials for risk of bias and were blinded to each other's assessments. Any disagreements were resolved by discussion. The authors used the following criteria for quality assessment:

Random sequence generation

- Low risk;
- Unclear risk;
- High risk.

Random sequence generation was rated as low risk if every participant had equal chance to be selected for either condition and if the investigator was unable to predict which treatment the participant would be assigned to. Use of date of birth, date of admission or alternation resulted in high risk of bias.

Allocation concealment

- Low risk - methods to conceal allocation include:
 - central randomization;
 - serially numbered, opaque, sealed envelopes;
 - other descriptions with convincing concealment;

- Unclear risk - authors did not adequately report on method of concealment;
- High risk (e.g. alteration methods were used).

Blinding of participants and personnel

- Low risk;
- Unclear risk;
- High risk.

Blinding of outcome assessors

- Low risk;
- Unclear risk;
- High risk.

Incomplete outcome data

We recorded the proportion of participants whose outcomes were analysed. We coded loss to follow-up for each outcome as:

- Low risk: if fewer than 20% of patients were lost to follow-up and reasons for loss to follow-up were similar in both treatment arms;
- Unclear risk: if loss to follow-up was not reported;
- High risk: if more than 20% of patients were lost to follow-up or reasons for loss to follow-up differed between treatment arms.

Selective reporting

- Low risk: reports of the study were free of suggestion of selective outcome reporting;
- Unclear risk;
- High risk: reports of the study suggest selective outcome reporting.

Other sources of bias

- Low risk;
- Unclear risk;
- High risk.

Information on potential financial conflicts of interest was considered as a possible source of additional bias.

The above criteria were used to give each article an overall quality rating (based on *Cochrane Handbook for Systematic Reviews of Interventions*, section 8.7 (Higgins 2011))

A. Low risk of bias - all criteria met.

B. Moderate risk of bias - one or more of the criteria only partly met.

C. High risk of bias - one or more criteria not met.

Studies were not excluded based on a low quality score. We planned to use the overall quality assessment rating for sensitivity analysis. However, since most trials were at high risk of bias, we could not carry out this analysis.

Dealing with missing data

We did not impute missing outcome data. Data were analyzed on an endpoint basis, including only participants for whom final data point measurement was obtained (available case analysis). It was not assumed that participants who dropped out after randomization had a negative outcome.

Assessment of heterogeneity

We investigated heterogeneity using visual inspection of the forest plots as well as the I^2 statistic (Higgins 2002).

Assessment of reporting biases

There were insufficient trials in each of the meta-analyses to assess reporting biases. We had planned to compute funnel plots corresponding to meta-analysis of the primary outcome to assess the potential for small study effects such as publication bias.

Data synthesis

All outcomes in this review were presented as continuous variables. We calculated standardized mean differences for outcome measures using results from different scales. We used mean differences (MD) for results using the same scales. We anticipated that some individual trials would have used final scores and others change scores and even analysis of covariance (ANCOVA) in their statistical analyses of the results. We combined these different types of analyses as MD. We determined not to pool the results in case of significant clinical heterogeneity. We calculated pooled estimates using the more conservative random-effects model. We calculated 95% confidence intervals (CI) for each effect size estimate.

The following treatment comparison was made: Music interventions versus standard care alone.

We had planned to include the following additional treatment comparison but there were insufficient trials to do so: Music interventions versus other therapies or placebo. Therefore, trials comparing music interventions to other therapies or placebo are included in the narrative but not the meta-analysis of this review.

Subgroup analysis and investigation of heterogeneity

The following subgroup analyses were determined a priori, but these could not be carried out because of insufficient numbers of trials per outcome:

- music medicine with music therapy interventions;
- type of intervention (e.g. active music making versus music listening);
- patient-preferred music with researcher-selected music;
- different age groups;
- stages of illness.

Subgroup analyses would have been conducted as described by Deeks et al (Deeks 2001) and as recommended in the *Cochrane*

Handbook for Systematic Reviews of Interventions, section 9.6 (Higgins 2011).

Sensitivity analysis

We examined the impact of sequence generation by comparing the results of including and excluding trials that used inadequate or unclear randomization methods.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#); [Characteristics of studies awaiting classification](#); [Characteristics of ongoing studies](#).

Results of the search

The database searches and handsearching of conference proceedings, journals, and reference lists resulted in 773 unique citations. One review author (JB) and a research assistant examined the titles and abstracts and identified 101 reports as potentially relevant, which were retrieved for further assessment. These were then independently screened by one review author (JB) and a research assistant.

Thirty-six references reporting on 30 trials were included in this review (see [Characteristics of included studies](#)). Where necessary, we contacted chief investigators to obtain additional information on trial details and data. Two ongoing trials were identified (Hunter 2010; O'Brien 2010) and these will be considered in future updates of this review.

Included studies

We included 30 trials with a total of 1891 participants. Nine trials included participants who underwent chemotherapy or radiation therapy (Bulfone 2009; Cai 2001; Clark 2006; Ferrer 2005; Montserrat Gimeno 2008; Smith 2001; Straw 1991; Xie 2001; Zhao 2008), eight trials examined the effects of music during procedures or surgery (Binns-Turner 2008; Bufalini 2009; Burns 2009; Cassileth 2003; Danhauer 2010; Kwekkeboom 2003; Li 2004; Nguyen 2010), and 13 trials included general cancer patients (Allen 2010; Beck 1989; Burns 2001; Burns 2008; Chen 2004; Duocastella 1999; Hanser 2006; Harper 2001; Hilliard 2003; Huang 2006; Robb 2008; Shaban 2006; Wan 2009). Four trials examined music interventions with pediatric patients (Bufalini 2009; Burns 2009; Duocastella 1999; Nguyen 2010). This review included 860 females and 617 males. Four trials did not provide gender distribution information (Danhauer 2010;

Robb 2008; Shaban 2006; Xie 2001). The average age of the participants was 55.05 years for adult trials and 10.98 years for pediatric trials. Eight studies (Allen 2010; Burns 2001; Burns 2008; Cassileth 2003; Duocastella 1999; Ferrer 2005; Robb 2008; Straw 1991) did not report on the ethnicity of the participants. For those trials that did provide information on ethnicity, the distribution was as follows: 53% Caucasian, 37% Asian, 5% Black, 3% Latino, and 2% other. The trials were conducted in seven different countries: USA (Allen 2010; Beck 1989; Binns-Turner 2008; Burns 2001; Burns 2008; Burns 2009; Cassileth 2003; Clark 2006; Danhauer 2010; Ferrer 2005; Hanser 2006; Harper 2001; Hilliard 2003; Kwekkeboom 2003; Montserrat Gimeno 2008; Robb 2008; Smith 2001; Straw 1991), China (Cai 2001; Chen 2004; Li 2004; Wan 2009; Xie 2001; Zhao 2008), Italy (Bufalini 2009; Bulfone 2009), Iran (Shaban 2006), Spain (Duocastella 1999), Taiwan (Huang 2006), and Vietnam (Nguyen 2010). Trial sample size ranged from 8 to 260 participants.

Thirteen trials were classified as music therapy studies (Allen 2010; Bufalini 2009; Burns 2001; Burns 2008; Burns 2009; Cassileth 2003; Clark 2006; Duocastella 1999; Ferrer 2005; Hanser 2006; Hilliard 2003; Montserrat Gimeno 2008; Robb 2008). Of these trials, seven used interactive music making with the participants, four used music-guided imagery, one used music-guided relaxation, and one used music video making. Seventeen trials were classified as music medicine studies, as defined by the authors in the background section, and used listening to pre-recorded music as the intervention.

Frequency and duration of treatment sessions greatly varied among the trials. The total number of sessions ranged from one session to 40 sessions. Most sessions lasted 30 to 45 minutes. Details on frequency and duration of sessions for each trial are included in the [Characteristics of included studies](#) table.

Twenty-eight trials used parallel group designs, whereas two trials used a cross-over design (Beck 1989; Montserrat Gimeno 2008). Not all trials measured all outcomes identified for this review. Details of the trials included in the review are shown in the [Characteristics of included studies](#) table.

Excluded studies

Twenty-seven of the 101 reports that were retrieved for further assessment turned out not to be outcome research studies. We identified 38 experimental research studies that appeared eligible for inclusion. However, we excluded these after closer examination or after receiving additional information from the chief investigators. Reasons for exclusions were: (1) not a randomized or quasi-randomized controlled trial (29 studies), (2) insufficient data reporting (two studies), (3) unacceptable methodological quality (three studies), (4) not music intervention (one study), (5) not exclusively cancer patients (one study), and (6) article could not be located (two studies). For studies with insufficient data reporting or those that could not be located, we attempted to contact the authors on multiple occasions.

Details about reasons for exclusion are provided in the [Characteristics of excluded studies](#) table.

Risk of bias in included studies

We included 19 trials that used appropriate methods of randomization (e.g. computer-generated table of random numbers, draw of lots, flip of coins), three trials that used alternate group assignment as allocation method, and eight trials that reported using randomization but failed to state the randomization method.

Sixteen trials used allocation concealment whereas six trials did not. For the remainder of the trials, use of allocation concealment was not mentioned.

Only four trials reported blinding of the outcome assessors for objective measures. For two trials, the use of blinding was unclear. The other trials did not use blinding. However, it is important to point out that blinding of outcome assessors is not possible in the case of subjective measurement tools (e.g. STAI ([Spielberger 1983](#))) unless the participants are blinded to the intervention. Blinding of the participants is often not feasible in music therapy and music medicine studies. This may introduce possible bias.

The dropout rate was small for most trials, namely between 0 and 16.6%. Four trials reported dropout rates of more than 20% ([Beck 1989](#); [Burns 2008](#); [Hanser 2006](#); [Montserrat Gimeno 2008](#)). For eight trials, it was unclear whether there were any partici-

pant withdrawals. Most trials reported reasons for dropout. Detailed information on dropout rate and reasons is included in the [Characteristics of included studies](#) table.

As a result, only one trial ([Nguyen 2010](#)) was at low risk of bias for objective outcomes as it satisfied all criteria used to assess risk of bias. Twenty-seven trials were at high risk of bias. One trial ([Binns-Turner 2008](#)) was at moderate risk of bias. The main reason for receiving a high risk of bias rating was the lack of blinding. As pointed out above, blinding is often impossible in music therapy and music medicine studies that use subjective outcomes, unless in studies where the music intervention is compared to another treatment intervention (e.g. progressive muscle relaxation). This is especially true for music therapy studies that use active music making. Therefore, it appears impossible for these types of studies to receive a low or even moderate risk of bias even if all other risk factors (e.g. randomization, allocation concealment, etc.) have been adequately addressed.

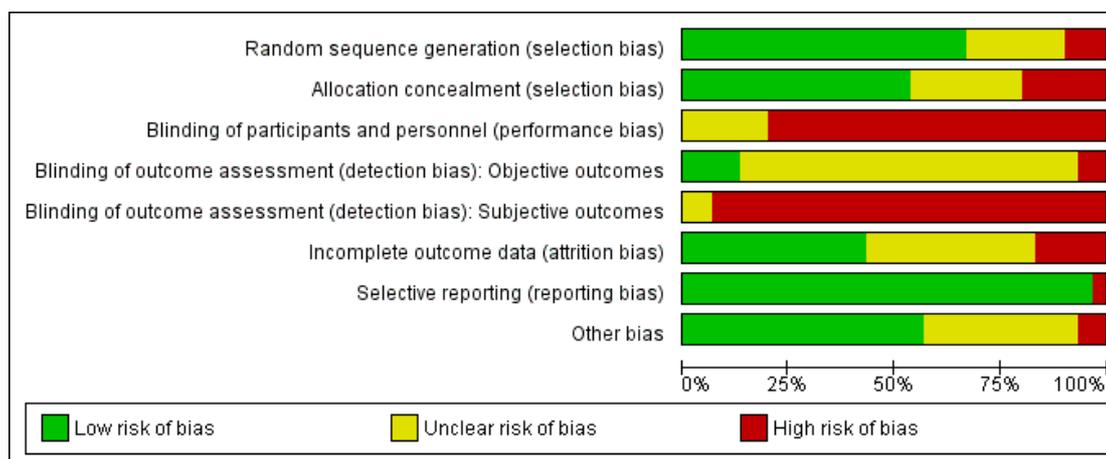
It is worth noting that the Chinese trials were particularly problematic in terms of providing sufficient information regarding risk of bias. It is unclear, however, if this was due to incomplete translations or lack of detail in the original trial reports.

Risk of bias is detailed for each trial in the risk of bias tables included with the [Characteristics of included studies](#) table and the Risk of Bias Summary ([Figure 1](#)). In addition, an overall assessment of risk of bias can be viewed in [Figure 2](#).

Figure 1. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias); Objective outcomes	Blinding of outcome assessment (detection bias); Subjective outcomes	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Allen 2010	+	+	-	?	-	?	+	-
Beck 1989	+	+	?	?	-	-	+	+
Binns-Turner 2008	+	+	?	+	-	+	+	+
Bufalini 2009	?	?	-	?	-	?	+	?
Bulfone 2009	-	-	-	?	-	+	+	?
Burns 2001	+	+	-	?	-	+	+	+
Burns 2008	?	?	-	?	-	-	-	+
Burns 2009	+	?	-	?	-	+	+	+
Cai 2001	?	?	-	?	-	?	+	?
Cassileth 2003	+	+	-	?	-	+	+	+
Chen 2004	+	-	-	?	?	?	+	?
Clark 2006	+	+	-	?	-	+	+	?
Danhauer 2010	+	+	?	?	-	+	+	+
Duocastella 1999	+	+	-	+	-	+	+	?
Ferrer 2005	?	?	-	?	-	?	+	+
Hanser 2006	+	+	-	?	-	-	+	-
Harper 2001	+	?	-	-	-	+	+	+
Hilliard 2003	+	+	-	+	-	?	+	+
Huang 2006	+	+	?	?	?	+	+	+
Kwekkeboom 2003	+	+	-	?	-	+	+	+
Li 2004	?	?	?	?	-	?	+	?
Montserrat Gimeno 2008	?	+	-	-	-	-	+	+
Nguyen 2010	+	?	+	-	-	+	+	+
Robb 2008	-	-	-	?	-	+	+	+
Shaban 2006	-	-	-	?	-	?	+	?
Smith 2001	+	+	-	?	-	+	+	+
Straw 1991	+	+	-	?	-	?	+	+
Wan 2009	+	-	-	?	-	?	+	?
Xie 2001	?	?	-	?	-	?	+	?
Zhao 2008	+	-	-	?	-	?	+	?

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Effects of interventions

See: [Summary of findings for the main comparison Music interventions versus standard care for cancer patients](#)

Primary outcomes

Psychological outcomes

State anxiety

Sixteen trials examined the effects of music interventions on anxiety in participants with cancer. Nine trials measured anxiety by means of the Spielberger State-Trait Anxiety Inventory - State Anxiety form (STAI-S) (Binns-Turner 2008; Bufalini 2009; Bulfone 2009; Danhauer 2010; Harper 2001; Kwekkeboom 2003; Smith 2001; Straw 1991; Wan 2009), one trial used the STAI-short form (Nguyen 2010), and six trials reported mean anxiety measured by other scales such as numeric rating scale and visual analogue scale (Cai 2001; Cassileth 2003; Ferrer 2005; Hanser 2006; Li 2004; Zhao 2008). The data of one trial (Burns 2008) could not be included because no post-test or follow-up scores were reported. Follow-up scores (4 weeks post-intervention) were received from the author, but these could not be combined with the post-test scores of the other trials. Moreover, Burns reported a large moderating effect of pre-intervention affect state scores on post-test scores and follow-up scores. The data of another trial (Kwekkeboom 2003)

were not included in the meta-analysis because this study suffered from a serious flaw in the implementation of the intervention. Participants in this trial listened to music while undergoing painful medical procedures. However, they reported that the use of headphones prevented them from hearing the surgeon, increasing their anxiety.

A meta-analysis of seven trials that only used the full STAI-State Anxiety form (STAI-S) to examine state anxiety in 386 participants indicated a significantly lower state of anxiety in participants who received standard care combined with music interventions than those who received standard care alone (MD = -11.20, 95% CI -19.59 to -2.82; P = 0.009). Statistical heterogeneity across the trials (I² = 93%) was due to some trials (Binns-Turner 2008; Harper 2001; Wan 2009) reporting much larger beneficial effects of music interventions than others (Analysis 1.1). In the trial by Kwekkeboom, participants in the music listening group reported higher levels of anxiety at post-test (mean = 33.45, standard deviation (SD) = 1.77) than those in the standard care group (mean = 30.59, SD = 1.93) but this difference was not statistically significant. A sensitivity analysis, deleting those trials that used inadequate methods of randomization (Bulfone 2009) or for which the method of randomization was unclear (Bufalini 2009; Wan 2009), resulted in a more conservative mean difference of -9.46 (95% CI -19.01 to 0.09, P = 0.05, I² = 83%) (Analysis 1.1).

The standardized mean difference (SMD) of those trials that reported post-test anxiety scores on measures different than the

STAI-S full form (Cai 2001; Cassileth 2003; Ferrer 2005; Hanser 2006; Li 2004; Zhao 2008) (N = 469) also suggested an anxiety-reducing effect of music (SMD = -0.61, 95% CI -0.97 to -0.26, P = 0.0007). The results were inconsistent across the trials (I² = 67%) (Analysis 1.2). The data of one trial (Cassileth 2003) were not included in the meta-analysis because change scores and final scores should not be combined for the computation of a SMD. However, the data by Cassileth and colleagues agreed with the meta-analysis results, reporting a greater effect of music therapy on anxiety (mean change score = -2.6, SD = 2.5) than standard care alone (mean change score = -0.9, SD = 3.0). A sensitivity analysis to examine the impact of randomization method, excluding the data of three trials (Cai 2001; Ferrer 2005; Li 2004), resulted in a smaller SMD of -0.54 (95% CI -1.33 to 0.26; I² = 83%), and this result was no longer statistically significant (P = 0.19) (Analysis 1.2).

One trial (Straw 1991) compared guided imagery and relaxation training to music listening and found that both interventions significantly reduced state anxiety (guided imagery post-test mean = 38.6, SD = 10.01; music listening post-test mean = 34.22, SD = 10.12). An ANCOVA analysis with pre-test anxiety scores as covariate indicated that the difference in effect of the two interventions on state anxiety was not statistically significant.

Depression

Five trials (Cai 2001; Cassileth 2003; Clark 2006; Hanser 2006; Wan 2009) examined the effects of music on depression in 468 participants. Their pooled estimate did not find support for an effect of music (SMD = -0.07, 95% CI -0.40 to 0.27, P = 0.69) and the results were inconsistent across trials (I² = 64%) (Analysis 1.3).

Distress

Two trials examined the effects of music therapy on reduction of distress. Their results could not be pooled because one trial used an audiobook control group whereas the other used a standard care control group (Analysis 1.4). Burns and colleagues (Burns 2009) compared a music therapy intervention in which patients created a music video with listening to audiobooks in adolescents and young adults during stem-cell transplantation. Both groups reported an increase in distress post-intervention. Follow-up measures at 100 days after the stem-cell transplantation indicated a lower mean distress score for the music therapy group (mean = 1.67, SD = 0.55) than the audiobook group (mean = 2.00, SD = 0.64). Hanser (Hanser 2006) compared the effects of music therapy with usual care on distress in 42 women with metastatic breast cancer. There were no statistically significant differences between the music therapy group (post-test mean = 10.5, SD = 5.3) and the standard care group (post-test mean = 9.1, SD = 6.7).

Body image

One study (Allen 2010) reported on the effects of music therapy compared to a cognitive-behavioral based support group on body image in 11 women with breast cancer. The music therapy sessions resulted in greater improvements in body image than the cognitive-behavioral based support group sessions (mean post-test scores of 114 and 146.2, respectively; SD were not reported) (P = 0.03).

Mood

The pooled estimate of three trials (Beck 1989; Cassileth 2003; Duocastella 1999) (N = 105) indicated that music interventions may improve mood in patients with cancer (SMD = 0.42, 95% CI 0.03 to 0.81, P = 0.03), and the results were consistent across studies (I² = 0%) (Analysis 1.5). All trials used adequate methods of randomization, therefore, no sensitivity analysis was performed for this outcome measure. The data of one trial (Burns 2001) could not be included in the meta-analysis because the authors did not use a constant in the computation of their scores, as recommended in the Profile of Mood States (POMS) (McNair 1971) scoring guide. The results of the meta-analysis were robust to the trial by Burns (Burns 2001) who reported a mean post-test score of -48.25 (SD = 32.96) for the music therapy group and a mean post-test score of 20.75 (SD = 30.87) for the control group.

Physical symptoms

Pain

Seven trials compared the effects of music versus standard care on pain (Binns-Turner 2008; Clark 2006; Danhauer 2010; Huang 2006; Kwekkeboom 2003; Nguyen 2010; Wan 2009). The data of the Clark study could not be included in the meta-analysis because of the use of change scores. The pooled estimate of the six remaining trials did not find evidence of a difference between the two groups for a pain-reducing effect of music (SMD = -0.23, 95% CI -0.84 to 0.38, P = 0.46). However, Kwekkeboom compared the effects of music listening, audiotape, and standard care on procedural pain and anxiety and found that participants did not like wearing the headsets as it prevented them from hearing the surgeon, causing greater anxiety (Kwekkeboom 2003). The literature suggests that increased anxiety leads to increased pain perception (McCracken 2009). Therefore, a subsequent analysis excluding Kwekkeboom's data resulted in a moderate effect (Cohen 1988) of music on pain perception in 391 participants with cancer (SMD = -0.59, 95% CI -0.92 to -0.27, P = 0.0003). There was some disagreement between the trials on the size of the effect (I² = 54%) (Analysis 1.6). Clark found that music therapy resulted in greater pain reduction (mean change score = -0.44, SD = 2.55) than standard care (mean change score = 0.45, SD = 1.87) (Clark 2006).

For one trial (Wan 2009), the randomization method was unclear. A sensitivity analysis excluding this trial resulted in a larger SMD of -0.72 (95% CI -0.97 to -0.46, $P = 0.00001$), and the results were consistent across trials ($I^2 = 31\%$).

Two trials compared the effects of music to other interventions. Beck used a 60-cycle hum as the placebo condition in a cross-over trial and found that music listening led to greater pain reduction (mean change score = -9.27, SD = 18.86) than the placebo condition (mean change score = -5.69, SD = 17.9) in 36 participants (Beck 1989). Shaban compared progressive muscle relaxation (PMR) to music listening and found that PMR was more effective in reducing pain (mean post-test score = 6.22, SD = 2.45) than listening to pre-recorded music (mean post-test score = 4.96, SD = 2.76) in 100 participants (Shaban 2006).

Fatigue

Three trials (Cassileth 2003; Clark 2006; Ferrer 2005) examined the effects of music listening on fatigue in 159 participants. Their pooled estimate indicated no evidence of effect for music interventions (SMD = -0.44, 95% CI -0.99 to 0.11, $P = 0.11$) and the results were inconsistent across studies ($I^2 = 66\%$) (Analysis 1.7). Burns (Burns 2008) also collected data on fatigue, however, post-intervention data were not reported. The Burns trial also provided us with 4-week post-intervention follow-up scores, but could not provide the immediate post-test scores. This prevented us from pooling the Burns data with the other three studies.

Physical status

Three trials (Hanser 2006; Hilliard 2003; Xie 2001) examined the effects of music on participants' physical status. The results of one trial (Hanser 2006) could not be included in the pooled estimate because of the use of change scores. The pooled estimate of one music therapy trial (Hilliard 2003) and one music medicine trial (Xie 2001) indicated no evidence for an effect of music on physical status in 340 participants with cancer (SMD = 1.51, 95% CI -1.02 to 4.04, $P = 0.24$). The results were highly inconsistent ($I^2 = 99\%$) with the Xie trial reporting a much larger beneficial effect (Analysis 1.8) (Xie 2001). In Hanser's trial, music therapy led to a greater improvement in physical status (mean change score = 2.0, SD = 4.6) than standard care (mean change score = -0.4, SD = 3.65), but this difference was not statistically significant (Hanser 2006).

Secondary outcomes

Physiological outcomes

Heart rate

Five trials (Binns-Turner 2008; Ferrer 2005; Harper 2001; Nguyen 2010; Zhao 2008) examined the effects of music on heart rate, using a standard care control group, in 235 participants. Their pooled estimate showed a significant effect on heart rate, favoring music interventions over standard care (MD = -3.78, 95% CI -6.50 to -1.06, $P = 0.007$), and the results were consistent across studies (Analysis 1.9). A sensitivity analysis excluding the Ferrer trial (Ferrer 2005) because of unknown randomization method, resulted in a larger effect (MD = -4.63, 95% CI -7.64 to -1.63, $P = 0.002$, $I^2 = 0\%$) (Analysis 1.9)).

One cross-over trial compared the effect of music and imagery with imagery alone (Montserrat Gimeno 2008). Both interventions resulted in statistically significant decreases in heart rate from pre-test to post-test: the music and imagery group's mean heart rate reduced from 89.58 beats per minute (bpm) (SD = 17.32) at pre-test to 78.84 bpm (SD = 13.46) at post-test; the imagery only group's mean heart rate was reduced from 93.31 bpm (SD = 15.76) to 81.05 bpm (SD = 13.96), but the difference between the two interventions was not statistically significant.

Respiratory rate

The pooled estimate of two trials (Nguyen 2010; Zhao 2008) ($N = 135$) suggested that music may reduce respiratory rate (MD = -2.34, 95% CI -4.51 to -0.17, $P = 0.03$). Both studies agreed on the beneficial effects of music on respiratory rate but the studies did not agree on the size of such effects ($I^2 = 69\%$) (Analysis 1.10). Both trials used appropriate methods of randomization.

Systolic blood pressure

A pooled estimate of -3.37 mmHg (95% CI -7.52 to 0.77) ($N = 205$) (Ferrer 2005; Harper 2001; Nguyen 2010; Zhao 2008) was found for systolic blood pressure (SBP), favoring music interventions, but this difference of effect was not statistically significant ($P = 0.11$). The results were consistent across studies (Analysis 1.11). However, excluding the Ferrer trial because of lack of clarity regarding randomization method used, resulted in a larger effect that was statistically significant (MD = -5.95, 95% CI -10.80 to -1.10, $P = 0.02$) and consistent across studies ($I^2 = 0\%$) (Analysis 1.11).

Diastolic blood pressure

The pooled estimate of -1.22 mmHg (95% CI -7.28 to 4.84) ($N = 205$) (Ferrer 2005; Harper 2001; Nguyen 2010; Zhao 2008) was found for diastolic blood pressure (DBP) which was not statistically significant ($P = 0.69$) and inconsistent across studies ($I^2 = 83\%$) (Analysis 1.12). Similar to the SBP analysis, excluding the Ferrer trial in a sensitivity analysis resulted in a larger MD of -4.28 (95% CI -7.14 to -1.42) that was statistically significant ($P = 0.003$), and the effect was consistent across studies ($I^2 = 11\%$) (Analysis 1.12).

Mean arterial pressure

One trial (Binns-Turner 2008) with 30 participants reported on the effects of music on mean arterial pressure (MAP) and found a large decrease in MAP for the music group (mean change score = -15.1, SD = 17.1, 95% CI -23.76 to -6.44). In contrast, participants in the standard care group experienced an increase in MAP (mean change score = 4.5, SD = 15.3, 95% CI -3.25 to 12.25).

Oxygen saturation level

One trial (Nguyen 2010) with 40 participants reported no effects for music listening on oxygen saturation levels in children undergoing lumbar puncture (LP) (mean score during LP = 99.2, SD = 1.14; mean post-test score = 99.7, SD = 0.49) compared to standard care (mean score during LP = 98.0, SD = 2.77; mean post-test score = 99.2, SD = 1.47).

Immune system functioning

Two trials examined the effects of music on immune system functioning. In one trial (Duocastella 1999) with 30 children they found that live music making with children led to a greater increase in Immunoglobulin A (IgA) levels (mean change score = 7.07, SD = 34.52) than engaging children in activities that did not involve music (mean change score = 4.13, SD = 41.02), but this difference was not statistically significant. Another trial compared music listening to standard care in 46 participants and found the following post-test differences for indicators of immune system functioning, namely CD3 (music: mean = 44, SD = 12.62; control: mean = 36.73, SD = 11.01), CD4/CD8 (music: mean = 1.67, SD = 0.76; control: mean = 1.32, SD = 1.01), and natural killer (NK) cell activity (music: mean = 25.23, SD = 15.20; control: mean = 21.36, SD = 12.86), indicating a positive effect of music listening on the immune system in women with breast cancer (Chen 2004). CD3 and CD4/CD8 are proteins that play a role in immune system functioning.

Social and spiritual support

Spirituality

Two music therapy trials examined the impact of music therapy on participants' spirituality. One trial compared music therapy to usual care using the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being subscale (FACIT-Sp) (Hanser 2006). Results indicated no statistically significant difference between the two groups (music therapy mean change score = 2.5 (SD = 8.56); control group mean change score = 0.7 (SD = 6.95)). Burns and colleagues compared music therapy with an audiobook control using the Reed Spiritual Perspective Scale with 10 adolescents and young adults during stem-cell transplantation (Burns 2009). Whereas the mean spirituality scores remained the same for the music therapy group (baseline mean = 4.93 (SD = 0.71); post-intervention mean = 4.93 (SD = 0.62), they slightly increased for the audiobook control group (baseline mean = 4.30 (SD = 1.11);

post-intervention mean = 4.50 (SD = 1.04). Follow-up measures at 100 days after the stem-cell transplantation suggested an improvement in spirituality in the music therapy group (mean = 5.10, SD = 0.61) but not in the control group (mean = 4.60, SD = 1.49).

Communication

One trial in children with cancer (Robb 2008) compared the effects of one session of active music making to music listening and audio story books on 55 children's levels of active engagement and initiation. Active music therapy sessions led to higher active engagement (post-test mean = 26.03, SD = 4.1) than music listening (post-test mean = 15.65, SD = 6.2) ($P < 0.0001$) or audio story-books (post-test mean = 15.17, SD = 4.9) ($P < 0.0001$). These differences were statistically significant. Active music making (post-test mean = 14.19, SD = 8.3) and music listening (post-test mean = 15.89, SD = 11.2) also increased the child's initiation behavior compared to the audio storybooks (post-test mean = 7.43, SD = 6.6). These differences were also statistically significant ($P = 0.04$ and $P = 0.002$, respectively).

Quality of life

Four trials compared the impact of music interventions to standard care on QoL (Burns 2001; Hanser 2006; Hilliard 2003; Xie 2001). Because of large pre-test differences, change scores had to be used for one trial (Hanser 2006) and, therefore, those results could not be included in the pooled estimate. Meta-analysis of the three other trials (Burns 2001; Hilliard 2003; Xie 2001) ($N = 348$) resulted in a heterogeneous, non-significant effect of 2.01 (95% CI -0.09 to 4.11, $P = 0.06$) with the Xie trial (Xie 2001) again reporting a much larger beneficial effect than the two music therapy trials (Burns 2001; Hilliard 2003) (Analysis 1.13). The pooled estimate of the two music therapy trials ($N = 88$) resulted in a homogeneous, large effect (Cohen 1988) of music therapy on QoL (SMD = 1.02, 95% CI 0.58 to 1.47, $P = 0.00001$). Both studies used appropriate methods of randomization. In the Hanser trial, music therapy resulted in a greater improvement in QoL (mean change score = 2.0, SD = 4.6) than standard care (mean change score = -0.4, SD = 3.65), but this difference was not statistically significant (Hanser 2006).

One music therapy trial (Burns 2009) and one music medicine trial (Straw 1991) compared music to other interventions. Burns, comparing music therapy to an audiobook control, found a small increase in QoL in the music therapy group (mean change score = 0.31, SD = 1.73, $N = 7$) and a small decrease in the control group (mean change score = -0.22, SD = 1.24, $N = 3$). However, the sample size was too small to draw any meaningful conclusions. Straw compared a guided imagery and relaxation intervention to music listening and found that music listening led to a greater increase in QoL (mean change score = 16.33, SD = 20.73) than the guided imagery and relaxation group (mean change score = 4.6, SD = 20.49).

DISCUSSION

Summary of main results

The results of 16 trials suggest that music therapy and music medicine interventions may have a beneficial effect on anxiety in people with cancer, with a reported anxiety reduction of 11.20 units, on average, on the STAI-S and -0.61 standardized units on other anxiety scales. Although the magnitude of the effect differed across the studies, the trials agreed on the direction of the point estimates. These anxiety-reducing results are consistent with the findings of two other Cochrane systematic reviews on the use of music with coronary heart disease patients (Bradt 2009) and the use of music with mechanically ventilated patients (Bradt 2010b). As for mood, the pooled estimate of three trials indicate that music interventions may help improve the mood of people with cancer. However, five trials looking at depression specifically did not find evidence of an effect of music.

As for the effect of music on physical symptoms, the results of six trials suggest that music has a moderate pain-reducing effect of -0.54 standardized units. No evidence was found for an effect of music on fatigue or physical status. Reduction of anxiety and pain are important outcomes for this population as they have an impact on the patients' health and overall QoL.

It is important that careful consideration is given to the implementation of music listening interventions. The results of one study (Kwekkeboom 2003) indicate that listening to music through headphones may be contraindicated during painful procedures because it prevents the patient from hearing instructions or comments by the surgeon. This may greatly increase patients' anxiety and, consequently, their perceived pain. In this case, it is better to listen to music without headphones.

Furthermore, results suggest that music interventions may have a beneficial effect on several physiological responses in patients with cancer. Listening to music may reduce heart rate by an average of 4 beats per minute and respiratory rate by an average of 2 breaths per minute. These results are consistent with the findings of a Cochrane systematic review on the use of music with coronary heart disease patients (Bradt 2009) which reported a heart rate reduction of 6.44 bpm for patient-selected music and 2.74 for researcher-selected music, and a respiratory rate reduction of 3.05 breaths per minute. Similar results were reported in a Cochrane review on music interventions for mechanically ventilated patients (Bradt 2010b), namely a mean heart rate reduction of 4.75 bpm and a mean respiratory rate reduction of 3.18 breaths per minute. In the case of a resting heart rate within normal range, a reduction of 4 bpm may not be clinically significant. However, in case of a tachycardiac rate, this reduction may be important. In a study examining the quantitative relationship between resting heart rate reduction and clinical benefit, it was found that each 10 bpm reduction in heart rate is estimated to reduce the relative risk of cardiac death by 30% (Cucherat 2007). The results of this review

also indicate that listening to music may have a beneficial effect on SBP and DBP. Trials on music listening with cardiac patients have also reported reductions in blood pressure (Bradt 2009). The reduction of heart rate, respiratory rate, and blood pressure corresponds with the anxiety-reducing effects found by subjective outcome measures in this review.

Single trials included in this review found support for a beneficial effect of music on mean arterial pressure and immunologic function, but no support for oxygen saturation level.

Finally, the results suggest that music interventions may have a large effect on QoL in cancer patients but no support was found for an effect on spirituality.

For all outcomes, the sensitivity analyses were robust to the original conclusions.

The [Summary of findings for the main comparison](#) provides a summary of the main results of this review with associated risks

Overall completeness and applicability of evidence

This review included 30 randomized controlled trials and quasi-randomized trials.

Seventeen trials used listening to pre-recorded music and 13 trials used music therapy interventions that actively engaged the patients ([Characteristics of included studies](#)). Because not all studies included the same outcomes and due to the small number of studies per outcome, we could not compare the effectiveness of music medicine interventions with that of music therapy interventions.

In general the trials that used listening to pre-recorded music included limited information about the music selections used, except for mentioning general music styles (e.g. new age, classical music, easy listening, etc.). Music within each of these styles can vary widely and more detailed information would help clinicians make well-informed decisions regarding music selections.

The frequency and duration of the interventions widely varied across the trials. The limited number of trials per outcome did not allow for a subgroup analysis to examine frequency and duration as moderator variables. Twelve trials offered a single music session. We would like to suggest that offering multiple music listening sessions allows for the patient to give feedback about the music, select different music if needed, and become more skilled in using music for relaxation purposes. In the case of music therapy interventions, multiple sessions allow for the development of a therapeutic relationship and deepening of the therapeutic process through the music. This may lead to greater health benefits. At this time, however, the relationship between the frequency and duration of treatment and treatment effect remains unclear. Further investigation into the optimal frequency and duration of music interventions for specific outcomes in people with cancer is needed. Presently, no data can be provided regarding cost or cost-effectiveness of music therapy or music medicine applications in the

care of cancer patients as these data were not included in the trials reviewed.

Quality of the evidence

Because of the large number of trials at high risk of bias, the findings of this review need to be interpreted with caution. Often blinding of participants is not possible in music medicine or music therapy studies unless a comparative design is used. Many of the trials in this review included subjective outcomes, such as anxiety, pain, mood, quality of life, and more. When participants cannot be blinded to the intervention, there is definitely an opportunity for bias when they are asked to report on these subjective outcomes. For many trials, the chief investigators needed to be contacted to provide additional methodological and statistical information, which improved the quality of evidence in the review.

For anxiety and pain, moderate to large effects were obtained across studies. For anxiety, the trials did not agree on the size of effect, with some reporting much larger beneficial effects than other trials, resulting in a large confidence interval. Lack of precision, as evidenced by a large CI, was also a problem with other outcomes included in this review.

In summary, the quality of evidence was low ([Summary of findings for the main comparison](#)).

Potential biases in the review process

The strength of our review is that we searched all available databases and a large number of music therapy journals (English, German, and French language), checked reference lists of all relevant trials, contacted relevant experts for identification of unpublished trials, and included publications without restricting language. In spite of such a comprehensive search, it is still possible that we missed some published and unpublished trials. We requested additional data where necessary for all trials we considered for inclusion. This allowed us to get accurate information on the trial quality and data for most trials and helped us make well-informed trial selection decisions.

We are confident that our detailed search strategy combined with extensive handsearching identified all relevant trials. It is possible that we did not identify some grey literature; however, it is doubtful that this would have had a significant impact on our results. Grey literature tends to include trials with relatively small numbers of participants and inconclusive results ([McAuley 2000](#)).

AUTHORS' CONCLUSIONS

Implications for practice

This systematic review indicates that music interventions may have beneficial effects on anxiety, pain, mood and QoL in people with cancer. Furthermore, the results suggest that music may reduce heart rate, respiratory rate, and blood pressure, though this reduction is rather small and therefore may not be clinically significant. Evidence of the trials included in this review suggest that music interventions may be offered as a complementary treatment to people with cancer.

This review included both music therapy and music medicine studies, as defined by the authors in the background section. Music therapists who work with cancer patients do not limit their interventions to offering music listening for relaxation purposes. Music therapists are specially trained clinically and academically to carefully select music interventions to offer emotional and spiritual support, support communication with loved ones, enhance sense of control, and improve physical well-being in patients with cancer. However, the limited number of trials per outcome in this review precluded a comparative analysis between music therapy interventions and pre-recorded music listening offered by medical personnel.

No evidence of effect was found for depression, fatigue, and physical status. However, only a small number of trials investigated the effects of music on these outcomes. More research is needed. No conclusions can be drawn at this time regarding the effects of music interventions on distress, body image, mean arterial pressure, oxygen saturation level, immunologic functioning, spirituality, and communication behaviors because the results of the studies that included these outcomes could not be pooled or because only one trial could be identified.

Implications for research

This systematic review provides evidence that music interventions may have beneficial effects on anxiety, pain, mood, QoL, heart rate, respiratory rate, and blood pressure in patients with cancer. However, more RCTs are needed for these outcomes to determine the effectiveness of music medicine versus music therapy. This can be achieved by including more music medicine as well as music therapy RCTs in future reviews, when these become available or, alternatively, future trials could directly compare the effects of these two types of interventions.

As stated in other reviews ([Bradt 2009](#); [Bradt 2010a](#); [Bradt 2010b](#)), it is important that qualitative research and results of non-RCT research be considered, as these enhance understanding of the qualitative aspects of a patient's experience and identify factors that may contribute to or limit the effectiveness of music therapy or music medicine interventions.

Future trials that use listening to pre-recorded music should report greater details related to the music selections made available to participants and exercise greater care in selecting music that reflects

the patient's true preference (rather than just giving the patient the option to select from four or five general genres). In addition, researchers need to carefully consider the potential negative impact of the use of headphones during procedures because of hampered communication between the patient and medical personnel.

More research is needed that examines the relationship between frequency and duration of music interventions and treatment effects.

Many trials used small sample sizes and did not indicate the use of power calculations. Future trials need to include power calculations so that adequate sample sizes are used.

More studies are needed on the use of music interventions in pediatric patients with cancer. Of the 30 trials in this review, only four studies focused on outcomes in children and adolescents.

Many studies examined the effects of music interventions on anxiety, but more studies are needed for all other outcomes included in this review.

Formal evaluation of cost benefit of music medicine and music

therapy is needed.

ACKNOWLEDGEMENTS

We would like to thank and acknowledge Clare Jess (Managing Editor), Chris Williams (Co-ordinating Editor), Barbara Wheeler, Claudia Lazado-Can, Megan Pictor, Andy Bryant, Lars Ole Bonde (peer reviewers) and Kathie Godfrey (consumer reviewer) for their help and editorial advice during the preparation of the protocol and the review. We would also like to acknowledge Patricia Gonzalez and Andi McGraw Hunt, graduate assistants at Temple University, for their help in the handsearching of journals and retrieval of articles, Patricia Winter, graduate assistant at Temple University for her help with data extraction, and Minjung Shim, research assistant at Drexel University, for her help with data input.

We'd like to thank the Cystic Fibrosis Group for permission to modify their data extraction form.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Allen 2010

Methods	Randomized controlled trial (RCT) Two-arm parallel group design	
Participants	Women with breast cancer Diagnosis: invasive carcinoma Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music therapy group: 5 N analyzed in control group: 6 Mean age: 60.65 years Sex: 11 (100%) females Ethnicity: not provided Setting: outpatient Country: USA	
Interventions	Two study groups: 1. Music therapy group: music-guided imagery 2. Control group: cognitive behavioral based support group Number of sessions: 10 Length of sessions: 60 minutes Categorized as music therapy	
Outcomes	Body image (Body Image after Breast Cancer Questionnaire) (Baxter 1998) Self-concept (Tennessee Self-Concept Scale) (Fitts 1996): only t-scores are provided; not used in this review Well-being (researcher-devised instrument): not used in this review	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Draw of lots: "Random assignment was achieved by having participants select a sealed envelope. Inside the envelope was a sheet of paper listing either the control or the experimental group".
Allocation concealment (selection bias)	Low risk	Random assignment was achieved by having participants select a sealed envelope. Inside the envelope was a sheet of paper listing either the control or the experimental

Allen 2010 (Continued)

		group.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and music therapist was not possible given the interactive nature of the music therapy sessions
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	No objective outcomes were included in this study
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	High risk	The researcher conducted both the music therapy sessions and the cognitive behavioral support control sessions

Beck 1989

Methods	RCT Cross-over trial
Participants	Adults with documented cancer-related pain Type of cancer: breast (N = 7, 47%), multiple myeloma (N = 4, 27%), rectal (N = 1, 7%), prostate (N = 1, 7%), sarcoma (N = 1, 7%), lymphoma (N = 1, 7%) Total N randomized: 21 Total N analyzed: 15 Mean age: 55.6 years Sex: 12 (80%) females, 3 (20%) males Ethnicity: 15 (100%) Caucasian Setting: patients' home Country: USA
Interventions	Two treatment conditions: 1. Music listening via headphones 2. Listening to 60-cycle hum via headphones Music selections provided: the researcher asked a registered music therapist to select relaxing music in seven categories including classical, jazz, folk, rock, country and western, easy listening, and new age Number of sessions: 3 Length of sessions: 45 minutes Categorized as music medicine trial

Beck 1989 (Continued)

Outcomes	Mood (Visual Analogue Scale, VAS), pain (VAS): change scores	
Notes	Because of significant pre-test differences, JB used data provided in Beck's dissertation to compute change scores	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Using a coin flip for a random start, assignment was alternated between the 2 groups which differed on the order of the intervention"
Allocation concealment (selection bias)	Low risk	Cross-over trial; all participants received both conditions
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	It is unclear whether personnel were blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	The study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	High risk	Six dropouts (28.6%) because of hospitalization (N = 1), deterioration (N = 2), inadequate baseline (N = 2), or withdrawal during baseline (N = 1)
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Binns-Turner 2008

Methods	RCT 2-arm parallel group design
Participants	Women undergoing mastectomy Type of cancer: breast cancer Total N randomized: 30 N randomized to music group: 15 N randomized to control group: 15 N analyzed in music group: 15 N analyzed in control group: 15 Mean age: 56.63 years

Binns-Turner 2008 (Continued)

	Sex: 30 (100%) females, 0 (0%) males Ethnicity: 24 (80%) White, 6 (20%) Black Setting: inpatient Country: USA	
Interventions	Two study groups: 1. Music group: music listening during mastectomy via iPod and headphones 2. Control group: iPod and headphones but no music or sounds (note: iPod case concealed the function status of the iPod to ensure blinding of medical personnel) Music selections provided: 4 hours of continuous non-repeating music in genre selected by the participant from the following genres: classical, easy listening, inspirational or new age. Number of sessions: 1 Length of sessions: Duration of mastectomy (music was begun after the participant received midazolam preoperatively) Categorized as music medicine	
Outcomes	Anxiety (Spielberger State-Trait Anxiety Inventory - State Anxiety form, STAI-S), pain (VAS): post-test scores Heart rate (HR), mean arterial pressure (MAP): change scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "the participants were assigned by the investigator to experimental or control groups by selecting numbers from an envelope which contained papers numbered 1 to 30 (odd numbers were assigned to the experimental group and even numbers to the control group)."
Allocation concealment (selection bias)	Low risk	Not reported. We assumed that the participants were present when the lot was drawn therefore assuring allocation concealment.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Personnel were blinded. Quote: "the iPod was placed in a carrying case which concealed the function of the player; participants were not blinded." We decided to assign 'unclear risk' because it is unlikely that the participants' knowledge of group allocation influenced their physiological responses (objective outcome measures). However, this knowledge may have influenced their reporting on subjective outcomes.

Binns-Turner 2008 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Outcomes assessors were blinded for HR and MAP (iPod function was concealed from medical personnel who obtained the HR and MAP data).
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	No subject loss
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Bufalini 2009

Methods	Controlled clinical trial (CCT) (randomization method unclear) 2-arm parallel group design
Participants	<p>Children with cancer who had previously undergone more than two painful, invasive procedures (e.g. osteomedullar biopsy, lumbar puncture) and who were scheduled to undergo a painful medical procedure.</p> <p>Type of cancer: Acute lymphatic leukemia (N = 18, 47% in music group, N = 25, 65% in control group), non-Hodgkin lymphoma (N = 12, 32% in music group, N = 8, 20% in control group), neuroblastoma (N = 4, 11% in music group, N = 4, 10% in control group), osteosarcoma (N = 2, 5% in music group, N = 2, 5% in control group), medulloblastoma (N = 2, 5% in music group, 0% in control group)</p> <p>Total N randomized: unclear N analyzed in music group: 20 N analyzed in control group: 19 Mean age: 6.72 years Sex: 15 (38%) females, 24 (72%) males Ethnicity: 39 (100%) Caucasian (Italian) Setting: inpatient Country: Italy</p>
Interventions	<p>Two study groups:</p> <ol style="list-style-type: none"> 1. Music therapy group: conscious sedation and interactive music therapy 2. Control group: conscious sedation alone <p>Music provided: during the initial music listening phase, the following music was used: Lullabies (e.g. Brahms); infant songs (Walt Disney); folk songs (Italian/non Italian), ethnic songs (Albania, Romania, Latin America), pop (Italian /non Italian), classical music (e.g. Bach), other music (Celtic music, Simon and Garfunkel, etc.). This phase was followed by active music making with the child using small percussion instruments and vocal and body percussion.</p> <p>Number of sessions: 1 Length of sessions: 15 minutes for phase 1 (music listening); length of active music</p>

Bufalini 2009 (Continued)

	making is not specified. Categorized as music therapy	
Outcomes	Anxiety (STAI-S): post-test scores Induction compliance (not used in this review)	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Music therapist and participants could not be blinded as this trial used an interactive music therapy intervention
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	The study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report

Bulfone 2009

Methods	Quasi-randomized trial (alternate assignment) 2-arm parallel group design
Participants	Women with breast cancer waiting for adjuvant chemotherapy Type of cancer: stage I-II Breast cancer Total N randomized: 60 N randomized to music group: 30

Bulfone 2009 (Continued)

	<p>N randomized to control group: 30 N analyzed in music group: 30 N analyzed in control group: 30 Mean age: 50.95 years Sex: 60 (100%) females Ethnicity: 60 (100%) Caucasian (Italian) Setting: inpatient Country: Italy</p>	
Interventions	<p>Two study groups: 1. Music group: listening to pre-taped music themes with Walkman® and earphones while waiting for chemotherapy 2. Control group: standard care Music provided: participants were asked to select from new age music, nature music, film soundtracks, Celtic melodies, or classical music Number of sessions: 1 Length of sessions: 15 minutes Categorized as music medicine</p>	
Outcomes	<p>Anxiety (STAI-S); post-test scores</p>	
Notes	<p>The chief investigator provided us with standard deviations as these were not given in the study report</p>	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Alternate assignment using order of admission (personal communication with chief investigator)
Allocation concealment (selection bias)	High risk	Alternate assignment prohibited allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	High risk	It is unclear whether personnel were blinded; participants were not blinded.
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	The study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	No subject loss

Bulfone 2009 (Continued)

Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information is not provided. Conflict of interest statement is lacking.

Burns 2001

Methods	2-arm parallel group design
Participants	<p>Adult patients with cancer Diagnosis: ovarian (N = 1, 13%), breast (N = 7, 87%) Total N randomized: 8 N randomized to music group: 4 N randomized to control group: 4 N analyzed in music group: 4 N analyzed in control group: 4 Mean age: 48 (6.56) years Sex: 8 (100%) females Ethnicity: no information provided Setting: outpatient Country: USA</p>
Interventions	<p>Two study groups: 1. Music therapy group: 10 weekly sessions of the Bonny Method of Guided Imagery and Music 2. Control group: wait-list control group Music provided: Quote from study report (p. 55): The Bonny Method of Guided Imagery and Music is an in depth music psychotherapy that utilizes specially sequenced Western Art music to elicit imagery and emotional expression. Number of sessions: 10 Length of sessions: 90-120 minutes Categorized as music therapy</p>
Outcomes	<p>Mood (Profile of Mood States, POMS): could not be included because constant of 100 was not used in total score computation by the authors Quality of Life (QOL-Cancer Scale): post-test scores</p>
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with chief investigator)

Burns 2001 (Continued)

Allocation concealment (selection bias)	Low risk	Statistical program Aleator (personal communication with chief investigator)
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and music therapist was not possible given the interactive nature of the music therapy sessions
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	The study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	No subject loss
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	Study was supported by Trustees of the Paul Jenkins fund

Burns 2008

Methods	CCT (randomization method unclear) 2-arm parallel group design
Participants	Adults with acute leukemia Diagnosis: acute leukemia, high-grade non-Hodgkin's lymphoma Total N randomized: 49 N randomized to music group: 25 N randomized to control group: 24 N analyzed in music group: 15 N analyzed in control group: 15 Mean age: 54 years Sex: 30 (61%) females, 19 (39%) males Ethnicity: not provided Setting: inpatient Country: USA
Interventions	Two study groups: 1. Music therapy group: participants received music-guided imagery sessions 2. Control group: standard care Music provided: classical music and new age music based on patient preference was used Number of sessions: 8 Length of sessions: 45 minutes Categorized as music therapy

Burns 2008 (Continued)

Outcomes	Anxiety (STAI-S): 4-weeks postintervention scores Fatigue: 4-weeks post-intervention scores Positive and negative affect: 4 weeks post-intervention scores (not used in this review)	
Notes	Post-test scores were not reported in this study report. Values were obtained from the chief investigator. However, she could only provide us with the 4-weeks post-intervention scores.	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and music therapist was not possible given the interactive nature of the music therapy sessions
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	High risk	Attrition rate is 38.8%. There were 10 withdrawals in the experimental group, 9 in the control group for the following reasons: too sick to complete the measures or carry out the intervention (N = 6), voluntary withdrawal (N = 4), transfer to ICU (N = 4), death (N = 3), did not complete follow-up questionnaires (N = 2).
Selective reporting (reporting bias)	High risk	Only feasibility data were reported. No post-test or follow-up scores were reported. Follow-up scores (4 weeks post-intervention) were received from the author.
Other bias	Low risk	Supported by a grant from the National Center for Complementary and Alternative Medicine 5F32AT001144-02, and Bardett-Kenkel award from the Walter Cancer Institute

Burns 2009

Methods	RCT 2-arm parallel group design
Participants	Adolescents and young adults with cancer during stem-cell transplantation (SCT) Diagnosis: no further diagnosis details reported Total N randomized: 12 N randomized to music group: 7 N randomized to control group: 5 N analyzed in music group: 7 N analyzed in control group: 2 Mean age: 17.5 years Sex: 5 (42%) females, 7 (58%) males (at the onset of the trial) Ethnicity: 8 (66%) Caucasian, other information not provided Setting: inpatient Country: USA
Interventions	Two study groups: 1. Music therapy group: participants in the music therapy group created a therapeutic music video with a board-certified music therapist. Delivered during the acute phase of SCT. 2. Control group: listened to audiobook with certified child life specialist. Delivered during the acute phase of SCT. Number of sessions: 6 Length of sessions: 60 minutes Categorized as music therapy
Outcomes	Distress (McCorkle Symptom Distress Scale): post-test scores QoL (Index of Well-Being): post-test scores Spiritual beliefs (Reed Spiritual Perspective Scale): change scores Hope (Herth Hope index): not included in this review Mood (Mental Health Scale of the Child Health Questionnaire), pain (Child Health Questionnaire): cannot be included because of high attrition

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with chief investigator)
Allocation concealment (selection bias)	Unclear risk	Central randomization was used but author is unsure how information was transferred to field people (personal communication with chief investigator)
Blinding of participants and personnel (performance bias) All outcomes	High risk	Music therapist could not be blinded because of the interactive nature of the music therapy sessions; participants were blinded to the purpose of the study

Burns 2009 (Continued)

		(personal communication with chief investigator)
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Two participants (16.6%) were dropped from the study when they became very ill and were transferred to the intensive care unit; 1 of these 2 participants eventually died. One participant withdrew from the study after learning randomization status.
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	Supported by American Cancer society IRG-84-002-19

Cai 2001

Methods	CCT (randomization method unclear) 2-arm parallel group design
Participants	Adults with cancer receiving chemotherapy or radiation therapy Diagnosis: lung cancer (N = 25, 14%), gastric carcinoma (N = 45, 25%), intestinal carcinoma (N = 28, 15%), and breast cancer (N = 84, 46%) Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 128 N analyzed control group: 54 Mean age: 51 years Sex: 107 (59%) females, 75 (41%) males Ethnicity: 182 (100%) Chinese Setting: inpatient Country: China
Interventions	Two study groups: 1. Music group: listening to pre-recorded music 2. Control group: standard care Music provided: Chinese classical music Number of sessions: 30 Length of sessions: 30 minutes Categorized as music medicine

Cai 2001 (Continued)

Outcomes	Depression (Zung Self-Rating Depression Scale): post-test scores Anxiety (Zung Self-Rating Anxiety Scale): post-test scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not provided in the translation of the study report
Allocation concealment (selection bias)	Unclear risk	Not provided in the translation of the study report
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants randomized
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report.

Cassileth 2003

Methods	RCT 2-arm parallel group design
Participants	Adults with hematologic malignancy admitted for high dose therapy with autologous stem cell transplantation Diagnosis: Hodgkin (N = 8, 12%), Non-Hodgkin lymphoma (N = 31, 45%), myeloma/amyloidosis (N = 30, 43%) Total N randomized: 69

Cassileth 2003 (Continued)

	<p>N randomized to music group: 36 N randomized to control group: 33 N analyzed in music group: 34 N analyzed in control group: 26 Mean age: 52 years Sex: 37 (54%) females, 32 (46%) males Ethnicity: not provided Setting: inpatient Country: USA</p>
Interventions	<p>Two study groups: 1. Music therapy group: live bedside music therapy provided by trained music therapist 2. Control group: standard care Music provided: each music therapy session was individualized according to the needs of the participant. Number of sessions: the treatment group received a median of 5 sessions during a median of 10 days Length of sessions: 20-30 minutes Categorized as music therapy</p>
Outcomes	<p>Depression (POMS): post-test scores (after 1 session) Anxiety (POMS): change scores (after 1 session) Mood (POMS total score): change scores (after 1 session) Fatigue (POMS): post-test scores (after 1 session)</p>
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "randomized by telephone using the MSKCC clinical research database" and "randomly permuted blocks with the following strata: whole body/whole lymphatic irradiation(yes/no); diagnosis (lymphoma, hodgkin disease, myeloma/amyloidosis); and center (MSKCC/ICC)."
Allocation concealment (selection bias)	Low risk	Quote: "the use of telephone registration and randomization ensured concealment of treatment allocation"
Blinding of participants and personnel (performance bias) All outcomes	High risk	Music therapist and participants could not be blinded given the interactive nature of the music therapy session
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes

Cassileth 2003 (Continued)

Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate = 9 (13%) Withdrew before learning allocation (N = 7); Discharged before post-test (N = 2)
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	Supported in part, by the Memorial Sloan-Kettering Cancer Center Translational/Integrative Medicine Research Fund

Chen 2004

Methods	RCT 2-arm parallel group design
Participants	Adults who are ready to receive adjuvant chemotherapy after mastectomy Diagnosis: breast cancer Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 42 N analyzed in control group: 44 Mean age: not provided Sex: 86 (100%) females Ethnicity: 86 (100%) Chinese Setting: inpatient Country: China
Interventions	Two study groups: 1. Music group: listening to music and guided imagery 2. Control group: standard care Music provided: music selection was based on the patient's psychological status (excited or inhibited), but no further details are provided. Number of sessions: 36 Length of sessions: 60 minutes Categorized as music medicine
Outcomes	CD3, CD4, CD8, CD4/CD8, NK cell activity: post-test scores
Notes	
<i>Risk of bias</i>	

Chen 2004 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Translation sheet: "Table of random numbers"
Allocation concealment (selection bias)	High risk	No allocation concealment was used
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	Information regarding blinding of outcome assessors is not provided in the translation of the report
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	This study did not address subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report

Clark 2006

Methods	RCT 2-arm parallel group design
Participants	Adults with cancer undergoing radiation therapy Diagnosis: prostate (N = 8, 13%), breast (N = 13, 21%), lung (N = 8, 13%), head & neck (N = 14, 22%), gastrointestinal (N = 9, 14%), gynecological (N = 5, 8%), other (N = 6, 10%). Total N randomized: 63 N randomized to music group: 35 N randomized to control group: 28 Total N analyzed: 59 N analyzed in music group: 18-28 (depending on outcome) N analyzed in control group: 14-21 (depending on outcome) Mean age: 57.59 years Sex: 24 (38%) females, 39 (62%) males Ethnicity: 54 (86%) Caucasian, 7 (11%) Black, 2 (3%) other Setting: not stated in study report

Clark 2006 (Continued)

	Country: USA	
Interventions	<p>Two study groups:</p> <p>1. Music therapy group: a trained music therapist provided with instructions on how to use music for relaxation and distraction. A personalized tape was created for each patient to use at any time during the course of therapy.</p> <p>2. Control group: standard care</p> <p>Number of sessions: 2-4 times per week for approximately 4-5 weeks</p> <p>Length of sessions: unknown</p> <p>Categorized as music therapy</p>	
Outcomes	<p>Depression (Hospital Anxiety and Depression Scale, HADS): post-test scores</p> <p>Fatigue (POMS): post-test scores</p> <p>Pain (Numeric Rating Scale, NRS): change scores</p> <p>Distress (NRS): change scores</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Patients were randomized using a minimization procedure in which the first subject is assigned to a group with a coin toss. Subsequent subjects were assigned based upon covariates (tumor site, gender and pain) and assignment of previous subjects using a computer program."
Allocation concealment (selection bias)	Low risk	Minimization procedure as described above
Blinding of participants and personnel (performance bias) All outcomes	High risk	The music therapist and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate: 8%. Participants did not meet inclusion criteria (N = 4), did not return for radiation therapy treatment (N = 1)
Selective reporting (reporting bias)	Low risk	

Clark 2006 (Continued)

Other bias	Unclear risk	Funding information is not provided. Conflict of interest statement is lacking.
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Danhauer 2010

Methods	RCT 2-arm parallel group design
Participants	Patients with cancer undergoing bone marrow biopsy Diagnosis: hematological malignancy Total N randomized: 63 N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 29 N analyzed in control group: 30 Mean age: 50.9 years Sex: not provided Ethnicity: 46 (78%) Caucasian, 13 (22%) Black Setting: outpatient Country: USA
Interventions	Two study groups: 1. Music group: listening to pre-recorded music for the duration of the procedure 2. Control group: standard care Music provided: participants selected from 8 music CDs with various types of relaxing music (classical, harp, general instrumental, nature sounds, country, gospel and jazz) Number of sessions: 1 Length of sessions: 20-60 minutes Categorized as music medicine
Outcomes	Anxiety (STAI-S): post-test scores Pain (VAS): post-test scores
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with chief investigator)
Allocation concealment (selection bias)	Low risk	Researcher was blind to randomized blocks (personal communication with chief investigator)
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported

Danhauer 2010 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate: 6.3%. Data for 4 participants were incomplete
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Duocastella 1999

Methods	RCT 2-arm parallel group design
Participants	Children with neoplasms needing chemotherapy Diagnosis: acute lymphocytic leukemia (N = 9, 27%), osteosarcoma (N = 5, 15%), Burkitt's lymphoma (N = 2, 6%), acute myeloid leukemia (N = 2, 6%), synovial sarcoma (N = 2, 6%), Hodgkin's (N = 2, 6%), tumor in the trunk (N = 2, 6%), Wilm's tumor (N = 2, 6%), Ewings sarcoma (N = 1, 3%), brain tumor (N = 1, 3%), lymphoblastic lymphoma (N = 1, 3%), primitive neuroectodermal tumor (N = 1, 3%). Total N randomized: 33 N randomized to music group: 17 N randomized to control group: 16 N analyzed in music group: 15 N analyzed in control group: 15 Mean age: 10.6 years Sex: 15 (50%) females, 15 (50%) males Ethnicity: not provided Setting: inpatient Country: Spain
Interventions	Two study groups: 1. Music therapy group: music therapy interventions were adapted for in-the-moment needs of the child. Cultural and ethnic characteristics were considered in selecting songs and instruments. The music therapy session included singing, instrument playing, movement to music, and musical games. 2. Control group: activity session led by music therapist but music activities were excluded. Number of sessions: 1 Length of sessions: 45 minutes Categorized as music therapy

Duocastella 1999 (Continued)

Outcomes	Mood (Patient Opinion Likert Scale, OPEL): post-test scores Immunoglobulin A (IgA) levels: change scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Translation sheet: "Computer-generated number list"
Allocation concealment (selection bias)	Low risk	Translation sheet: "Statistical program Aleator"
Blinding of participants and personnel (performance bias) All outcomes	High risk	The music therapist and the participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Staff responsible for analyzing IgA were likely unaware of the participants' group assignment
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective data
Incomplete outcome data (attrition bias) All outcomes	Low risk	There were 3 dropouts (9%) (1 in control group)
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report.

Ferrer 2005

Methods	CCT (randomization method unclear) 2-arm parallel group design
Participants	Adults with cancer receiving chemotherapy Diagnosis: no details reported Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 25 N analyzed in control group: 25 Mean age: 55 years

Ferrer 2005 (Continued)

	Sex: 26 (52%) females, 24 (48%) males Ethnicity: not provided Setting: outpatient Country: USA
Interventions	Two study groups: 1. Music group: live, patient-preferred music with guitar accompaniment; participants were encouraged to sing along 2. Control group: standard care Number of sessions: 1 Length of sessions: 20 minutes Categorized as music therapy
Outcomes	Anxiety (VAS): post-test scores Fatigue (VAS): post-test scores Systolic blood pressure (SBP): post-test scores Diastolic blood pressure (DBP): post-test scores Heart rate: post-test scores Fear (VAS), worry (VAS), level of comfort (VAS), level of relaxation (VAS): not used in this review
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	The music therapist and the participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants randomized
Selective reporting (reporting bias)	Low risk	

Ferrer 2005 (Continued)

Other bias	Low risk	
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Hanser 2006

Methods	RCT 2-arm parallel group design
Participants	Women with metastatic breast cancer Diagnosis: metastatic breast cancer (stage IV) Total N randomized: 70 N randomized to music group: 35 N randomized to control group: 35 N analyzed in music group: 20 N analyzed in control group: 22 Mean age: 51.5 years Sex: 70 (100%) females, 0 males Ethnicity: 58 (83%) Caucasian, 7 (10%) Black, 1 (2%) Latino Setting: outpatient Country: USA
Interventions	Two study groups: 1. Music therapy group: music therapy sessions consisted of live music, improvisation, and songwriting 2. Control group: standard care Number of sessions: 3 Length of sessions: 45 minutes Categorized as music therapy
Outcomes	Depression (HADS): post-test scores Anxiety (HADS): post-test scores Distress (HADS): post-test scores Physical well-being (The Functional Assessment of Cancer Therapy-General , FACT-G): post-test scores QoL (FACT-G): post-test scores Spirituality (Functional Assessment of Chronic Illness Therapy-Spiritual Well-being Scale, FACIT-Sp): change scores
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Computer-generated random numbers determined the assignment of numbered folders to control or experimental conditions"

Hanser 2006 (Continued)

Allocation concealment (selection bias)	Low risk	Quote: “the participants opened the sealed envelope to reveal group assignment to either the experimental/music therapy intervention or control/usual care condition”
Blinding of participants and personnel (performance bias) All outcomes	High risk	The music therapist and the participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	High risk	Attrition rate: N = 28 or 40%. Music therapy group participants cancelled before the onset of the study because they were too busy (N = 5), baseline to first follow-up (too busy, N = 2; no interest, N = 2; moved, N = 1; health limits, N = 1; lost, N = 1), first to second follow-up (health limits, N = 1; died, N = 1; lost, N = 1). Control group participants cancelled before the onset of the study (too busy, N = 2; died, N = 2), baseline to first follow-up (not interested, N = 1; moved, N = 1; died, N = 2), first to second follow-up (died, N = 2; lost, N = 3)
Selective reporting (reporting bias)	Low risk	
Other bias	High risk	The three music sessions were spread over 15 weeks. Music therapy treatment is usually offered on a weekly or biweekly basis with this population. The author reported that it was not feasible to have patients come to the clinic each week.

Harper 2001

Methods	RCT 3-arm parallel group design
Participants	Adults with cancer undergoing chemotherapy Diagnosis: breast (N = 13, 32.5%), colon (N = 12, 30%), ovarian (N = 7, 17.5%), lung (N = 7, 17.5%), prostate (N = 1, 2.5%). Total N randomized: 40 N randomized to music-only group: 10

Harper 2001 (Continued)

	<p>N randomized to problem-focused visualization group: 10 N randomized to emotion-focused visualization group: 10 N randomized to control group: 10 N analyzed in music group: 10 N analyzed in control group: 10 N analyzed in problem-focused visualization: 10 (not included in this review) N analyzed in emotion-focused visualization: 10 (not included in this review) Mean age: 52 years Sex: 33 (83%) females, 7 (17%) males Ethnicity: 32 (80%) Caucasian, 4 (10%) Black, 4 (10%) Latino Setting: outpatient Country: USA</p>	
Interventions	<p>The following two study arms were used in this review: 1. Music group: music-only intervention, using just the background music from the problem-focused and emotion-focused tapes. 2. Control group: standard care Music provided: new age music, namely Health Journeys: Cancer Image Path Number of sessions: 1 Length of sessions: 30 minutes Categorized as music medicine</p>	
Outcomes	<p>Anxiety (STAI-S): change scores Anxiety (Beck Anxiety Inventory, BAI): not used in this review Coping (Coping Orientations to Problems Experienced, COPE): not used in this review Heart rate, SBP, DBP: change scores White blood cell count (WBC), red blood cell count (RBC), absolute neutrophil count (ANC): not used in this review; only measured at intake and at 6 weeks follow-up while only 1 music session was used.</p>	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A table of random numbers was used to assign each participant number to a condition" (personal communication with chief investigator)
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	High risk	Outcome assessors for WBC, RBC, and ANC were blinded. Outcome assessor for HR, SBP, and DBP was not blinded (personal communication with

Harper 2001 (Continued)

		chief investigator).
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	No subject loss in music group or control group
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Hilliard 2003

Methods	RCT 2-arm parallel group design
Participants	Adults with terminal cancer Diagnosis: cancer of lung (N = 25, 31%), colon (N = 7, 9%), kidney (N = 3, 4%), nasopharynx (N = 1, 1%), prostate (N = 3, 4%), liver (N = 2, 3%), esophagus (N = 3, 4%), breast (N = 5, 6%), pancreas (N = 5, 6%), brain (N = 3, 4%), oral cavity (N = 1, 1%), ovary (N = 2, 3%), stomach (N = 2, 3%), endometrium (N = 1, 1%), sinus (N = 1, 1%), larynx (N = 1, 1%), leukemia (N = 2, 3%), melanoma (N = 3, 4%), multiple myeloma (N = 1, 1%), lymphoma (N = 1, 1%), head, neck and face (N = 1, 1%) and unspecified cancer (N = 3, 4%). Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 40 N analyzed in control group: 40 Mean age: 65.5 years Sex: 40 (50%) females, 40 (50%) males Ethnicity: 60 (75%) Caucasian, 20 (25%) Black Setting: home hospice care Country: USA
Interventions	Two study groups: 1. Music therapy group: cognitive-behavioral music therapy. The sessions included singing, lyric analysis, instrument playing, song parody, planning of funerals, song gifts. Music therapy interventions were selected based on the participant's in-the-moment needs. 2. Control group: standard care Number of sessions: 2 to 13. Sessions were offered weekly or bi-weekly until the patient died. Length of sessions: unknown Categorized as music therapy

Hilliard 2003 (Continued)

Outcomes	QoL (Hospice QoL Index-Revised): post-test scores Physical status (Palliative Performance Scale): post-test scores Length of life (in days)	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A computer generated number list was used for randomization" (personal communication with chief investigator)
Allocation concealment (selection bias)	Low risk	Quote: "Researcher and assistant did not know what treatment patient was assigned to until after consent was completed" (personal communication with chief investigator)
Blinding of participants and personnel (performance bias) All outcomes	High risk	The music therapists and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Outcome assessors were not blinded but it is unlikely that the report of length of life (in days) would have been biased
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "When participants were lost due to death before they had completed 2 sessions, additional participants were recruited until a complete dataset of 80 participants was obtained" (personal communication with chief investigator)
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Huang 2006

Methods	RCT 2-arm parallel group design	
Participants	<p>Adult cancer patients with pain Diagnosis: cancer of head or neck (N = 53, 41%), gastrointestinal (N = 26, 20%), haematological (N = 17, 13%), genitourinary (N = 15, 12%), lung (N = 8, 6%), bone (N = 1, 1%), other (N = 12, 9%) Total N randomized: 129 N randomized to music group: 65 N randomized to control group: 64 N analyzed in music group: 62 N analyzed in control group: 64 Mean age: 54 years Sex: 38 (30%) females, 88 (70%) males Ethnicity: 129 (100%) Taiwanese Setting: inpatient Country: Taiwan</p>	
Interventions	<p>Two study groups: 1. Music group: listening to pre-recorded music 2. Control group: bedrest Music provided: music was sedative (60-80 beats) without lyrics, with a sustained melody quality, and controlled volume and pitch. Participants were asked to select from four audiotapes: two with Taiwanese music (Taiwanese folk songs and Buddhist music) and two with American music (harp music and piano music). Number of sessions: 1 Length of sessions: 30 minutes Categorized as music medicine</p>	
Outcomes	Pain (VAS): post-test scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A computerized minimization program was used to randomize and conceal the allocation until after assignment and to stratify the groups on hospital unit"
Allocation concealment (selection bias)	Low risk	Quote: "A computerized minimization program was used to randomize and conceal the allocation until after assignment and to stratify the groups on hospital unit"

Huang 2006 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate: 2.4%. Inability to focus on the music (N = 1), did not complete music protocol because of interruptions (N = 2).
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Kwekkeboom 2003

Methods	RCT 3-arm parallel group design
Participants	Adults with cancer having noxious medical procedures such as tissue biopsy or port placement or removal Diagnosis: breast cancer (N = 17, 28%), lymphoma (N = 17, 28%), leukemia (N = 9, 15%); procedures: Hickman catheter or port placement (N = 30, 50%); breast biopsy (N = 9, 15%), lymph node biopsy (N = 8, 13%), Hickman catheter or port removal (N = 7, 12%), excision biopsy (N = 3, 5%), hematoma evacuation (N = 1, 2%). Total N randomized: 60 N randomized to music group: 24 N randomized to audiobook group: 15 N randomized to control group: 21 N analyzed in music group: 24 N analyzed in audiobook group: 14 (not included in this review) N analyzed in control group: 20 Mean age: 53.28 years Sex: 40 (69%) females, 18 (31%) males Ethnicity: 60 (100%) Caucasian Setting: inpatient Country: USA
Interventions	The following two study groups are included in this review: 1. Music group: listening to pre-recorded music just prior to and during the procedure 2. Control group: standard care Number of sessions: 1

Kwekkeboom 2003 (Continued)

	Length of sessions: duration of procedure Categorized as music medicine	
Outcomes	Anxiety (STAI-S): post-test scores Pain (NRS): post-test scores Sense of control: not included in this review	
Notes	Author's comment: " Patients may not want to be distracted or inattentive during the medical procedure as they may have felt the need to monitor what was happening. Some patients specifically commented that the music or book tape made it impossible for them to hear or focus on the surgeon".	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with chief investigator)
Allocation concealment (selection bias)	Low risk	Opaque sealed envelopes (personal communication with chief investigator)
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate: N = 2 (3%). One participant was excluded because he was randomized to the audiobook group but requested music; one from the control group was excluded because the surgeon requested that music be played.
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Li 2004

Methods	CCT (randomized method unclear) 2-arm parallel group design	
Participants	<p>Adults with gastric cancer awaiting surgery Diagnosis: stage II and III gastric cancer Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 30 N analyzed in control group: 30 Mean age: 68.5 years Sex: 23 (38%) females, 37 (62%) males Ethnicity: 60 (100%) Chinese Setting: inpatient Country: China</p>	
Interventions	<p>Two study groups: 1. Music group: listening to pre-recorded music 2. Control group: standard care Music provided: Chinese classical music (6 different compositions) (no further detailed provided) Number of sessions: 2 sessions/day for 4 days pre-operatively, totalling 8 sessions Length of sessions: 20-30 minutes Categorized as music medicine</p>	
Outcomes	Anxiety (Zung State Anxiety Scale, SAS): post-test scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not provided in translation of study report
Allocation concealment (selection bias)	Unclear risk	Not provided in translation of study report
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not provided in translation of study report
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes

Li 2004 (Continued)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report.

Montserrat Gimeno 2008

Methods	CCT (randomization method unclear) cross-over trial	
Participants	Adult patients with cancer undergoing chemotherapy Diagnosis: breast cancer (N = 10, 50%), non-small cell lung cancer (N = 5, 25%), lymphoma (N = 2, 10%), sarcoma (N = 1, 5%), colon cancer (N = 1, 5%), tongue cancer (N = 1, 5%). Total N randomized: 20 Total N analyzed: 10 Mean age: 55.6 years Sex: 16 (80%) females, 4 (20%) males Ethnicity: 9 (45%) Caucasian, 1 (5%) Black, 1 (5%) Latino, 9 (45%) Asian Setting: outpatient Country: USA	
Interventions	Two study groups: 1. Music group: adapted Bonny Method of Guided Imagery and Music intervention (BGIM) 2. Control group: imagery only Music provided: new age music Number of sessions: 3 BGIM sessions and 3 imagery-only sessions Length of sessions: 60-90 minutes Categorized as music therapy	
Outcomes	Heart rate: post-test scores Nausea and emesis (no standard deviations (SD) reported): not included in this review	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported

Montserrat Gimeno 2008 (Continued)

Allocation concealment (selection bias)	Low risk	Cross-over trial. All patients received both sessions.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and music therapist was not possible given the interactive nature of the music therapy sessions.
Blinding of outcome assessment (detection bias) Objective outcomes	High risk	Outcome assessors were not blinded
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	High risk	Attrition rate: 50% 1 patient was excluded from the analysis because she only completed 4 sessions. However, chief investigator mentions other reasons for withdrawal but does not provide specific numbers.
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Nguyen 2010

Methods	RCT 2-arm parallel group design
Participants	Children with cancer undergoing lumbar puncture (LP) Diagnosis: leukemia Total N randomized: 40 N randomized to music group: 20 N randomized to control group: 20 N analyzed in music group: 20 N analyzed in control group: 20 Mean age: 9.1 years Sex: 15 (38%) females, 25 (62%) males Ethnicity: 40 (100%) Vietnamese Setting: inpatient Country: Vietnam
Interventions	Two study groups: 1. Music group: listening to music via iPod and headphones 2. Control group: put on headphones connected to iPod but did not hear any music Music provided: traditional Vietnamese songs and children's songs Number of sessions: 1

Nguyen 2010 (Continued)

	Length of sessions: music started 10 minutes before LP and continued for the length of the procedure. Duration of the procedure was on average 23 minutes. Categorized as music medicine	
Outcomes	Anxiety (STAI-S): post-test scores Pain (NRS): post-test scores Heart rate, respiratory rate, oxygen saturation level, SBP, and DBP: post-test scores	
Notes	Measurements for these outcomes were also obtained during the procedure and are reported in the study report.	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Randomization was carried out using opaque envelopes, half of which contained a paper that said "music" and half a paper that said "no music."
Allocation concealment (selection bias)	Low risk	Quote: " Randomization was carried out using opaque envelopes, half of which contained a paper that said "music" and half a paper that said "no music."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Personnel were blinded. Quote: "The researcher and the physician did not know to which group the patient belonged." Participants were not blinded since they knew whether they were listening to music or not. However, it is unlikely that this influenced their physiological responses.
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Blinding was used for objective outcomes. Quote: "The researcher and the physician did not know to which group the patient belonged. Heart rate (HR), blood pressure (BP), and oxygen saturation (SpO2) were recorded, and the respiratory rate (RR) was measured manually by the researcher".
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	The flowchart indicates no subject loss
Selective reporting (reporting bias)	Low risk	

Nguyen 2010 (Continued)

Other bias	Low risk	
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Robb 2008

Methods	CCT 3-arm parallel group design	
Participants	Children with cancer Diagnosis: no further details provided Total N randomized: 83 N randomized to active music engagement group: 27 N randomized to music listening group: 28 N randomized to control group: 28 N analyzed in active music engagement group: 27 N analyzed in music listening group: 28 (not included in this review) N analyzed in audiobook control group: 28 Mean age: not reported Sex: not reported Ethnicity: not reported Setting: inpatient Country: USA	
Interventions	The following two study groups were included in this review: 1. Active Music Engagement group: greeting song (adapted version of the song Willoughby Wallaby Woo, which incorporated the child's name and encouraged manipulation of a stuffed vinyl monkey), (b) instrument playing (choice of hand-held rhythm instruments played to live music), (c) action songs (finger puppets, props, and sound effect instruments used with the songs, Five Little Speckled Frogs and Five Little Monkeys), (d) illustrated songs in story-book form (Wheels on the Bus and Down by the Bay), and (e) closing song (an original song Time to Say Good-Bye, which included choice of sound effects). 2. Audiobook control group: listening to two audio storybook with illustrated story books. Number of sessions: 1 Length of sessions: 30 minutes Categorized as music therapy	
Outcomes	Positive affect (behavioral form): post-test scores Active engagement (behavioral form): post-test scores Initiation (behavioral form): post-test scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement

Robb 2008 (Continued)

Random sequence generation (selection bias)	High risk	Quote: "Participants were sequentially assigned on of three study conditions"
Allocation concealment (selection bias)	High risk	Quote: "Participants were sequentially assigned one of three study conditions. Assignment was done in the same manner at each hospital to maintain an equal number of participants in each condition across all sites"
Blinding of participants and personnel (performance bias) All outcomes	High risk	The music therapist could not be blinded given the interactive nature of the music therapy session. It is unclear whether the children were blinded to the purpose of the study.
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Outcome assessors were not blinded
Incomplete outcome data (attrition bias) All outcomes	High risk	No data records were kept on number of subjects approached, consented and withdrawn (personal communication with chief investigator).
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Shaban 2006

Methods	CCT 2-arm parallel group design
Participants	Adults with cancer with pain Diagnosis: no further details available in translation of study report Total N randomized: 100 N randomized to music group: 50 N randomized to control group: 50 N analyzed in music group: 50 N analyzed in control group: 50 Mean age: not reported Sex: not reported Ethnicity: 100 (100%) Caucasian Setting: unclear if inpatient or outpatient (treatment provided in hospital) Country: Iran

Shaban 2006 (Continued)

Interventions	<p>Two study groups:</p> <ol style="list-style-type: none"> 1. Music group: listening to pre-recorded music 2. Control group: progressive muscle relaxation (taught by the investigator) <p>Music provided: 3 types of music (no further detail provided in translation of study report)</p> <p>Number of sessions: 3</p> <p>Length of sessions: 30 minutes</p> <p>Categorized as music medicine</p>	
Outcomes	Pain (VAS): post-test scores	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Alternate assignment. Quote: "The first patient included in one group and second person to another group" (personal communication with chief investigator)
Allocation concealment (selection bias)	High risk	Alternation method
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No drop-outs reported. However, it is unlikely that no attrition occurred in a study with this sample size.
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report.

Smith 2001

Methods	RCT 2-arm parallel group design	
Participants	<p>Adults with cancer receiving radiation therapy</p> <p>Diagnosis: prostate (N = 24, 55%), lung (N = 6, 14%), head or neck (N = 4, 9%), colorectal (N = 4, 9%), squamous cell skin (N = 2, 5%), stomach (N = 1, 2%), melanoma (N = 1, 2%)</p> <p>Total N randomized: 44</p> <p>N randomized to music group: 20</p> <p>N randomized to control group: 24</p> <p>N analyzed in music group: 19</p> <p>N analyzed in control group: 23</p> <p>Mean age: 62.8 years</p> <p>Sex: 42 (100%) males</p> <p>Ethnicity: 31 (74%) Caucasian, 5 (12%) Black, 5 (12%) Hispanic, and 1 (2%) other</p> <p>Setting: outpatient</p> <p>Country: USA</p>	
Interventions	<p>Two study groups:</p> <ol style="list-style-type: none"> 1. Music group: listening to pre-recorded music selected by the participants 2. Control group: standard care <p>Music provided: participants were asked to select from rock and roll, big band, country and western, classical, easy listening, Spanish, or religious music.</p> <p>Number of sessions: daily for duration of treatment</p> <p>Length of sessions: 30 minutes</p> <p>Categorized as music medicine</p>	
Outcomes	Anxiety (STAI-S): post-test scores after 1 week of music interventions	
Notes	Post-test scores for week 3 and week 5 are also reported	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A biostatistician prepared a randomization list using a computer. Only one member of the research team had access to this list of case numbers and randomization assignments, which was maintained in a locked filing cabinet."
Allocation concealment (selection bias)	Low risk	Central randomization. Quote: "At the time the patient agreed to participate in the study and the consent form was signed, the research associate called the registrar to obtain the patient's assigned case number and randomization group."

Smith 2001 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded. It is unclear whether the personnel were blinded.
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate: 5% Quote: "Two patients, one from each group, were excluded from final analysis because of incomplete data".
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Straw 1991

Methods	RCT 2-arm parallel group design
Participants	Adults with cancer receiving chemotherapy Diagnosis: no further details provided Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear N analyzed in music group: 9 N analyzed in control group: 10 Mean age: 49 years Sex: 13 (27%) females, 26 (73%) males Ethnicity: not provided Setting: unclear if inpatient or outpatient Country: USA
Interventions	Two study groups: 1. Music group: listening to pre-recorded music 2. Control group: listening to guided imagery and relaxation tape Music provided: a music tape was created by the researcher. If the participants disliked the music, they could listen to a tape of their own. Number of sessions: participants listened to tape during chemotherapy treatments and at home. Participants were encouraged to listen to the tape each day. Length of sessions: 30-40 minutes Categorized as music medicine

Straw 1991 (Continued)

Outcomes	Anxiety (STAI-S): post-test scores QoL (Functional Living Index): post-test scores Level of control: not included in this review	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Random assignment of subjects to condition involved choosing pieces of paper from a box. Half of the pieces had "one" written on them, and half a "two". In this way, subjects had an equal chance being assigned to either group".
Allocation concealment (selection bias)	Low risk	Not reported but we assume that lots were drawn in the presence of the subjects.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Wan 2009

Methods	RCT 2-arm parallel group design
Participants	Adult cancer patients with pain Diagnosis: cancer of the lung, liver, gastrointestinal, lymphoma Total N randomized: 136 N randomized to music group: unclear N randomized to control group: unclear

	<p>N analyzed in music group: 65 N analyzed in control group: 71 Mean age: 52.5 years Sex: 76 (56%) females, 60 (44%) males Ethnicity: 136 (100%) Chinese (Han) Setting: inpatient Country: China</p>	
Interventions	<p>Two study groups: 1. Music group: music and imagery 2. Control group: standard care Music provided: no details on the music reported Number of sessions: 1 Length of sessions: 30 minutes Categorized as music medicine</p>	
Outcomes	<p>Depression (Center for Epidemiologic Studies Depression Scale, CES-D): post-test scores Anxiety (STAI-S): post-test scores</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Translation quote: "Simple randomization"
Allocation concealment (selection bias)	High risk	Not used
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	

Wan 2009 (Continued)

Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report
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Xie 2001

Methods	CCT (randomization method unclear) 2-arm parallel group design	
Participants	Adults with cancer receiving chemotherapy Diagnosis: no further details available in the translation of the study report Total N randomized: 260 N randomized to music group: 124 N randomized to control group: 136 N analyzed in music group: 124 N analyzed in control group: 136 Mean age: not reported Sex: not reported Ethnicity: 260 (100%) Chinese Setting: not reported Country: China	
Interventions	Two study groups: 1. Music group: music and imagery 2. Control group: standard care Music provided: no details provided Number of sessions: 2 times per day for 20 days Length of sessions: 60 minutes Categorized as music medicine	
Outcomes	Physical functioning (Karnofsky Performance Scale): post-test scores QoL (QoL Questionnaire for Chinese cancer patients): post-test scores	
Notes		

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded

Xie 2001 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report

Zhao 2008

Methods	RCT 2-arm parallel group design
Participants	Adults with cancer undergoing radiation therapy Diagnosis: cancer of the lung, esophageal, gastric, liver, breast, ovary, uterine, renal, bladder, ureter Total N randomized: 95 N randomized to music group: 49 N randomized to control group: 46 N analyzed in music group: 49 N analyzed in control group: 46 Mean age: 53.87 years Sex: 43 (45%) females, 52 (55%) males Ethnicity: 95 (100%) Chinese (Han) Setting: outpatient Country: China
Interventions	Two study groups: 1. Music group: listening to pre-recorded music during radiation therapy 2. Control group: standard care Music provided: sacred music (Buddhism and Christianity), Chinese classical music, Western classical music, or yoga music Number of sessions: 1 Length of sessions: 30 minutes Categorized as music medicine

Zhao 2008 (Continued)

Outcomes	Anxiety (Zung State Anxiety Scale): post-test scores Anxiety (Hamilton Anxiety Scale, HAMA): not included in this review HR, RR, SBP, DBP: post-test scores	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Draw of lots
Allocation concealment (selection bias)	High risk	Not used
Blinding of participants and personnel (performance bias) All outcomes	High risk	Personnel and participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	This study did not address objective outcomes
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Self-report measures were used for subjective outcomes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It is unclear whether number of participants analyzed equals the number of participants recruited
Selective reporting (reporting bias)	Low risk	
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report.

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Akombo 2006	Not RCT or CCT
Bailey 1983	Not RCT or CCT
Barrera 2002	Not RCT or CCT

(Continued)

Boldt 1996	Not RCT or CCT
Bozcuk 2006	Not RCT or CCT
Bunt 1995	Not RCT or CCT
Burke 1997	Sample included participants with malignant as well as benign tumors
Burns S 2001	Not RCT or CCT
Cermak 2005	Severe confounding issues with study design: the music group received two sessions whereas the control group only received one.
Chi 2009	Not music intervention
Cuenot 1994	Not RCT or CCT
Ezzone 1998	Insufficient data reporting; attempts to contact authors unsuccessful
Flaughner 2002	Not RCT or CCT
Frank 1985	Not RCT or CCT
Furioso 2002	Not RCT or CCT
Hasenbring 1999	Insufficient data reporting; attempts to contact authors unsuccessful
Hogenmiller 1986	Unacceptable methodological quality: there were important pain related differences between the 2 groups at pre-test. For example, there was unequal distribution of different procedures with the music group having significantly more biopsy procedures than the control group. Because biopsy procedures are more painful than other procedures included in the study, the author flagged this as a serious confounding variable. In addition, the amount of time that the patient listened to music was not controlled. The author stated that some patients only listened for 30 seconds prior to procedure.
Huang 2000	Not RCT or CCT
Kemper 2008	Not RCT or CCT
Lee 2000	Not RCT or CCT
Na Cholburi 2004	Article cannot be located. We requested the article through our interlibrary loan departments and through our Cochrane Review Group. These attempts were unsuccessful. We then googled the investigator and e-mailed her to request the research report. Three e-mail requests over a period of 8 months were sent but no response was received.
Nakayama 2009	Not RCT or CCT
Pfaff 1989	Not RCT or CCT

(Continued)

Pienta 1998	Not RCT or CCT
Robinson 2009	Not RCT or CCT
Rose 2008	Not RCT or CCT
Sahler 2003	Not RCT or CCT
Schur 1987	Not RCT or CCT
Sedei 1980	Thesis cannot be located; attempts to contact author unsuccessful
Standley 1992	Not RCT or CCT
Tan 2008	Unacceptable methodological quality; control group exposed to background music
Tilch 1999	Not RCT or CCT
Walden 2001	Not RCT or CCT
Washington 1990	Not RCT or CCT
Weber 1997	Not RCT or CCT
Wurr 2000	Not RCT or CCT (personal communication with chief investigator)
Yildirim 2007	Not RCT or CCT
Zimmernam 1989	Not RCT or CCT

Characteristics of studies awaiting assessment *[ordered by study ID]*

Stordahl 2009

Methods	Unclear
Participants	Women at the completion of treatment for breast cancer
Interventions	Music
Outcomes	Depression and affect
Notes	

Characteristics of ongoing studies *[ordered by study ID]*

Hunter 2010

Trial name or title	Mindfulness relaxation compared with relaxing music and standard symptom management education in treating patients who are undergoing chemotherapy for newly diagnosed solid tumors
Methods	RCT
Participants	Patients who are undergoing chemotherapy for newly diagnosed solid tumors
Interventions	Mindfulness relaxation compared with relaxing music and standard symptom management education
Outcomes	Conditioned and nonconditioned nausea and vomiting, mental health (anxiety, depression, and distress), QoL (cancer-related symptoms, fatigue, sleep, and pain), and immune function
Starting date	June 2004
Contact information	Jon Hunter, MD, FRCP, Principal Investigator, Mount Sinai Hospital - Toronto
Notes	

O'Brien 2010

Trial name or title	The effect of the Guided Original Lyrics and Music (GOLM) songwriting protocol on cancer patients' mood, distress levels, QoL, and satisfaction with hospital stay
Methods	RCT mixed methods
Participants	Adult patients with cancer
Interventions	Guided Original Lyrics and Music (GOLM) songwriting
Outcomes	Mood, distress levels, QoL, and satisfaction with hospital stay
Starting date	Unclear
Contact information	Emma O'Brien, University of Melbourne, Australia; Emma.O'Brien@mh.org.au
Notes	

DATA AND ANALYSES

Comparison 1. Music versus Control

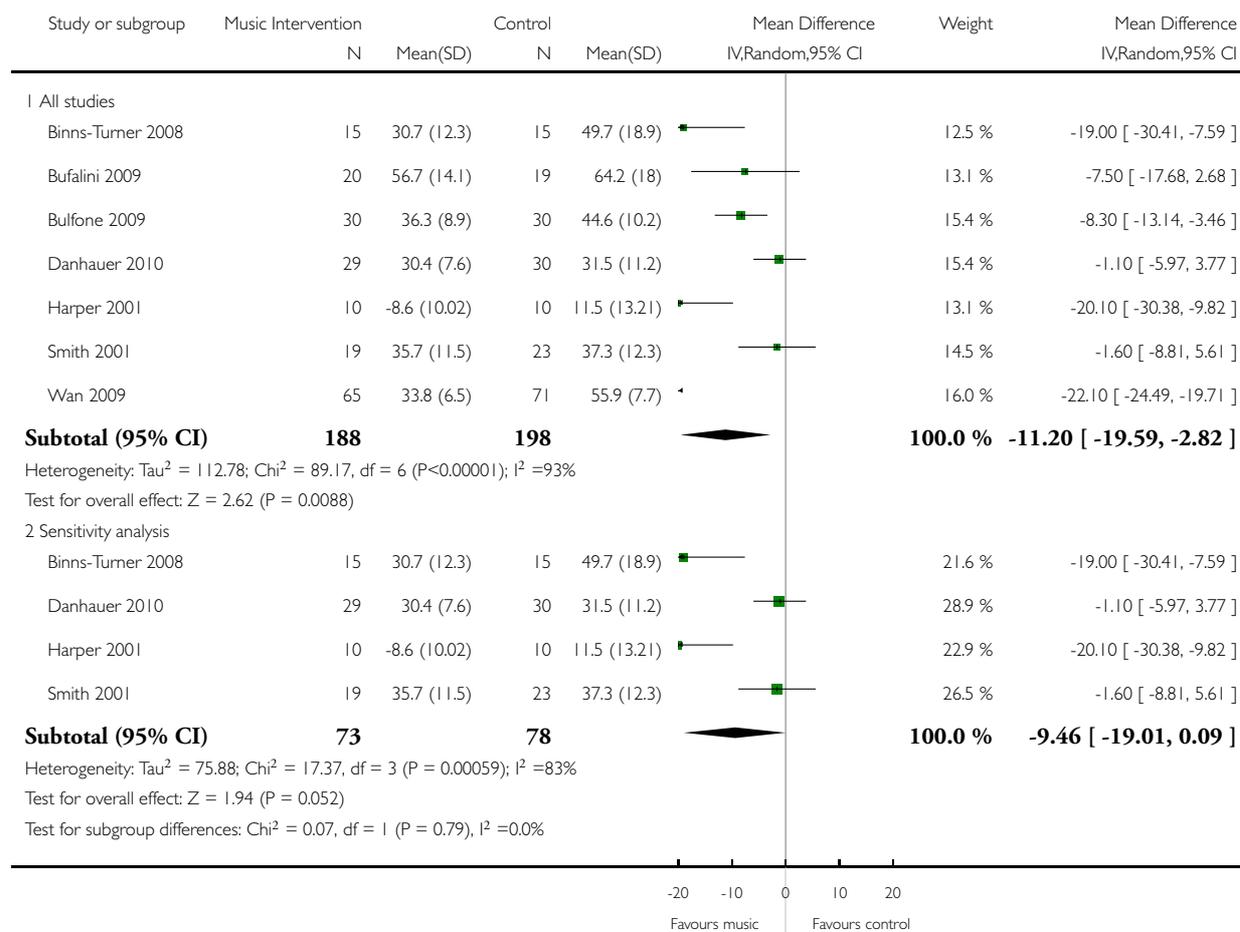
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety (STAI)	7		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 All studies	7	386	Mean Difference (IV, Random, 95% CI)	-11.20 [-19.59, -2.82]
1.2 Sensitivity analysis	4	151	Mean Difference (IV, Random, 95% CI)	-9.46 [-19.01, 0.09]
2 Anxiety (non-STAI (full version) measures)	6		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
2.1 All studies	6	469	Std. Mean Difference (IV, Random, 95% CI)	-0.61 [-0.97, -0.26]
2.2 Sensitivity analysis	3	177	Std. Mean Difference (IV, Random, 95% CI)	-0.54 [-1.33, 0.26]
3 Depression	5	468	Std. Mean Difference (IV, Random, 95% CI)	-0.07 [-0.40, 0.27]
4 Distress	2		Mean Difference (IV, Random, 95% CI)	Subtotals only
4.1 Music versus audiobook control	1	10	Mean Difference (IV, Random, 95% CI)	0.34 [-0.60, 1.28]
4.2 Music versus standard care	1	42	Mean Difference (IV, Random, 95% CI)	1.40 [-2.24, 5.04]
5 Mood	3	105	Std. Mean Difference (IV, Random, 95% CI)	0.42 [0.03, 0.81]
6 Pain	5	391	Std. Mean Difference (IV, Random, 95% CI)	-0.59 [-0.92, -0.27]
7 Fatigue	3	159	Std. Mean Difference (IV, Random, 95% CI)	-0.44 [-0.99, 0.11]
8 Physical status	2	340	Std. Mean Difference (IV, Random, 95% CI)	1.51 [-1.02, 4.04]
9 Heart rate	5		Mean Difference (IV, Random, 95% CI)	Subtotals only
9.1 All studies	5	235	Mean Difference (IV, Random, 95% CI)	-3.78 [-6.50, -1.06]
9.2 Sensitivity analysis	4	185	Mean Difference (IV, Random, 95% CI)	-4.63 [-7.64, -1.63]
10 Respiratory rate	2	135	Mean Difference (IV, Random, 95% CI)	-2.34 [-4.51, -0.17]
11 Systolic blood pressure	4		Mean Difference (IV, Random, 95% CI)	Subtotals only
11.1 All studies	4	205	Mean Difference (IV, Random, 95% CI)	-3.53 [-9.01, 1.95]
11.2 Sensitivity analysis	3	155	Mean Difference (IV, Random, 95% CI)	-5.95 [-10.80, -1.10]
12 Diastolic blood pressure	4		Mean Difference (IV, Random, 95% CI)	Subtotals only
12.1 All studies	4	205	Mean Difference (IV, Random, 95% CI)	-1.22 [-7.28, 4.84]
12.2 Sensitivity analysis	3	155	Mean Difference (IV, Random, 95% CI)	-4.28 [-7.14, -1.42]
13 Quality of Life	3	348	Std. Mean Difference (IV, Random, 95% CI)	2.01 [-0.09, 4.11]

Analysis 1.1. Comparison 1 Music versus Control, Outcome 1 Anxiety (STAI).

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 1 Anxiety (STAI)

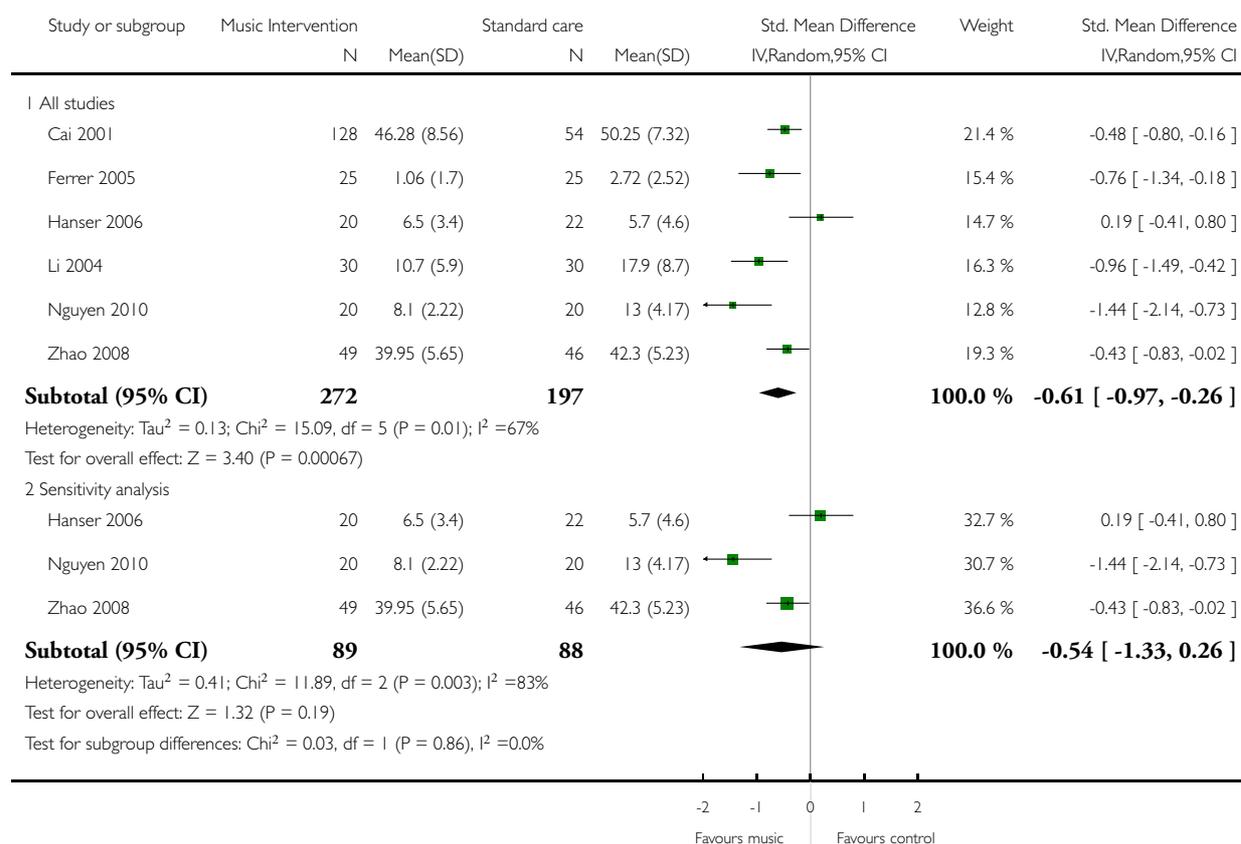


Analysis 1.2. Comparison 1 Music versus Control, Outcome 2 Anxiety (non-STAI (full version) measures).

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 2 Anxiety (non-STAI (full version) measures)

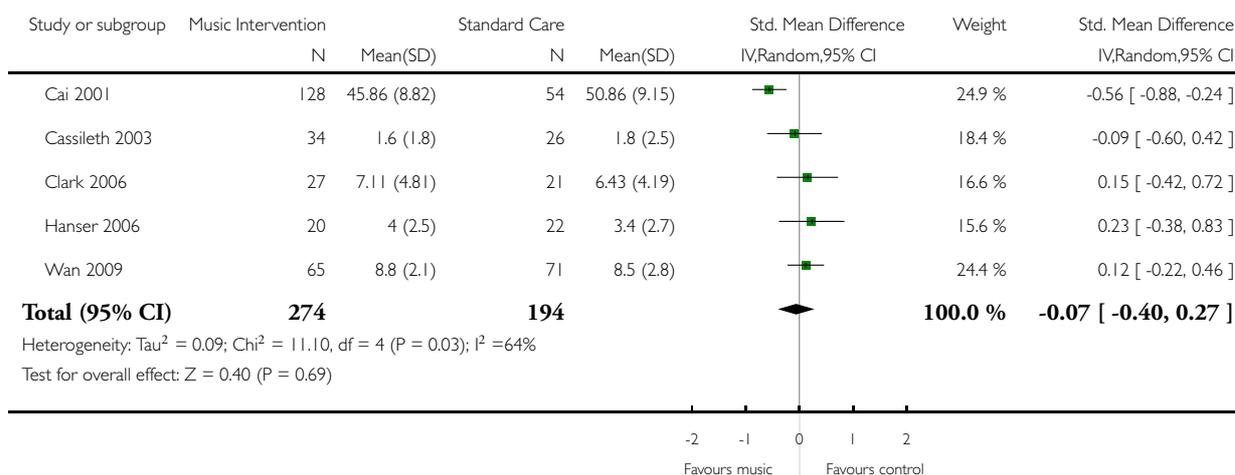


Analysis I.3. Comparison I Music versus Control, Outcome 3 Depression.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: I Music versus Control

Outcome: 3 Depression

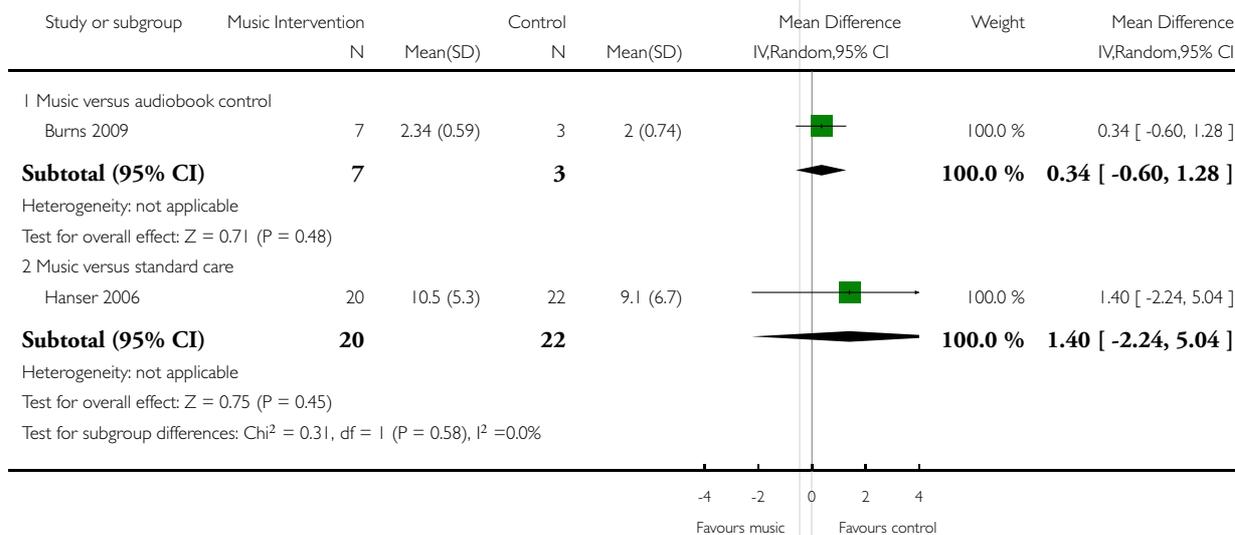


Analysis I.4. Comparison I Music versus Control, Outcome 4 Distress.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: I Music versus Control

Outcome: 4 Distress

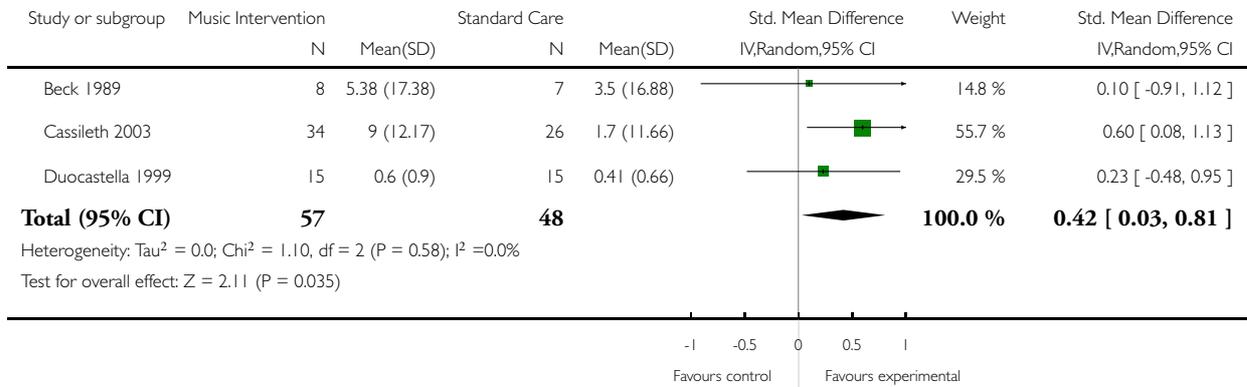


Analysis 1.5. Comparison 1 Music versus Control, Outcome 5 Mood.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 5 Mood

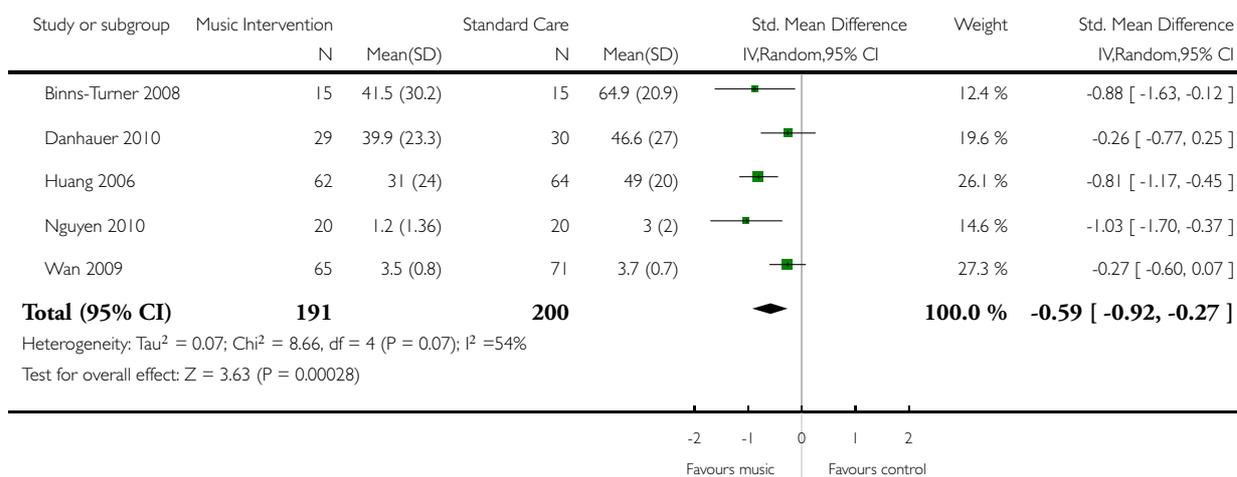


Analysis 1.6. Comparison 1 Music versus Control, Outcome 6 Pain.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 6 Pain

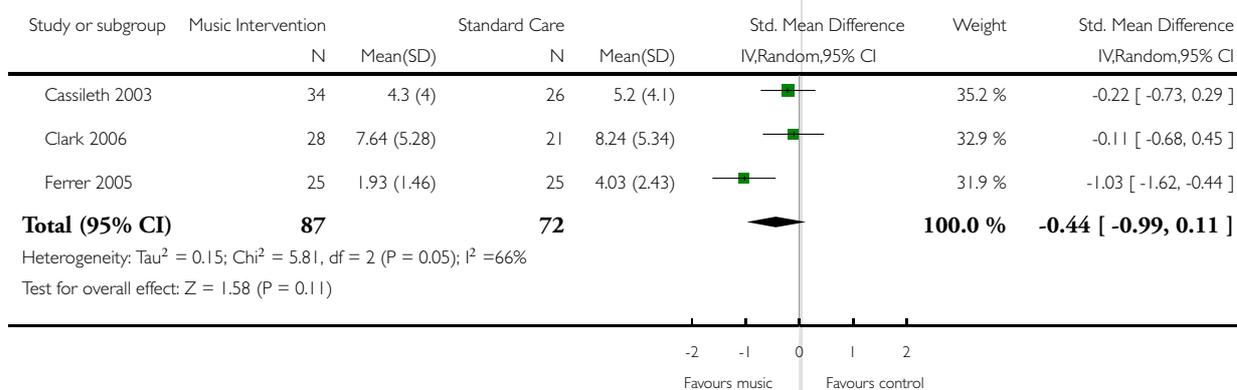


Analysis 1.7. Comparison 1 Music versus Control, Outcome 7 Fatigue.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 7 Fatigue

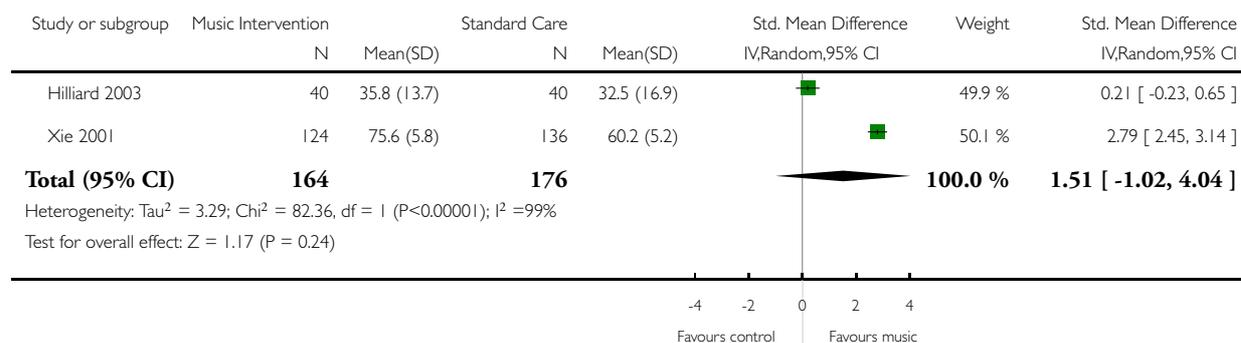


Analysis 1.8. Comparison 1 Music versus Control, Outcome 8 Physical status.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 8 Physical status

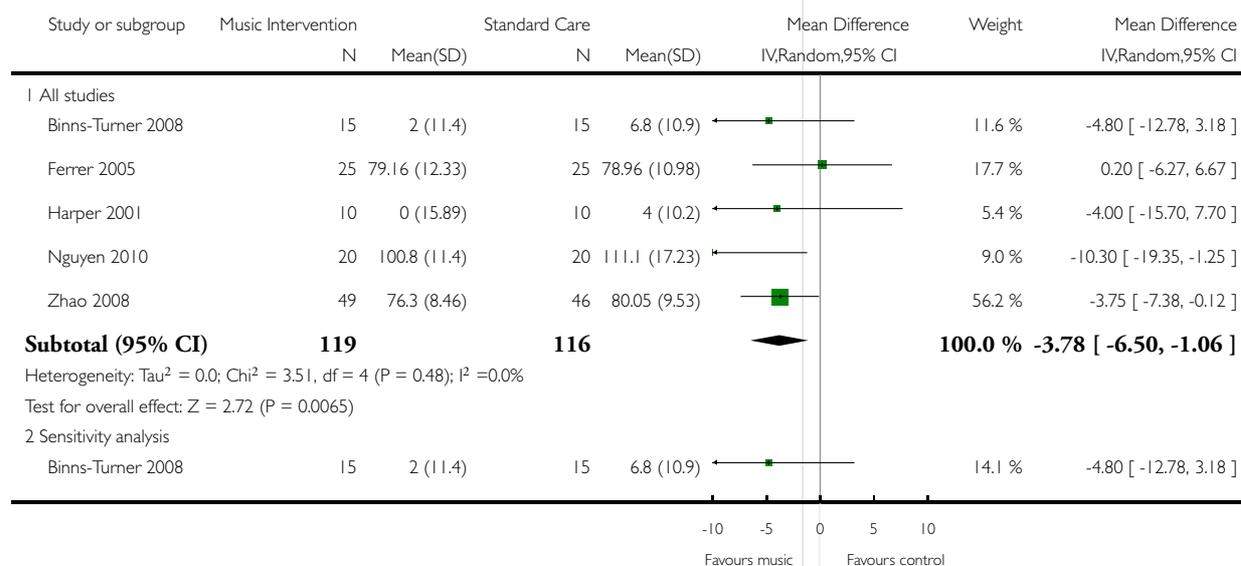


Analysis 1.9. Comparison 1 Music versus Control, Outcome 9 Heart rate.

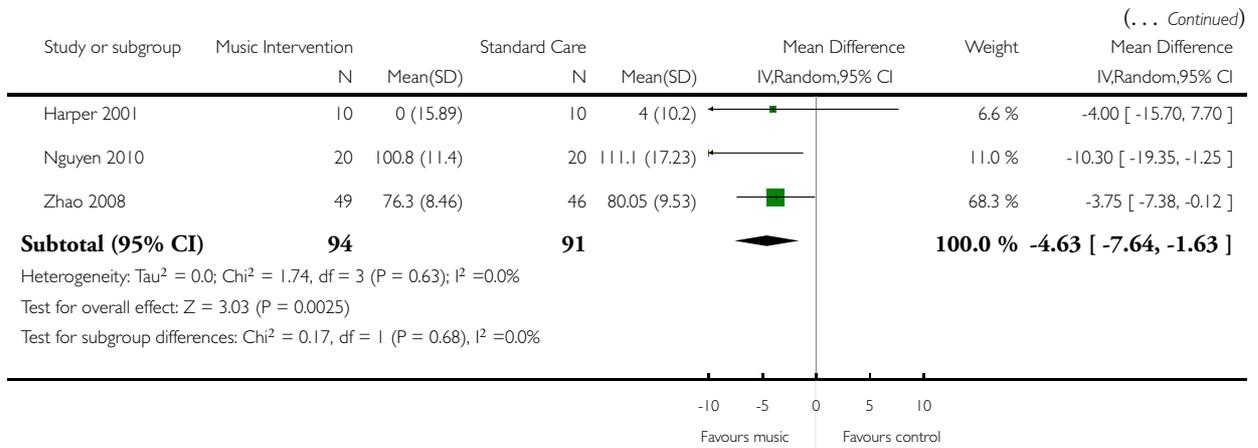
Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 9 Heart rate



(Continued ...)

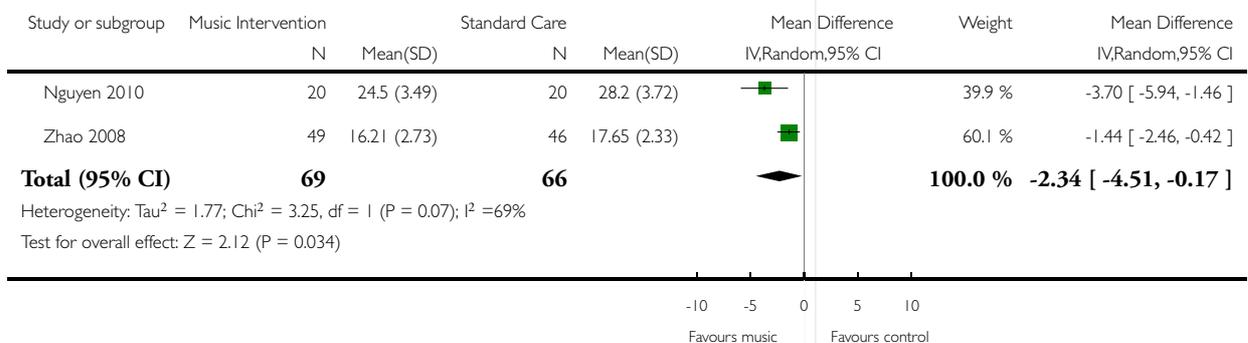


Analysis 1.10. Comparison 1 Music versus Control, Outcome 10 Respiratory rate.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 10 Respiratory rate

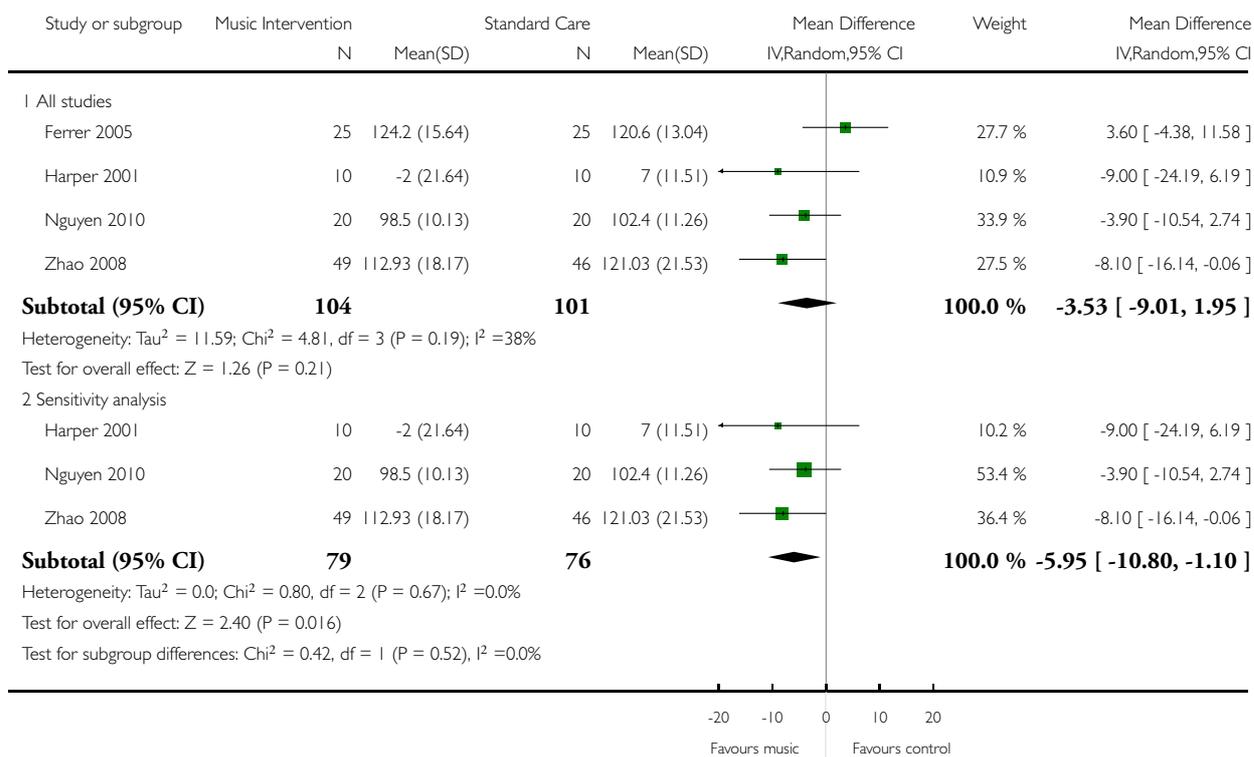


Analysis 1.11. Comparison 1 Music versus Control, Outcome 11 Systolic blood pressure.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 11 Systolic blood pressure

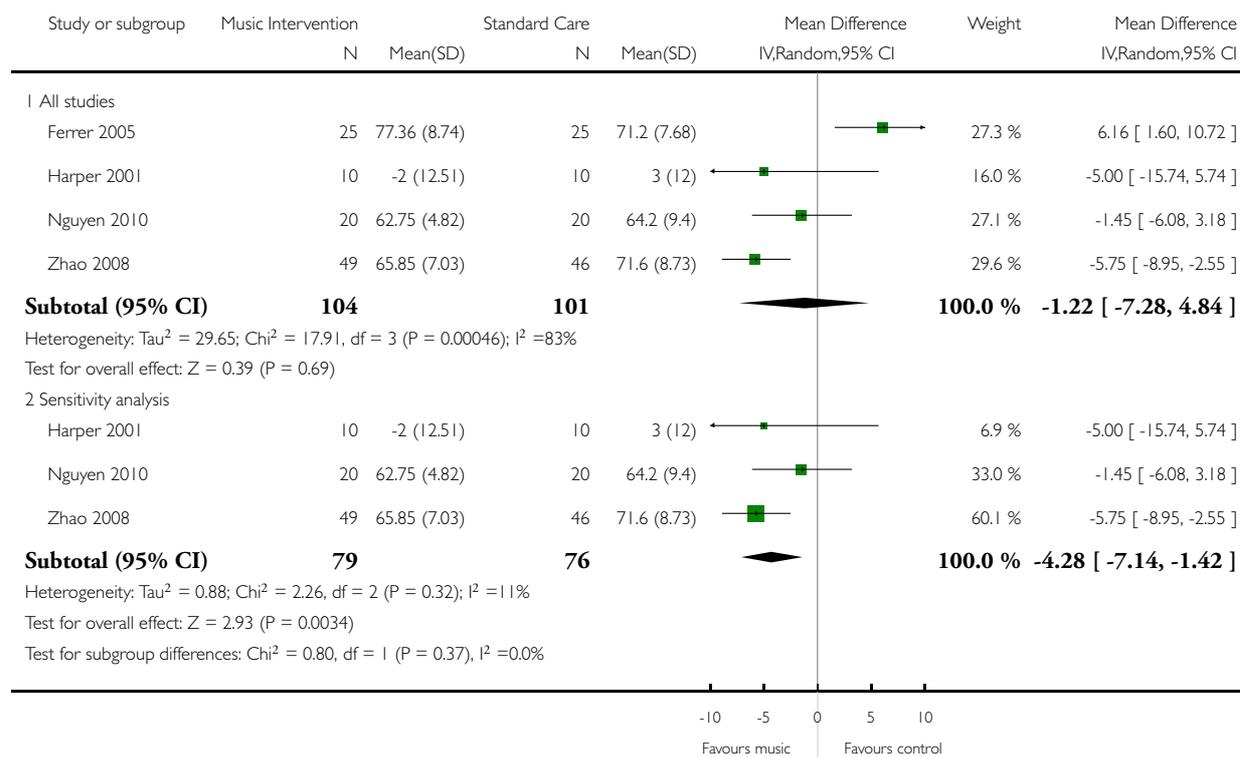


Analysis 1.12. Comparison 1 Music versus Control, Outcome 12 Diastolic blood pressure.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 12 Diastolic blood pressure

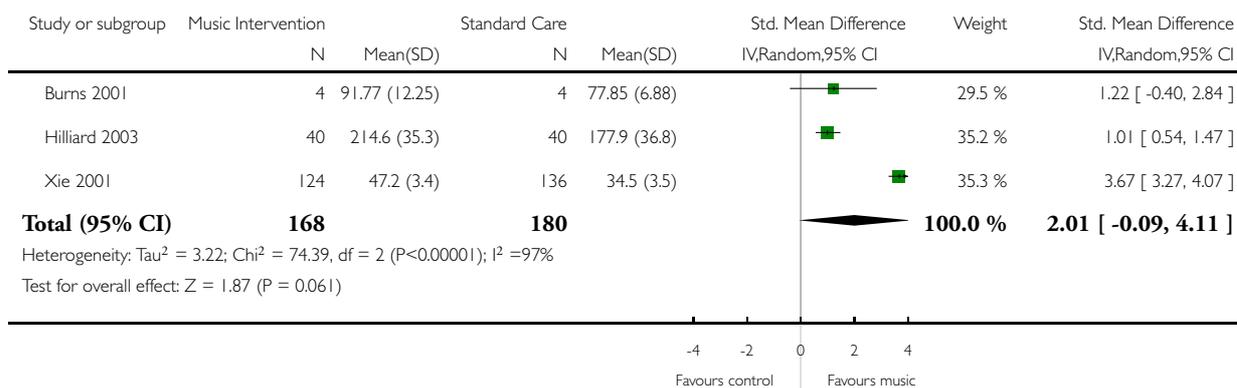


Analysis 1.13. Comparison 1 Music versus Control, Outcome 13 Quality of Life.

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Comparison: 1 Music versus Control

Outcome: 13 Quality of Life



APPENDICES

Appendix 1. CENTRAL search strategy

- #1 MeSH descriptor Neoplasms explode all trees
- #2 malignan* or neoplasm* or cancer or carcinoma* or tumo*
- #3 (#1 OR #2)
- #4 MeSH descriptor Music explode all trees
- #5 MeSH descriptor Music Therapy explode all trees
- #6 music* or melod*
- #7 sing or sings or singing or song* or compose or composing or improvis*
- #8 (#4 OR #5 OR #6 OR #7)
- #9 (#3 AND #8)

Appendix 2. MEDLINE search strategy (OvidSp)

- 1 exp Neoplasms/
- 2 (malignan\$ or neoplasm\$ or cancer or carcinoma\$ or tumo\$).tw.
- 3 1 or 2
- 4 music/ or music therapy/
- 5 (sing or sings or singing or song\$ or improvis\$).tw.
- 6 (music\$ or melod\$).tw.
- 7 or/4-6
- 8 Randomized Controlled Trials/
- 9 random allocation/
- 10 Controlled Clinical Trials/

- 11 control groups/
- 12 clinical trials/
- 13 double-blind method/
- 14 single-blind method/
- 15 Placebos/
- 16 placebo effect/
- 17 cross-over studies/
- 18 Multicenter Studies/
- 19 Therapies, Investigational/
- 20 Research Design/
- 21 Program Evaluation/
- 22 evaluation studies/
- 23 randomized controlled trial.pt.
- 24 controlled clinical trial.pt.
- 25 clinical trial.pt.
- 26 multicenter study.pt.
- 27 evaluation studies.pt.
- 28 random\$.tw.
- 29 (controlled adj5 (trial\$ or stud\$)).tw.
- 30 (clinical\$ adj5 trial\$).tw.
- 31 ((control or treatment or experiment\$ or intervention) adj5 (group\$ or subject\$ or patient\$)).tw.
- 32 (quasi-random\$ or quasi random\$ or pseudo-random\$ or pseudo random\$).tw.
- 33 ((multicenter or multicentre or therapeutic) adj5 (trial\$ or stud\$)).tw.
- 34 ((control or experiment\$ or conservative) adj5 (treatment or therapy or procedure or manage\$)).tw.
- 35 ((singl\$ or doubl\$ or tripl\$ or trebl\$) adj5 (blind\$ or mask\$)).tw.
- 36 (coin adj5 (flip or flipped or toss\$)).tw.
- 37 latin square.tw.
- 38 (cross-over or cross over or crossover).tw.
- 39 placebo\$.tw.
- 40 sham.tw.
- 41 (assign\$ or alternate or allocat\$ or counterbalance\$ or multiple baseline).tw.
- 42 controls.tw.
- 43 (treatment\$ adj6 order).tw.
- 44 or/8-43
- 45 3 and 7 and 44
- 46 limit 45 to humans

Appendix 3. EMBASE search strategy (OvidSp)

- 1 exp Neoplasm/
- 2 (malignan* or neoplasm* or cancer or carcinom* or tumo*).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
- 3 1 or 2
- 4 exp music therapy/ or exp music/
- 5 (music* or melod*).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
- 6 (sing or sings or singing or song* or compose or composing or improvis*).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
- 7 6 or 4 or 5
- 8 Randomized Controlled Trial/
- 9 Randomization/
- 10 exp Controlled Clinical Trial/

- 11 Control Group/
 12 Clinical Trial/
 13 Double Blind Procedure/
 14 Single Blind Procedure/
 15 Placebo/
 16 Crossover Procedure/
 17 Multicenter Study/
 18 Experimental Therapy/
 19 Methodology/
 20 exp Health Care Quality/
 21 exp Evaluation/
 22 random*.mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 23 (controlled adj5 (trial* or stud*)).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 24 (clinical* adj5 trial*).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 25 ((control or treatment or experiment* or intervention) adj5 (group* or subject* or patient*)).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 26 (quasi-random* or quasi random* or pseudo-random* or pseudo random*).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 27 ((multicenter or multicentre or therapeutic) adj5 (trial* or stud*)).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 28 ((control or experiment* or conservative) adj5 (treatment or therapy or procedure or manage*)).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 29 ((single* or double* or tripl* or trebl*) adj5 (blind* or mask*)).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 30 (coin adj5 (flip or flipped or toss*)).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 31 latin square.mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 32 (cross-over or cross over or crossover).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 33 placebo*.mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 34 sham.mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 35 (assign* or alternate or allocat* or counterbalance* or multiple baseline).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 36 controls.mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 37 (treatment* adj6 order).mp. [mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
 38 35 or 33 or 32 or 11 or 21 or 26 or 17 or 22 or 18 or 30 or 23 or 16 or 13 or 29 or 27 or 25 or 28 or 36 or 9 or 12 or 14 or 15 or 20 or 8 or 34 or 37 or 24 or 10 or 19 or 31
 39 38 and 3 and 7
 40 39
 41 limit 40 to human

Appendix 4. CINAHL search strategy (EbscoHost)

S22 S21 and S7 and S4
S21 S20 or S19 or S18 or S17 or S16 or S15 or S14 or S13 or S12 or S11 or S10 or S9 or S8
S20 TI ((singl* or doubl* or treb* or tripl*)) and TI ((blind* or mask*))
S19 AB ((singl* or doubl* or treb* or tripl*)) and AB ((blind* or mask*))
S18 Randomized controlled trials/
S17 evaluation studies/
S16 comparative study/
S15 prospective studies/
S14 clinical trial/
S13 study design/
S12 AB ((control\$ or prospectiv\$ or volunteer\$)) or TI ((control\$ or prospectiv\$ or volunteer\$))
S11 AB random\$ or TI random\$
S10 AB placebo\$ or TI placebo\$
S9 placebos/
S8 AB (clin\$ N25 trial\$) or TI (clin\$ N25 trial\$)
S7 S5 OR S6
S6 TX (malignan\$ or neoplasm\$ or cancer or carcinoma\$ or tumo\$)
S5 neoplasms/
S4 S3 OR S2 OR S1
S3 TX (music\$ OR melod\$ OR sing OR singing OR sings OR song\$ OR improvis\$)
S2 music therapy/
S1 music/

Appendix 5. PsycInfo search strategy (OvidSp)

1 exp Neoplasms/
2 (malignan\$ or neoplasm\$ or cancer or carcinoma\$ or tumo\$).tw.
3 1 or 2
4 music/ or music therapy/
5 (music\$ or melod\$).tw.
6 (sing or sings or singing or song\$ or improvis\$).tw.
7 or/4-6
8 3 and 7
9 empirical study.md.
10 followup study.md.
11 longitudinal study.md.
12 prospective study.md.
13 quantitative study.md.
14 "2000".md.
15 treatment effectiveness evaluation/
16 exp hypothesis testing/
17 repeated measures/
18 exp experimental design/
19 placebo\$.ti,ab.
20 random\$.ti,ab.
21 (clin\$ adj25 trial\$).ti,ab.
22 ((singl\$ or doubl\$ or treb\$ or tripl\$) adj (blind\$ or mask\$)).ti,ab.
23 or/9-22
24 8 and 23
25 limit 24 to human

Appendix 6. LILACS search strategy (Virtual Health Library)

((music\$)) and (((((malignan\$ or neoplasm\$ or cancer or carcinoma\$ or tumor\$) or ("cancer")))))

Appendix 7. Social Science Citation Index search strategy (ISI)

#1 Topic=(music*)
#2 Topic=(music therapy)
#3 Topic=(singing or sings or song* or improvis* or melod*)
#4 #1 OR #2 OR #3
#5 Topic=(neoplasm*)
#6 Topic=(malignan* or neoplasm* or cancer or carcinoma* or tumor*)
#7 #5 OR #6
#8 Topic=(random allocation)
#9 Topic=(controlled clinical trial*)
#10 Topic=(randomized controlled trial*)
#11 Topic=(double blind method*)
#12 Topic=(single blind method*)
#13 Topic=(clinical trial*)
#14 Topic=(placebo*)
#15 Topic=(random*)
#16 #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15
#17 #4 AND #7 AND #16

Appendix 8. CancerLit search strategy

music OR (music therapy)

Appendix 9. CAIRSS search strategy

Cancer OR neoplasm OR neoplasms
Malignant OR carcinoma OR carcinomas
Tumor OR tumour

Appendix 10. Proquest Digital Dissertations search strategy (Proquest)

Music and (cancer or tumor or malignant or neoplasm)

Appendix 11. clinicaltrials.gov search strategy

music OR "music therapy"

Appendix 12. Current Controlled Trials search strategy

music OR “music therapy”

Appendix 13. National Research Register search strategy

music

Appendix 14. Musictherapyworld.de

The site’s research register, dissertation archive, and bibliography were searched in 2008 for the following terms: cancer or tumor or tumour or malignant or neoplasm or neoplasms or carcinoma or carcinomas
This database is no longer functional.

Appendix 15. RILM Abstracts of Music Literature search strategy (EbscoHost)

Cancer or tumor or malignant or neoplasm

Appendix 16. Study Selection, Quality Assessment & Data Extraction Form

Review: Music interventions for improving psychological and physical outcomes in cancer patients

Name Code:

Date:

Paper Code:

First author	Title	Journal/Conference etc	Proceedings	Year	Language

Other references to trial

If there are further references to this trial, link the papers now & list below. All references to a trial should be linked under one *Study ID* in RevMan (main paper should be [number]A; other publications related to the same trial should be [same number]B)

Code each paper	Author(s)	Journal/Conference Proceedings etc	Year	Language

Study eligibility

1. Level of Randomization			2. Cancer Patients?	3. Intervention: Music vs standard care alone Music vs. standard care + other treatment	4. Outcome: Psychological/physical/or social outcomes?
RCT	Systematic method	Unclear	Yes / No / Unclear	Yes / No / Unclear	Yes / No / Unclear

Do not proceed if the answers to 2), 3), or 4) are No. If study to be included in Excluded studies section of the review, record below the information to be inserted into Table of excluded studies (give specific reason for exclusion).

EXCLUDED BECAUSE (circle)

1. Not RCT (list study design:.....)
2. Not population of interest
3. Not music/music therapy intervention vs standard care or vs standard care + other treatment
4. Not outcome of interest
5. Other:.....

AWAIT FURTHER ASSESSMENT TO MAKE DECISION

Study Design (circle): 2-arm parallel group 3-arm parallel group cross-over trial

Describe experimental and control group/condition interventions:

Experimental group:

Control group:

Participants and trial characteristics

Participant characteristics									
Age (mean, median, range)	Experimental:		Control:		Total:		Range:		
Sex of participants (numbers / %)	Experimental:	F	M	Control:	F	M	Total:	F	M
Ethnicity (%)									
Diagnosis/Disease status (if available)									
Setting (please circle)	Inpatient Outpatient Other:								

Methodological quality

Method of randomization	
Was the trial reported as randomized?	Yes No
Random sequence generation	Low risk Unclear risk High risk
State here randomization method used and reasons for grading (circle):	
1. Computer-generated number list 2. Table of random numbers 3. Draw of lots 4. Flip coin 5. Systematic, please specify: 6. Other:	

Concealment of allocation	
Concealment of allocation	Low risk Unclear risk High risk
State here the method used to conceal allocation and reasons for grading	
1. Opaque sealed envelopes 2. Central randomization 3. Alteration method 4. Other.....	

Low risk: (1) central randomization, (2) serially numbered opaque envelopes, (3) other descriptions with convincing concealment

High risk: (1) alternation methods, (2) other manners in which allocation was not adequately concealed

Unclear risk: authors did not adequately report on method of concealment used

Blinding	
Blinding of study participants and music therapist/music provider	Low risk Unclear risk High risk

(Continued)

Blinding of outcome assessor(s) for objective outcomes	Low risk Unclear risk High risk
Blinding of outcome assessor(s) for subjective outcomes	Low risk Unclear risk High risk
Intention-to-treat	
<ul style="list-style-type: none"> • Low risk: if fewer than 20% of patients were lost to follow-up and reasons for loss to follow-up were similar in both treatment arms • Unclear risk: if loss to follow-up was not reported • High risk: if more than 20% of patients were lost to follow-up or reasons for loss to follow-up differed between treatment arms Number of withdrawals: Were withdrawals described? Yes No ? Not clear ? Please add reasons for withdrawal + N or % here:	Low risk Unclear risk High risk
Selective reporting	
<ul style="list-style-type: none"> • Low risk: reports of the study were free of suggestion of selective outcome reporting • High risk: reports of the study suggest selective outcome reporting 	Low risk Unclear risk High risk
Other sources of bias	
Are studies free of other problems that could have put them at high risk of bias (e.g. financial conflict of interest)? Please list other sources of bias:	Low risk Unclear risk High risk
Data reporting	
Is data reporting sufficient for inclusion in review (are means and SD for each outcome variable reported for experimental group/condition and for control group/condition)? If no, please detail what type of data is available:	Yes / No

Data extraction

Outcomes relevant to your review			
	Reported in paper (circle)		Reported in paper (circle)
Psychological outcomes (depression, anxiety, etc)	Yes / No	Communication	Yes / No
Physical outcomes (pain, nausea)	Yes / No	Disease-free survival	Yes / No
Physiological outcomes (HR, RR, AP, SBP, DBP)	Yes / No	Social/Spiritual outcomes	Yes / No
Quality of life	Yes / No		

For continuous data							
Code of paper	Outcomes	Unit of measurement or scale used	Intervention group		Control group		If mean (SD) are not reported, report either: - t-value and/or P value associated with t-test - SE of means calculated from within group - confidence interval from within group - description of
			N	Mean (SD)	N	Mean (SD)	
	Depression						
	Anxiety						
	Anger						
	Hopelessness						
	Helplessness						
	Other psychological:						

(Continued)

Other psycho- logical:							
Quality of life							
Fatigue							
Nausea							
Pain							
Heart rate							
Respira- tory rate							
Arterial pressure							
Systolic blood pressure							
Dias- tolic blood pressure							
Cortisol levels							
IgA lev- els							
Other hor- mone levels:							
Other hor- mone levels:							

(Continued)

	Social support. Specify:							
	Communication. Specify:							
	Disease free survival							

Other information which you feel is relevant to the results
 Indicate if: any data were obtained from the primary author; if results were estimated from graphs etc; or calculated by you using a formula (this should be stated and the formula given). In general if results not reported in paper(s) are obtained this should be made clear here to be cited in review.

Music Intervention

Music Medicine	Yes / No Type:	Patient-Preferred? Yes / No
Music Therapy	Yes / No	Intervention used (mark): Music Listening Music used: Patient-Preferred? Yes / No / Unknown Active Music Making Type: Music-guided Imagery Music used:

(Continued)

		Patient-Preferred? Yes / No / Unknown
Intensity	Number of sessions: Duration of each session: Time period (State weeks / months, etc, if cross-over trial give length of time in each arm):	

Appendix 1

Trial characteristics	
	Further details
Single centre / multicentre	
Country / countries	
How was participant eligibility defined?	
How many people were randomised?	
Number of participants in each intervention group (circle groups that are used for this review if 3-arm parallel group)	Exp.group 1: Exp group 2: Control:
Number of participants who received intended treatment	Exp.group 1: Exp group 2: Control:
Number of participants who were analysed	Exp.group 1: Exp group 2: Control:
Time-points when measurements were <u>taken</u> during the study	
Time-points <u>reported</u> in the study	
Time-points <u>you</u> are using in RevMan	
Other	

HISTORY

Protocol first published: Issue 1, 2008

Review first published: Issue 8, 2011

Date	Event	Description
24 June 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

Background, objectives, criteria for considering studies: Bradt, Dileo, Grocke, Magill

Search strategies, methods: Bradt (reviewed and approved by Dileo, Grocke, Magill)

Database searches and handsearches: Bradt, Dileo, Grocke, Magill

Screening search results: Bradt and graduate assistants

Organizing retrieval of papers: Bradt

Screening retrieved papers against inclusion criteria: Bradt and graduate assistant

Appraising quality of papers: Bradt and Dileo

Abstracting data from papers: Bradt and graduate assistant

Writing to authors of papers for additional information: Bradt and graduate assistant

Providing additional data about papers: Bradt

Obtaining and screening data on unpublished studies: Bradt

Data management for the review: Bradt

Entering data into Review Manager ([RevMan 5.0](#)): Bradt and research assistant

RevMan statistical data: Bradt

Other statistical analysis not using RevMan: Bradt

Interpretation of data: Bradt, Dileo, Grocke, Magill

Statistical inferences: Bradt

Writing the review: Bradt (reviewed and approved by Dileo, Grocke, Magill)

Securing funding for the review: Dileo

Guarantor for the review (one author): Bradt

Person responsible for reading and checking review before submission: Bradt

DECLARATIONS OF INTEREST

All authors are music therapists.

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- State of Pennsylvania Formula Fund, USA.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

DFS was listed in the protocol as a secondary outcome but was excluded in the review as per recommendation of the peer review.

The MEDLINE search strategy was slightly altered: the words 'compose' and 'composing' were removed as text words because they resulted in hundreds of irrelevant returns.

The RILM Abstracts of Music Literature database was added to the search strategy as per recommendation of the peer review.