Cochrane Library

Cochrane Database of Systematic Reviews

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

Bradt J, Dileo C, Magill L, Teague A

Bradt J, Dileo C, Magill L, Teague A.
Music interventions for improving psychological and physical outcomes in cancer patients.
Cochrane Database of Systematic Reviews 2016, Issue 8. Art. No.: CD006911.
DOI: 10.1002/14651858.CD006911.pub3.

www.cochranelibrary.com

WILEY

TABLE OF CONTENTS

[Intervention Review]

Music interventions for improving psychological and physical outcomes in cancer patients

Joke Bradt[1], Cheryl Dileo[2], Lucanne Magill[3,4], Aaron Teague[1]

[1]Department of Creative Arts Therapies, College of Nursing and Health Professions, Drexel University, Philadelphia, PA, USA. [2]Department of Music Therapy and The Arts and Quality of Life Research Center, Boyer College of Music and Dance, Temple University, Philadelphia, USA. [3]Creative Arts Therapy Department, Mount Sinai Hospital, New York, NY, USA. [4]Department of Music and Performing Arts Professions, New York University, New York, NY, USA

Contact address: Joke Bradt, Department of Creative Arts Therapies, College of Nursing and Health Professions, Drexel University, 1601 Cherry Street, room 7112, Philadelphia, PA, 19102, USA. jbradt@drexel.edu.

Editorial group: Cochrane Gynaecological, Neuro-oncology and Orphan Cancer Group
Publication status and date: New search for studies and content updated (conclusions changed), published in Issue 8, 2016.

Citation: Bradt J, Dileo C, Magill L, Teague A. Music interventions for improving psychological and physical outcomes in cancer patients. *Cochrane Database of Systematic Reviews* 2016, Issue 8. Art. No.: CD006911. DOI: 10.1002/14651858.CD006911.pub3.

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 assess and compare the effects of music therapy and music medicine interventions for psychological and physical outcomes in people with cancer.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (2016, Issue 1), MEDLINE, Embase, CINAHL, PsycINFO, LILACS, Science Citation Index, CancerLit, CAIRSS, Proquest Digital Dissertations, ClinicalTrials.gov, Current Controlled Trials, the RILM Abstracts of Music Literature, http://www.wfmt.info/Musictherapyworld/ and the National Research Register. We searched all databases, except for the last two, from their inception to January 2016; the other two are no longer functional, so we searched them until their termination date. We handsearched music therapy journals, reviewed reference lists and contacted experts. There was no language restriction.

Selection criteria

We included all randomized and quasi-randomized controlled trials of music interventions for improving psychological and physical outcomes in adult and pediatric patients with cancer. We excluded participants undergoing biopsy and aspiration for diagnostic purposes.

Data collection and analysis

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

Main results

We identified 22 new trials for inclusion in this update. In total, the evidence of this review rests on 52 trials with a total of 3731 participants. We included music therapy interventions offered by trained music therapists, as well as music medicine interventions, which are defined as listening to pre-recorded music, offered by medical staff. We categorized 23 trials as music therapy trials and 29 as music medicine trials.

The results suggest that music interventions may have a beneficial effect on anxiety in people with cancer, with a reported average anxiety reduction of 8.54 units (95% confidence interval (CI) −12.04 to −5.05, P < 0.0001) on the Spielberger State Anxiety Inventory - State Anxiety (STAI-S) scale (range 20 to 80) and −0.71 standardized units (13 studies, 1028 participants; 95% CI −0.98 to −0.43, P < 0.00001; low quality evidence) on other anxiety scales, a moderate to strong effect. Results also suggested a moderately strong, positive impact on depression (7 studies, 723 participants; standardized mean difference (SMD): −0.40, 95% CI −0.74 to −0.06, P = 0.02; very low quality evidence), but because of the very low quality of the evidence for this outcome, this result needs to be interpreted with caution. We found no support for an effect of music interventions on mood or distress.

Music interventions may lead to small reductions in heart rate, respiratory rate and blood pressure but do not appear to impact oxygen saturation level. We found a large pain-reducing effect (7 studies, 528 participants; SMD: −0.91, 95% CI −1.46 to −0.36, P = 0.001, low quality evidence). In addition, music interventions had a small to moderate treatment effect on fatigue (6 studies, 253 participants; SMD: −0.38, 95% CI −0.72 to −0.04, P = 0.03; low quality evidence), but we did not find strong evidence for improvement in physical functioning.

The results suggest a large effect of music interventions on patients' quality of life (QoL), but the results were highly inconsistent across studies, and the pooled effect size for the music medicine and music therapy studies was accompanied by a large confidence interval (SMD: 0.98, 95% CI −0.36 to 2.33, P = 0.15, low quality evidence). A comparison between music therapy and music medicine interventions suggests a moderate effect of music therapy interventions for patients' quality of life (QoL) (3 studies, 132 participants; SMD: 0.42, 95% CI 0.06 to 0.78, P = 0.02; very low quality evidence), but we found no evidence of an effect for music medicine interventions. A comparison between music therapy and music medicine studies was also possible for anxiety, depression and mood, but we found no difference between the two types of interventions for these outcomes.

The results of single studies suggest that music listening may reduce the need for anesthetics and analgesics as well as decrease recovery time and duration of hospitalization, but more research is needed for these outcomes.

We could not draw any conclusions regarding the effect of music interventions on immunologic functioning, coping, resilience or communication outcomes because either we could not pool the results of the studies that included these outcomes or we could only identify one trial. For spiritual well-being, we found no evidence of an effect in adolescents or young adults, and we could not draw any conclusions in adults.

The majority of studies included in this review update presented a high risk of bias, and therefore the quality of evidence is low.

Authors' conclusions

This systematic review indicates that music interventions may have beneficial effects on anxiety, pain, fatigue 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?

The issue

Cancer may result in extensive emotional, physical and social suffering. Current cancer care increasingly incorporates psychosocial interventions to improve quality of life. Music therapy and music medicine interventions have been used to alleviate symptoms and treatment side effects and address psychosocial needs in people with cancer. 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.

The aim of the review

This review is an update of a previous Cochrane review from 2011, which included 30 studies and found support for an effect of music interventions on several psychological and physical outcomes. For this review update, we searched for additional trials studying the effect of music interventions on psychological and physical outcomes in people with cancer. We searched for published and ongoing studies up to January 2016. We considered all studies in which music therapy or music medicine was compared with standard treatment alone or standard care combined with other treatments or placebo.

What are the main findings?

We identified 22 new studies, so the evidence in this review update now rests on 52 studies with 3731 participants. The findings suggest that music therapy and music medicine interventions may have a beneficial effect on anxiety, pain, fatigue, heart rate, respiratory rate and blood pressure in people with cancer. Because of the very low quality of the evidence for depression, it is unclear what impact music interventions may have. Music therapy but not music medicine interventions may improve patients' quality of life. We did not find evidence that music interventions improve mood, distress or physical functioning, but only a few trials studied these outcomes. We could not draw any conclusions about the effect of music interventions on immunologic functioning, coping, resilience or communication outcomes because there were not enough trials looking at these aspects. Therefore, more research is needed.

No adverse effects of music interventions were reported.

Quality of the evidence
Most trials were at high risk of bias, so these results need to be interpreted with caution. We did not identify any conflicts of interests in the included studies.

What are the conclusions?
We conclude that music interventions may have beneficial effects on anxiety, pain, fatigue and quality of life (QoL) in people with cancer. Furthermore, music may have a small positive effect on heart rate, respiratory rate and blood pressure. Reduction of anxiety, fatigue and pain are important outcomes for people with cancer, as they have an impact on health and overall QoL. Therefore, we recommend considering the inclusion of music therapy and music medicine interventions in psychosocial cancer care.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Music interventions compared to standard care for psychological and physical outcomes in cancer patients

Music interventions versus standard care for psychological and physical outcomes in cancer patients

Patient or population: cancer patients
Setting: inpatient and outpatient cancer care
Intervention: music interventions
Comparison: standard care

Outcomes	Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
Anxiety assessed with: Spielberger State Anxiety Index Scale from: 0 to 40	The mean anxiety in the music intervention group was 8.54 units less (12.04 less to 5.05 less) than in the standard care group	1028 (13 RCTs)	⊕⊕⊖⊖ Low[a,b]	—
Depression	The mean depression in the music intervention group was 0.40 standard deviations less (0.74 less to 0.06 less) than in the standard care group	723 (7 RCTs)	⊕⊖⊖⊖ Very low[a,c]	An SMD of 0.40 is considered a low to moderate effect size
Mood	The mean mood in the music intervention group was 0.47 standard deviations better (0.02 worse to 0.97 better) than in the standard care group	236 (5 RCTs)	⊕⊕⊖⊖ Low[a,d]	An SMD of 0.47 is considered a moderate effect size
Pain	The mean pain in the intervention group was 0.91 standard deviations less (1.46 less to 0.36 less) than in the standard care group	528 (7 RCTs)	⊕⊕⊖⊖ Low[a,e]	An SMD of 0.91 is considered a large effect size
Fatigue	The mean fatigue in the music intervention group was 0.38 standard deviations less (0.72 less to 0.04 less) than in the standard care group	253 (6 RCTs)	⊕⊕⊖⊖ Low[a]	An SMD of 0.38 is considered a small to moderate effect size
Quality of life	The mean quality of life in the music intervention group was 0.98 standard deviations more (0.36 less to 2.33 more) than in the standard care group	545 (6 RCTs)	⊕⊕⊖⊖ Low[a,f]	An SMD of 0.98 is considered a large effect size

*__The risk in the intervention group__ (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; **SMD**: standardized mean difference.

GRADE Working Group grades of evidence
High quality: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a] The majority of the trials were at high risk of bias.
[b] Results were inconsistent across studies as evidenced by I^2 = 93%, but all treatment effects were in the desired direction.
[c] Results were inconsistent across studies as evidenced by I^2 = 77%, but all treatment effects were in the desired direction.
[d] Results were inconsistent across studies as evidenced by I^2 = 70%, but all treatment effects were in the desired direction.
[e] Results were inconsistent across studies as evidenced by I^2 = 88%, but all treatment effects were in the desired direction.
[f] Results were inconsistent across studies as evidenced by I^2 = 98% ,but all treatment effects were in desired direction and large heterogeneity was mostly due to outlying values of one study.

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 have an impact on cancer patients' physical well-being and quality of life (QoL), 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 people with cancer experience elevated levels of psychological distress and depression in response to diagnosis and treatment (van't Spijker 1997; Massie 2004; Norton 2004; Parle 1996; Raison 2003; Sellick 1999). 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). It is therefore important that cancer care incorporates services that help meet patients' psychological, social and spiritual needs.

Description of the intervention

The use of music in cancer care can be situated along a continuum of care, namely from music listening initiated by patients, to pre-recorded music offered by medical personnel, to music psychotherapy interventions offered by a trained music therapist. Therefore, 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 healthcare professionals (music medicine) and those implemented by trained music therapists (music therapy). A substantive body of evidence suggests that music therapy interventions provided by medical professionals are significantly more effective than music medicine interventions for a wide variety of outcomes (Dileo 2005). 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 music making, and employ a systematic therapeutic process including assessment, treatment and evaluation. Dileo 1999 categorizes interventions as music medicine when medical personnel offer pre-recorded music for passive listening. For example, they may offer people a CD 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, instruments or both;
- composing music;
- combining music with other therapeutic modalities (e.g. movement, imagery, art) (Dileo 2007).

How the intervention might work

Music interventions have been used in different medical fields to meet patients' psychological, physical, social and spiritual needs. Research on the effects of music and music therapy for medical patients has burgeoned over the past 20 years, examining a variety of outcome measures in a wide range of specialty areas (Dileo 2005). For both adult and pediatric cancer patients, music has been used to decrease anxiety prior to or during surgical procedures (Burns 1999; Haun 2001; Pfaff 1989), to decrease stress 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 2001a; Cassileth 2003), to enhance pain management (Akombo 2006; Beck 1989), to improve immune system functioning (Burns 2001a; Camprubi 1999), and to improve quality of life (QoL) (Burns 2001a; Hilliard 2003).

There are inherent elements of music—such as rhythm and tempo, mode, pitch, timbre, melody and harmony—that are known to influence physiological and psycho-emotional responses in humans. For example, music has been found to arouse memory and association, stimulate imagery, evoke emotions, facilitate social interaction, and promote relaxation and distraction (Dileo 2006). In cancer settings, music therapists conduct ongoing assessments and utilize various individualized interventions in people with cancer and their families, including pertinent elements of music within the context of therapeutic relationships, to address prevailing biopsychosocial and spiritual issues, symptoms and needs (Magill 2009; McClean 2012). The following music therapy interventions are common: use of songs (singing, song writing, and lyric analysis); music improvisation (instrumental and vocal), music and imagery, music-based reminiscence and life review, chanting and toning, music-based relaxation, and instrumental participation (O'Callaghan 2015). Based on patient preferences and assessment outcomes, music therapists adapt and modify music interventions to address symptoms and areas of difficulty; they utilize music and verbal strategies to provide opportunities for expression and communication, reminiscence, the processing of thoughts and emotions and improvement of symptom management (Magill 2011). Therapist-supported music therapy environments often provide the space and time through which patients and families may experience social connection, improve self fulfilment and acquire effective coping strategies (Magill 2015).

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 of statistical power. In addition, differences in factors such as 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 in cancer patients as well as to identify variables that may moderate its effects.

OBJECTIVES

To assess and compare the effects of music therapy and music medicine interventions for psychological and physical outcomes in people with cancer.

METHODS

Criteria for considering studies for this review

Types of studies

All randomized controlled trials (RCTs) and studies with quasi-randomized methods of treatment allocation (e.g. alternate allocation of treatments) were eligible for inclusion.

Types of participants

This review included participants diagnosed with any type of cancer. There were no restrictions as to age, sex, ethnicity or type of setting. We did exclude participants undergoing biopsy, bone marrow biopsy and aspiration for diagnostic purposes. This review did not include studies with cancer survivors.

Types of interventions

The review included all trials comparing standard treatment plus music therapy or music medicine interventions with:

1. standard care alone;
2. standard care plus alternative intervention (e.g. music therapy versus music medicine);
3. standard care plus placebo.

Placebo treatment can involve the use of headphones for the patient without provision of music stimuli or with another type of auditory stimulus (e.g. audiobooks, 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. heart rate, respiratory rate, 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, 2016,* Issue 1) (Appendix 1);
2. MEDLINE (OvidSp) (1950 to January, week 2, 2016) (Appendix 2);
3. Embase (OvidSp) (1980 to 2016, week 4) (Appendix 3);
4. CINAHL (EbscoHost)(1982 to 23 January 2016) (Appendix 4);
5. 5. PsycINFO (OvidSp) (1967 to January 15 2016) (Appendix 5);
6. LILACS (Virtual Health Library) (1982 to January 2016) (Appendix 6).
7. The Science Citation Index (ISI) (inception to January 2016) (Appendix 7).
8. CancerLit (1983 to 2003) (http://www.cancer.gov) (Appendix 8).
9. CAIRSS for Music (inception to January 2016) (http://ucairss.utsa.edu/) (Appendix 9).
10. Proquest Digital Dissertations (Proquest) (inception to January 2016) (Appendix 10).
11. ClinicalTrials.gov (http://www.clinicaltrials.gov/) (inception to January 2016) (Appendix 11).
12. Current Controlled Trials (http://www.controlled-trials.com/) (inception to January 2016) (Appendix 12).
13. National Research Register (http://www.update-software.com/National/) (inception to September 2010; the NRR is no longer active) (Appendix 13).
14. http://www.wfmt.info/Musictherapyworld/ (database is no longer functional) (inception to March 2008) .
15. RILM Abstracts of Music Literature (EbscoHost) (1969 to January 2016) (Appendix 14).

Searching other resources

We handsearched the following journals from first available date to January 2016

- *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*.
- *Music and Medicine.*
- *Approaches.*

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. the American Music Therapy Association at www.musictherapy.org and the British Association for Music Therapy at http://www.bamt.org).

We also handsearched the website of the Deutsches Zentrum fur Musiktherapieforschung (www.dzm-heidelberg.de/forschung/publikationen/) and the research pages of the PhD programs that are listed on the website of the European Music Therapy Confederation (emtc-eu.com/music-therapy-research/).

Data collection and analysis

Selection of studies

We divided the responsibility of the searches, as outlined in the search strategy, amongst JB, AT and research assistants. JB, AT and research assistants scanned titles and abstracts of each record retrieved from the search and deleted obviously irrelevant references. When we could not reject a title or abstract with certainty, we consulted the other review authors. We used an inclusion criteria form to assess the trial's eligibility for inclusion (Appendix 15). We kept a record of all excluded trials that initially appeared eligible and the reason for exclusion.

Data extraction and management

JB and AT independently extracted data from the selected trials using a standardized coding form. We discussed differences in data extraction until reaching a consensus. 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)
- Length of intervention
- Frequency of intervention
- Comparison intervention

Participant information

- Total sample size
- Number in experimental group
- Number in control group
- Sex
- Age
- Ethnicity
- Diagnosis
- Illness stage
- Setting
- Inclusion criteria

Outcomes

We extracted pre-test means, post-test means, standard deviations and sample sizes 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.

1. Psychological outcomes (e.g. depression, anxiety, anger, hopelessness, helplessness)
2. Physical symptoms (e.g. fatigue, nausea, pain)
3. Physiological outcomes (e.g. heart rate, respiratory rate, immunoglobulin A (IgA) levels)
4. Social and spiritual support (e.g. family support, spirituality, social activity, isolation)
5. Communication (e.g. verbalization, facial affect, gestures)
6. Quality of life

Assessment of risk of bias in included studies

Two review authors (JB and CD) assessed all included trials for risk of bias for the original review. CD and LM conducted the 'Risk of bias' assessment for new studies included in this update. All authors were blinded to each other's assessments. We resolved any disagreements by discussion. The authors used the following criteria for quality assessment.

Random sequence generation

- Low risk
- Unclear risk
- High risk

We rated trials to be at low risk for random sequence generation if every participant had an equal chance to be selected for either condition and 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 a a judgement of 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. trials used alternation methods)

Blinding of participants and personnel

- Low risk
- Unclear risk
- High risk

Since participants cannot be blinded in a music intervention trial, we did not downgrade studies for not blinding the participants. As for personnel, in music therapy studies music therapists cannot be blinded because they are actively making music with the patients. In contrast, in music medicine studies blinding of personnel is possible by providing control group participants with headphones

but no music (e.g. blank CD). Therefore, downgrading for not blinding personnel was only applied in studies that used listening to pre-recorded music.

Blinding of outcome assessors

- Low risk
- Unclear risk
- High risk

When the study included no objective outcomes, we noted this in the Characteristics of included studies table, and we rated the trial as being at low risk of bias for outcome assessment of objective outcomes. The majority of the studies used self report measures for subjective outcomes. We rated these studies as being at high risk of bias for subjective outcomes, unless study participants were blinded to the study hypothesis (for comparative studies).

Incomplete outcome data

We recorded the proportion of participants whose outcomes were analyzed. 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 from suggestions 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

We considered information on potential financial conflicts of interest to be a possible source of additional bias.

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

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

Measures of treatment effect

We present all outcomes in this review as continuous variables. We calculated standardized mean differences with 95% confidence intervals (CI) for outcome measures using results from different scales. When there were sufficient data available from various studies using the same measurement instrument, we computed a mean difference (MD) with 95% CI.

Unit of analysis issues

In all studies included in this review, participants were individually randomized to the intervention or the standard care control group. Post-test values or change values on a single measurement for each outcome from each participant were collected and analyzed.

Dealing with missing data

We did not impute missing outcome data. We analyzed data on an endpoint basis, including only participants for whom final data point measurement was available (available case analysis). We did not assume 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

We tested for publication bias visually in the form of funnel plots (Higgins 2011).

Data synthesis

We present all outcomes in this review as continuous variables. We calculated standardized mean differences (SMD) 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 MDs. 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. We interpreted the magnitude of the SMDs using the interpretation guidelines put forth by Cohen 1988). Cohen suggested that an effect size of 0.2 be considered a small effect, an effect size of 0.5 medium, and an effect size of 0.8 large.

We made the following treatment comparisons in meta-analyses.

1. Music interventions plus standard care versus standard care alone.
2. Music therapy versus music medicine interventions (this was only possible for anxiety).
3. Music interventions plus standard care versus standard care plus alternative relaxation interventions
4. Music interventions plus standard care versus standard care plus placebo (audiobook control).

Several studies compared music interventions with non-music relaxation interventions. However, there was an insufficient number of trials to allow for a treatment comparison analysis. These studies are therefore included in the narrative under the third comparison (music intervention versus alternative intervention) but not in the meta-analysis of this review.

Subgroup analysis and investigation of heterogeneity

We conducted the following subgroup analyses within the music interventions plus standard care versus standard care alone comparison for outcomes with a sufficient number of available studies.

1. Music medicine versus music therapy.
2. Type of intervention (e.g. music listening alone versus music-guided relaxation).
3. Music preference (patient-preferred music versus researcher-selected music).

We planned the following subgroup analyses a priori, but we could not carry these out because of insufficient numbers of trials per outcome for age subgroup analysis and because no separate data were available according to stage of illness.

1. Different age groups.
2. Stages of illness.

We conducted subgroup analyses as described by Deeks 2001 and recommended in section 9.6 of 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

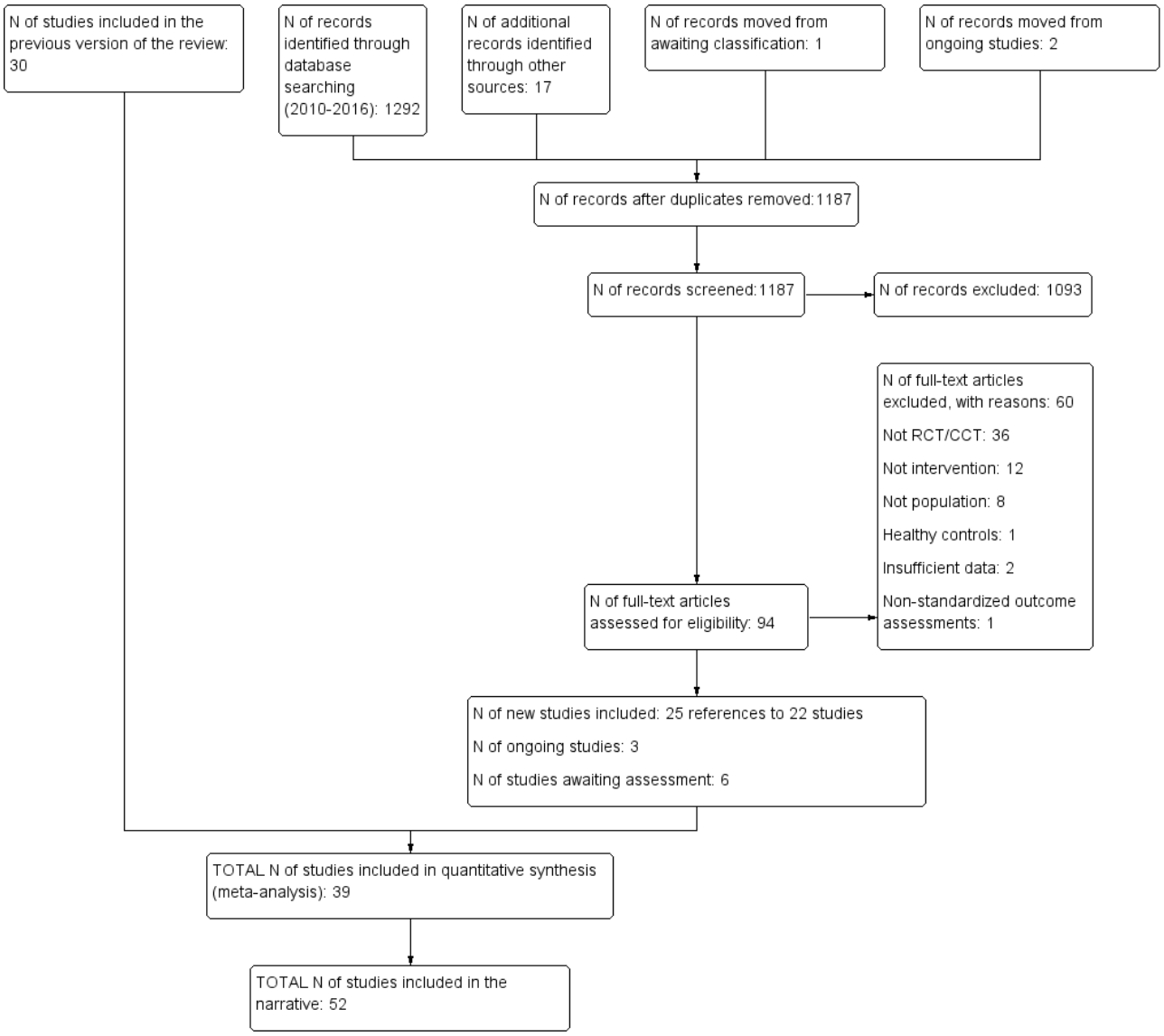
Description of studies

Results of the search

For the original review, 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 we retrieved for further assessment. One review author (JB) and a research assistant then independently screened them. We included 30 trials, reported in 36 records, in the original review. Where necessary, we contacted principal investigators to obtain additional details on trials and data. We identified three ongoing trials (NCT02261558; NCT02583126; NCT02583139). We moved two ongoing studies from the original review to the 'awaiting assessment' classification (NCT00086762; O'Brien 2010). Unfortunately, we could not include them in this update as their results were not yet available for inclusion. We classified four additional studies as awaiting assessment because their results were not yet published, and the authors could not provide the results for inclusion in this review.

The 2016 update of the search resulted in 1187 unique citations. Two review authors (JB and AT) and one research assistant examined the titles and abstracts, retrieving full-text articles where necessary. This resulted in the addition of 25 references reporting on 22 trials (Figure 1) and three new ongoing trials (NCT02261558; NCT02583126; NCT02583139).

Figure 1. Study flow diagram.



Included studies

We included 52 trials with a total of 3731 participants. Seventeen trials included participants who underwent chemotherapy or radiation therapy (Bradt 2015; Bulfone 2009; Burrai 2014; Cai 2001; Chen 2013; Clark 2006; Ferrer 2005; Gimeno 2008; Jin 2011; Lin 2011; Moradian 2015; O'Callaghan 2012; Romito 2013; Smith 2001; Straw 1991; Xie 2001; Zhao 2008), 20 trials examined the effects of music during procedures or surgery (Binns-Turner 2008; Bufalini 2009; Burns 2009; Cassileth 2003; Danhauer 2010; Fredenburg 2014a; Fredenburg 2014b; Kwekkeboom 2003; Li 2004; Li 2012; Nguyen 2010; Palmer 2015; Pinto 2012; Ratcliff 2014; Robb 2014; Rosenow 2014; Vachiramon 2013; Wang 2015; Yates 2015; Zhou 2015), and 14 trials included general cancer patients (Beck 1989; Burns 2001a; Burns 2008; Chen 2004; Cook 2013; Duocastella 1999; Hanser 2006; Harper 2001; Hilliard 2003; Huang 2006; Liao 2013; Robb 2008; Shaban 2006; Wan 2009). Five trials examined music interventions in pediatric patients (Bufalini 2009; Burns 2009; Duocastella 1999; Nguyen 2010; Robb 2014).

This review included 2090 females and 1171 males. Five trials did not provide information on the distribution between sexes (Danhauer 2010; Jin 2011; Robb 2008; Shaban 2006; Xie 2001). The average age of the participants was 54.67 years for adult trials and 10.93 years for pediatric trials. Seventeen studies did not report on the ethnicity of the participants (Burns 2001a; Burns 2008; Burrai 2014; Cassileth 2003; Chen 2013; Cook 2013; Duocastella 1999; Ferrer 2005; Lin 2011; Moradian 2015; O'Callaghan 2012; Robb 2008; Romito 2013; Straw 1991; Vachiramon 2013; Wang 2015; Zhou 2015). For trials that did provide information on ethnicity, the distribution was as follows: 50% white, 32% Asian, 7% black, 8% Latino, and 3% other. The trials took place in nine different countries: the United States (Bradt 2015; Beck 1989; Binns-Turner 2008; Burns 2001a; Burns 2008; Burns 2009; Cassileth 2003; Clark 2006; Cook 2013; Danhauer 2010; Ferrer 2005; Fredenburg 2014a; Fredenburg 2014b; Hanser 2006; Harper 2001; Hilliard 2003; Kwekkeboom 2003; Gimeno 2008; Palmer 2015; Ratcliff 2014; Robb 2008; Robb 2014; Rosenow 2014; Smith 2001; Straw 1991; Vachiramon 2013; Yates 2015), China (Cai 2001; Chen 2004; Jin 2011;

Li 2004; Li 2012; Liao 2013; Wan 2009; Xie 2001; Zhao 2008), Italy (Bufalini 2009; Bulfone 2009), Iran (Moradian 2015; Shaban 2006), Spain (Duocastella 1999), Taiwan (Chen 2013; Huang 2006; Lin 2011; Wang 2015; Zhou 2015), Brazil (Pinto 2012), Australia (O'Callaghan 2012) and Vietnam (Nguyen 2010). Trial sample size ranged from 8 to 260 participants.

We classified 23 trials as music therapy studies (Bradt 2015; Bufalini 2009; Burns 2001a; Burns 2008; Burns 2009; Cassileth 2003; Clark 2006; Cook 2013; Duocastella 1999; Ferrer 2005; Fredenburg 2014a; Fredenburg 2014b; Hanser 2006; Hilliard 2003; Gimeno 2008; Palmer 2015; Ratcliff 2014; Robb 2008; Robb 2014; Romito 2013; Rosenow 2014; Stordahl 2009; Yates 2015). Of these trials, nine used interactive music making with the participants, four used music-guided imagery, two used music-guided relaxation, six used live patient-selected music performed by the music therapist and two used music video making. We classified 29 trials 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 1 to 40 (e.g. multiple music listening sessions per day for length of hospital stay). Most sessions lasted 30 to 45 minutes. We report details on frequency and duration of sessions for each trial in the Characteristics of included studies table.

Forty-nine trials used parallel group designs, whereas three trials used a cross-over design (Bradt 2015; Beck 1989; Gimeno 2008). Not all trials measured all outcomes identified for this review.

We show details of the trials included in the review in the Characteristics of included studies table.

Excluded studies

In the original review, 27 of the 101 reports that we 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 principal investigators. Reasons for exclusions were: not a randomized or quasi-randomized controlled trial (29 studies); insufficient data reporting (2 studies); unacceptable methodological quality (3 studies); not a music intervention (1 study); not exclusively cancer patients (1 study); and article could not be located (2 studies).

For the update, we retrieved 94 reports for further assessment. We excluded 60 studies for the following reasons: not a randomized or quasi-randomized controlled trial (36 studies), insufficient data reporting (2 studies), not music intervention (12 studies), not population of interest (8 studies), use of healthy controls (1 study), and use of non-standardized measurement tools (1 study).

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 detail the risk of bias for each trial in the 'Risk of bias' tables included in the Characteristics of included studies table and the 'Risk of bias summary' (Figure 2). In addition, readers can consult an overall assessment of risk of bias in Figure 3.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

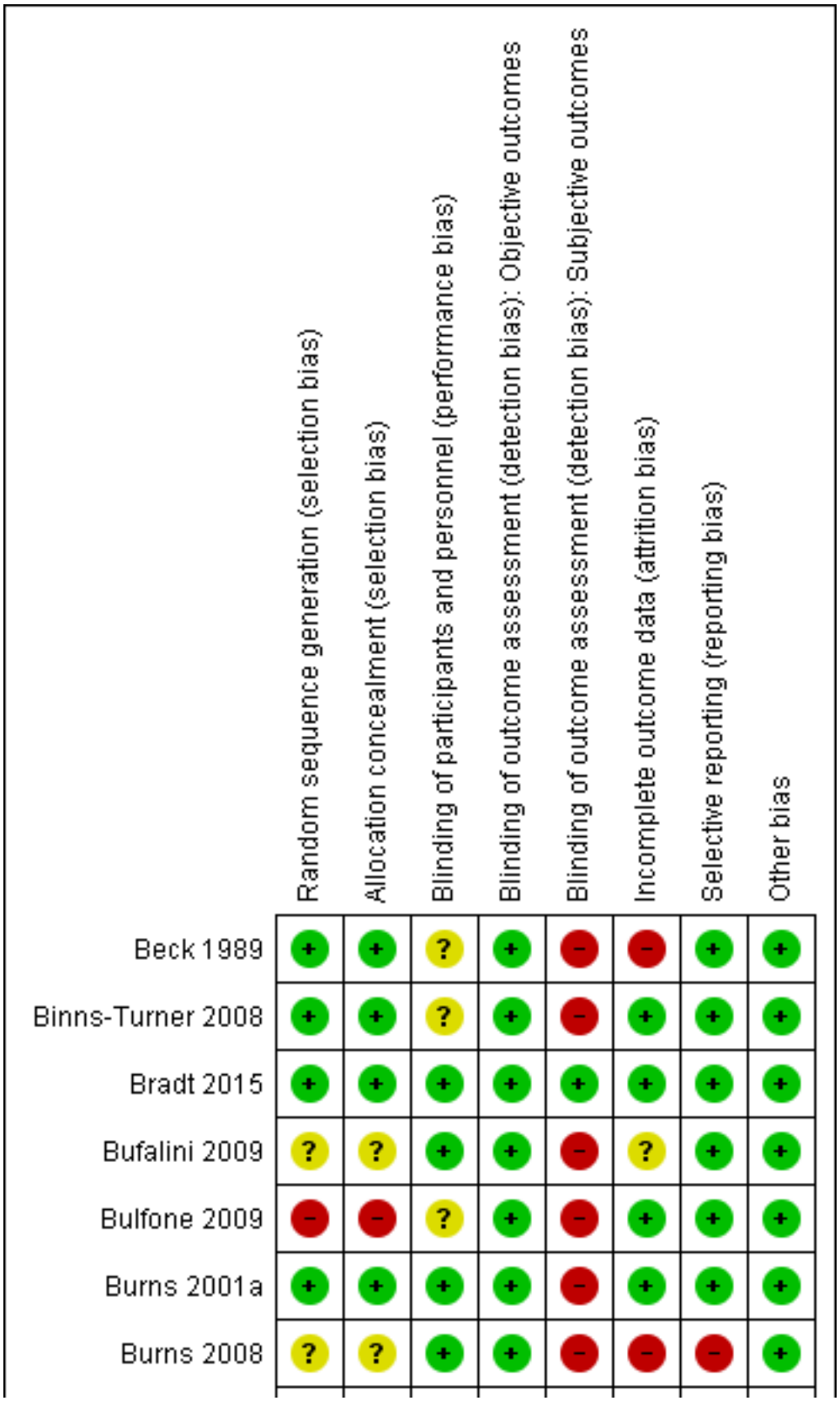


Figure 2. (Continued)

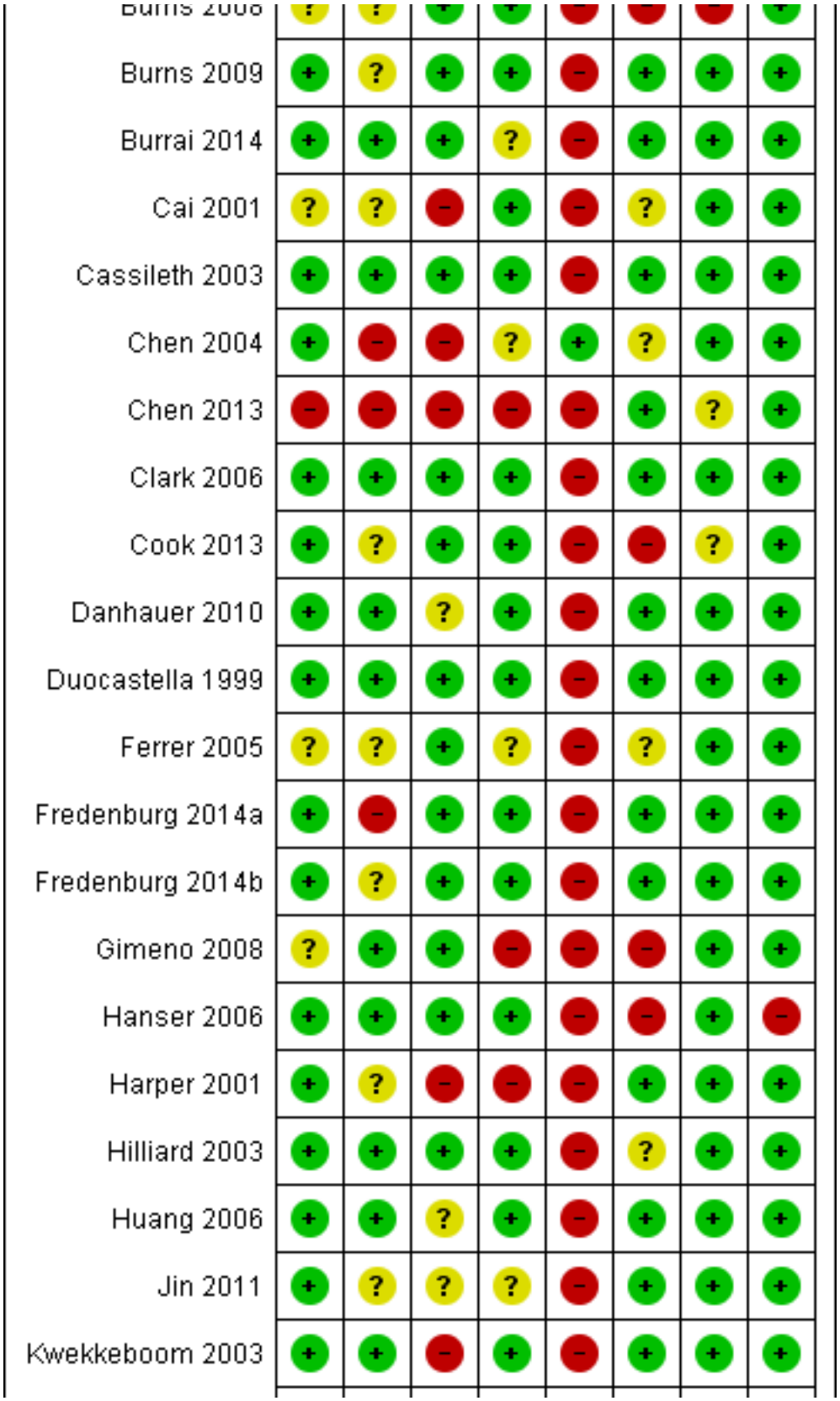


Figure 2. (Continued)

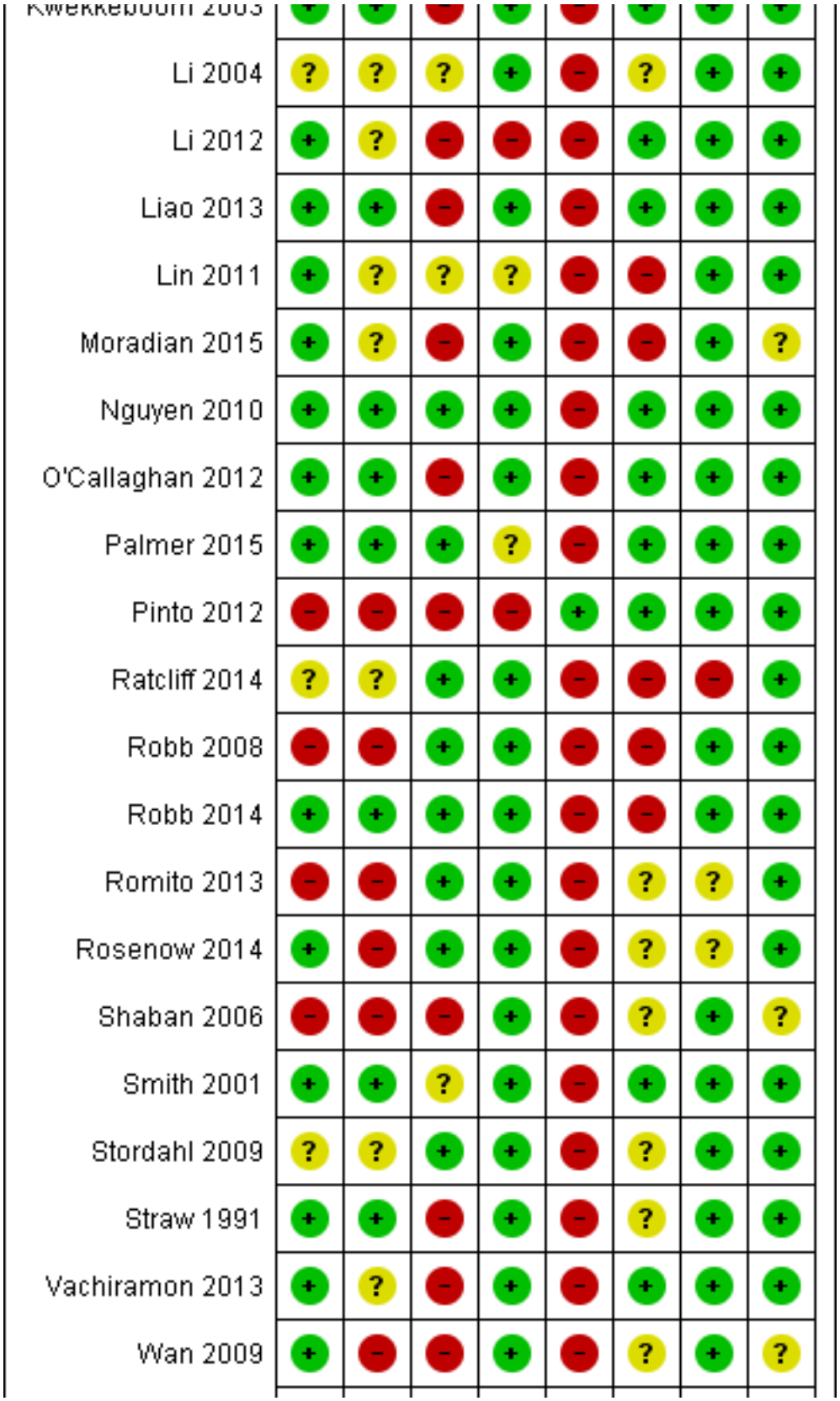


Figure 2. (Continued)

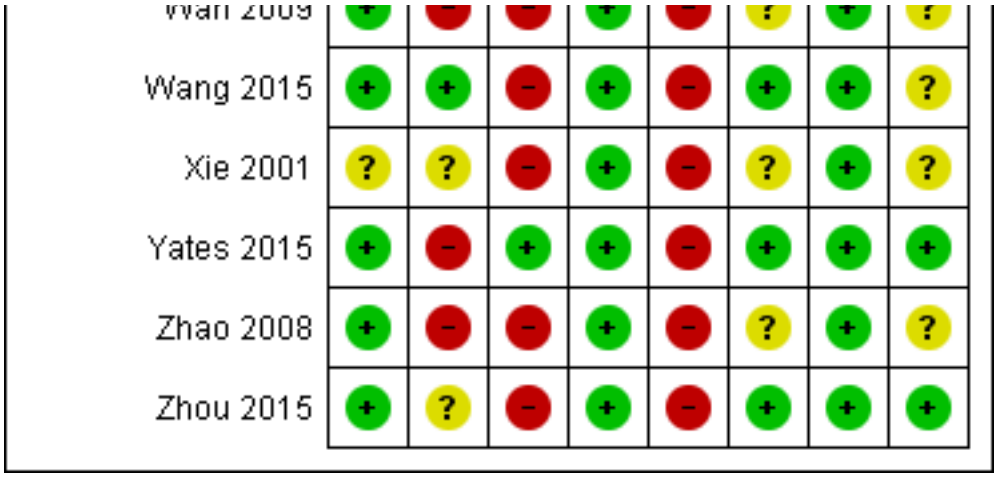
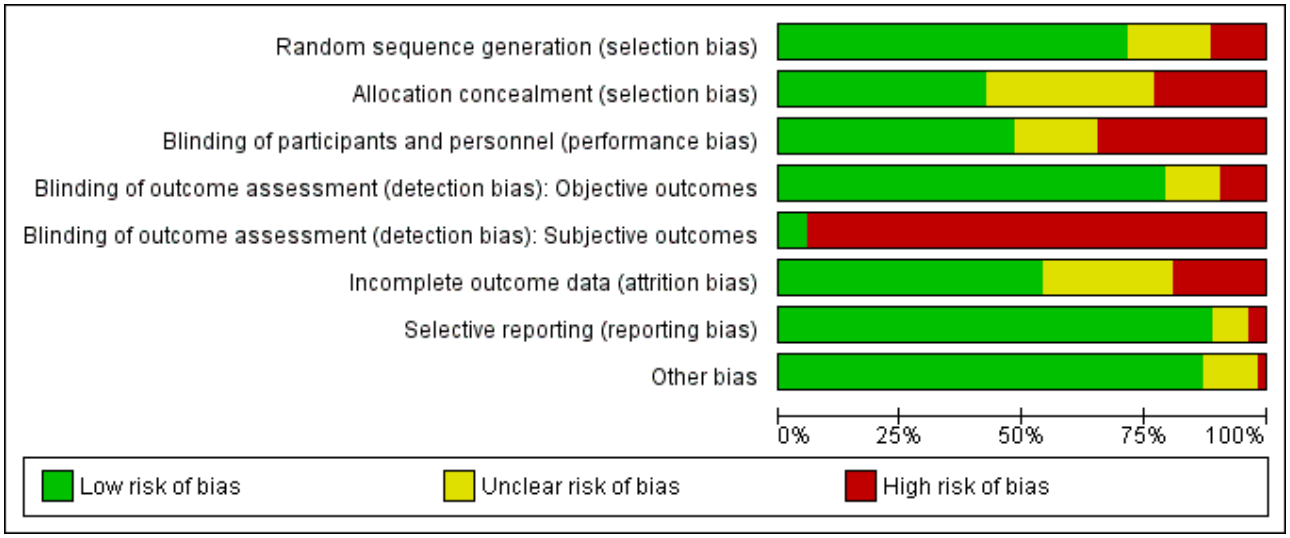


Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Allocation

We included 37 trials that used appropriate methods of randomization (e.g. computer-generated table of random numbers, drawing of lots, coin flip), 6 trials that used systematic methods of treatment allocation (e.g. alternate group assignment, date of birth), and 9 trials that reported using randomization but failed to state the randomization method.

Twenty-two trials concealed allocation, whereas 12 trials did not. For the remainder of the trials, authors did not mention allocation concealment.

Blinding

Fifteen trials included objective outcomes, but only four of them reported blinding of the outcome assessors. For six trials, the use of blinding was unclear. The other trials did not use blinding. The majority of the trials included subjective outcomes only. It is important to point out that blinding of outcome assessors is not possible in the case of self report measurement tools for subjective outcomes (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.

Incomplete outcome data

The dropout rate was small for most trials, falling between 0% and 17%. Ten trials reported dropout rates of more than 20%. For 14 trials, it was unclear whether there were any participant withdrawals. Most trials reported reasons for dropout. Detailed information on dropout rate and reasons is included in the Characteristics of included studies table.

Selective reporting

We did not find any evidence of selective reporting by the authors.

We examined publication bias visually in the form of funnel plots for several of the included outcomes. Visual inspection suggested

that there was no publication bias for anxiety (Figure 4), depression (Figure 5), pain (Figure 6), and heart rate (Figure 7). We did detect a possible publication bias for fatigue (Figure 8), but this was based on a small number of trials. For this outcome, it is possible that studies that did not result in statistically significant findings may not have been published.

Figure 4. Funnel plot of comparison: 1 Music intervention plus standard care versus standard care alone, outcome: 1.1 Anxiety (STAI).

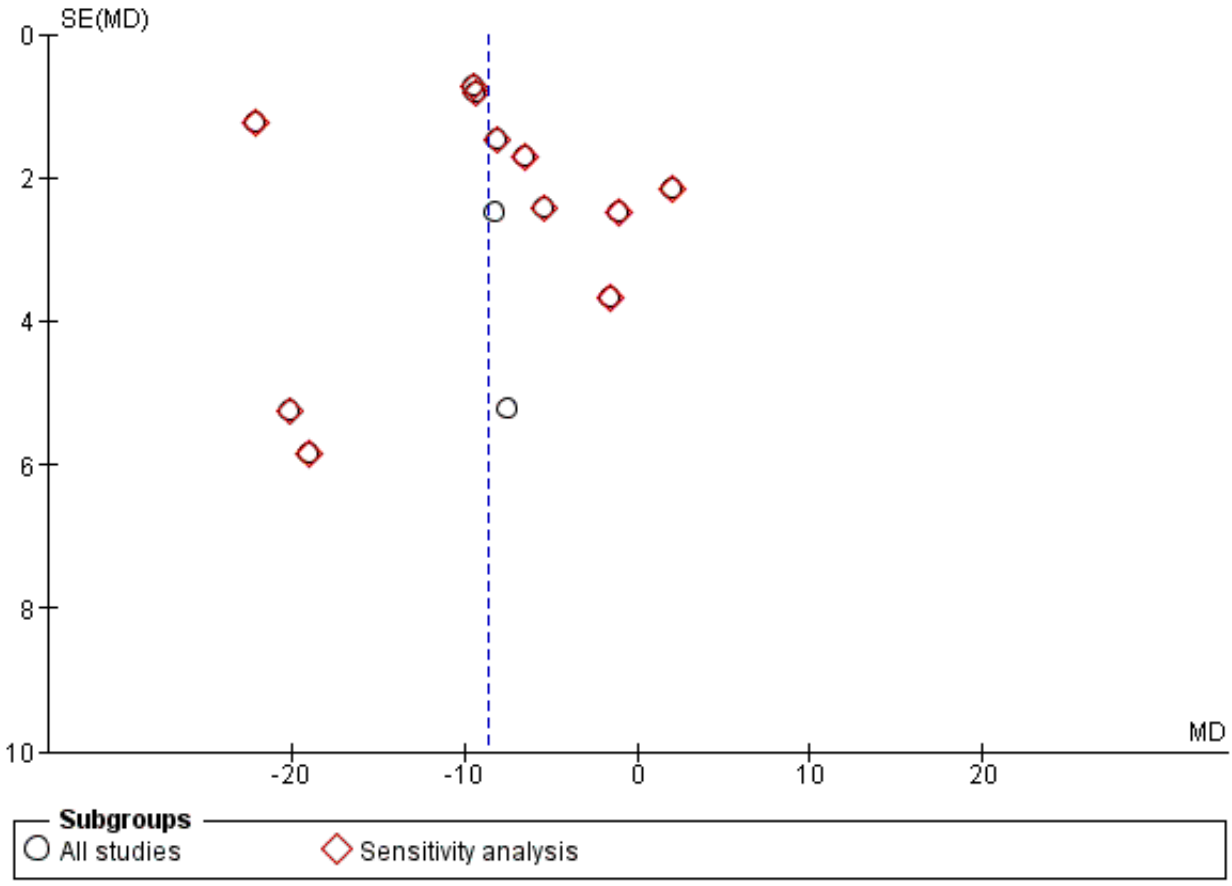


Figure 5. Funnel plot of comparison: 1 Music intervention plus standard care versus standard care alone, outcome: 1.6 Depression.

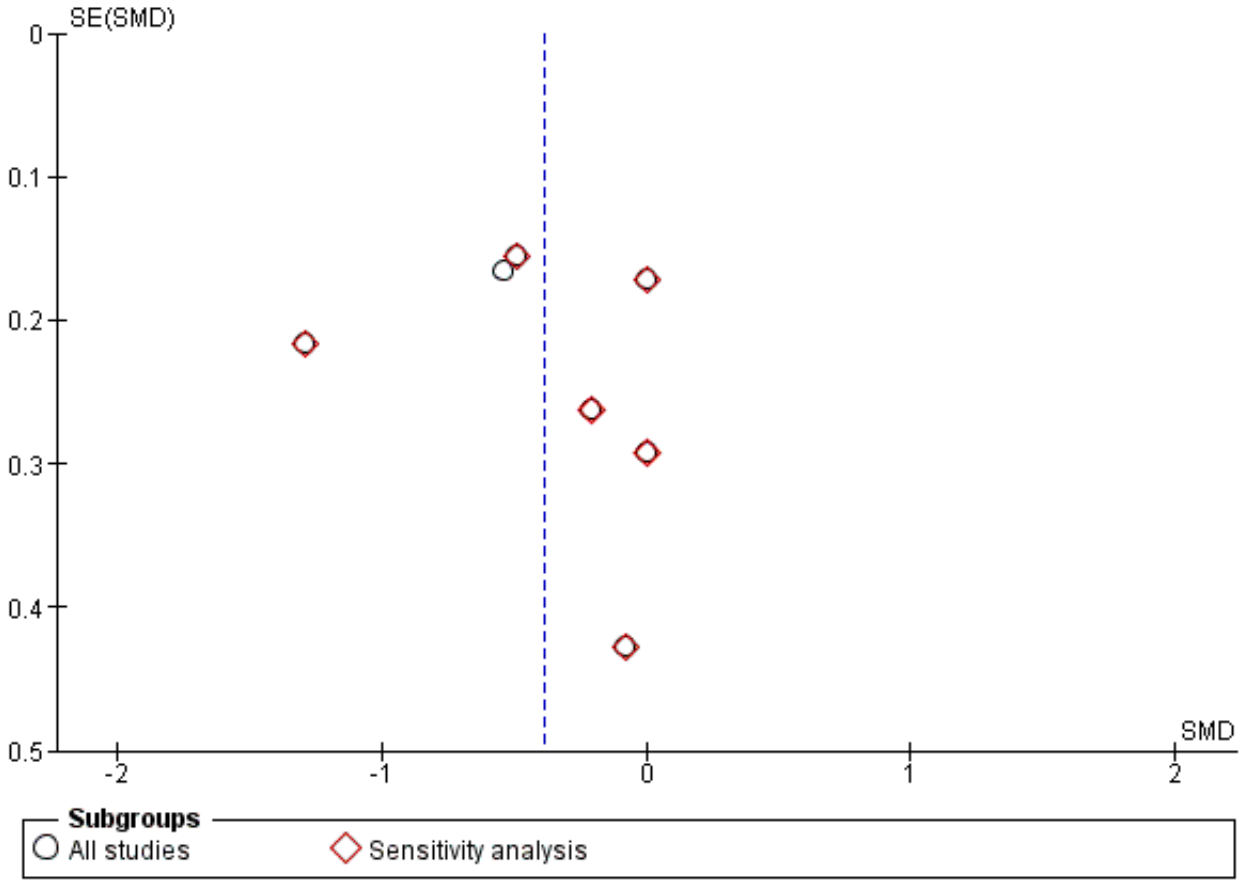


Figure 6. Funnel plot of comparison: 1 Music intervention plus standard care versus standard care alone, outcome: 1.11 Pain.

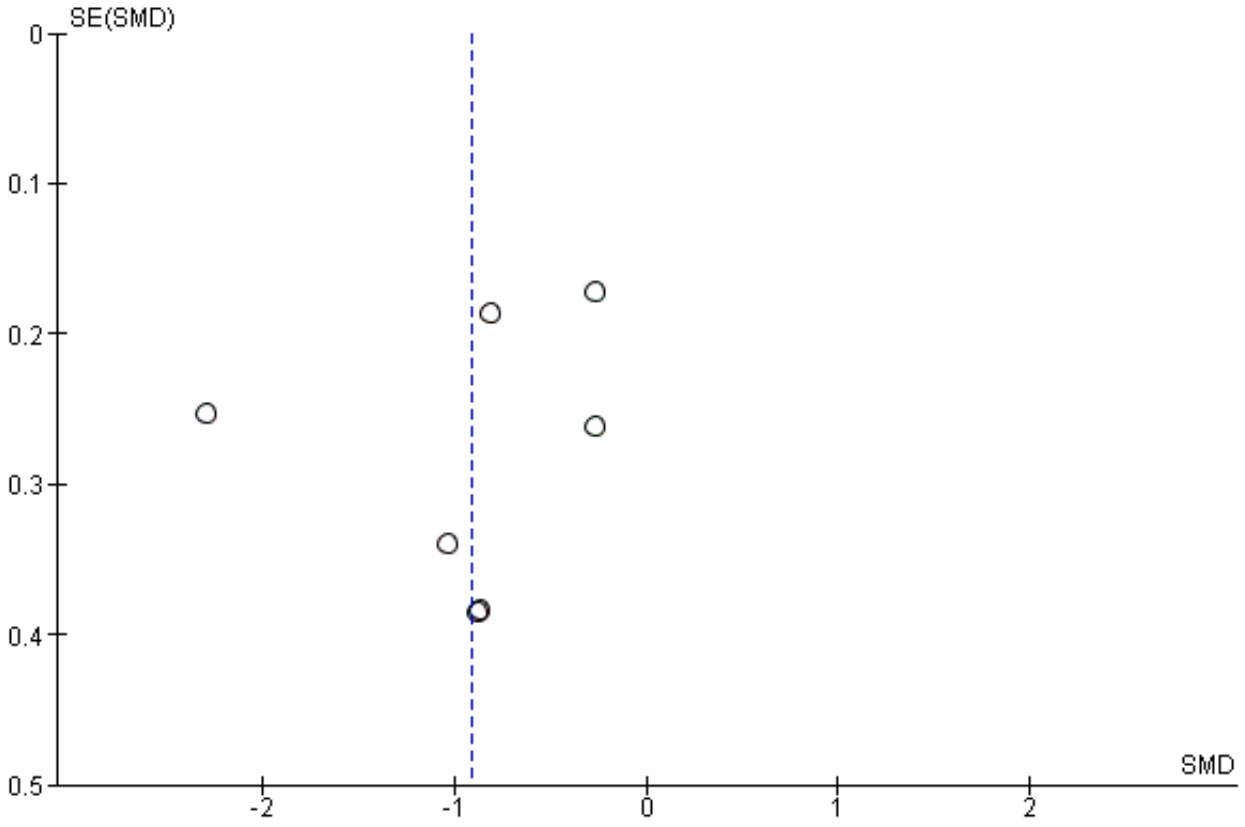


Figure 7. Funnel plot of comparison: 1 Music intervention plus standard care versus standard care alone, outcome: 1.15 Heart rate.

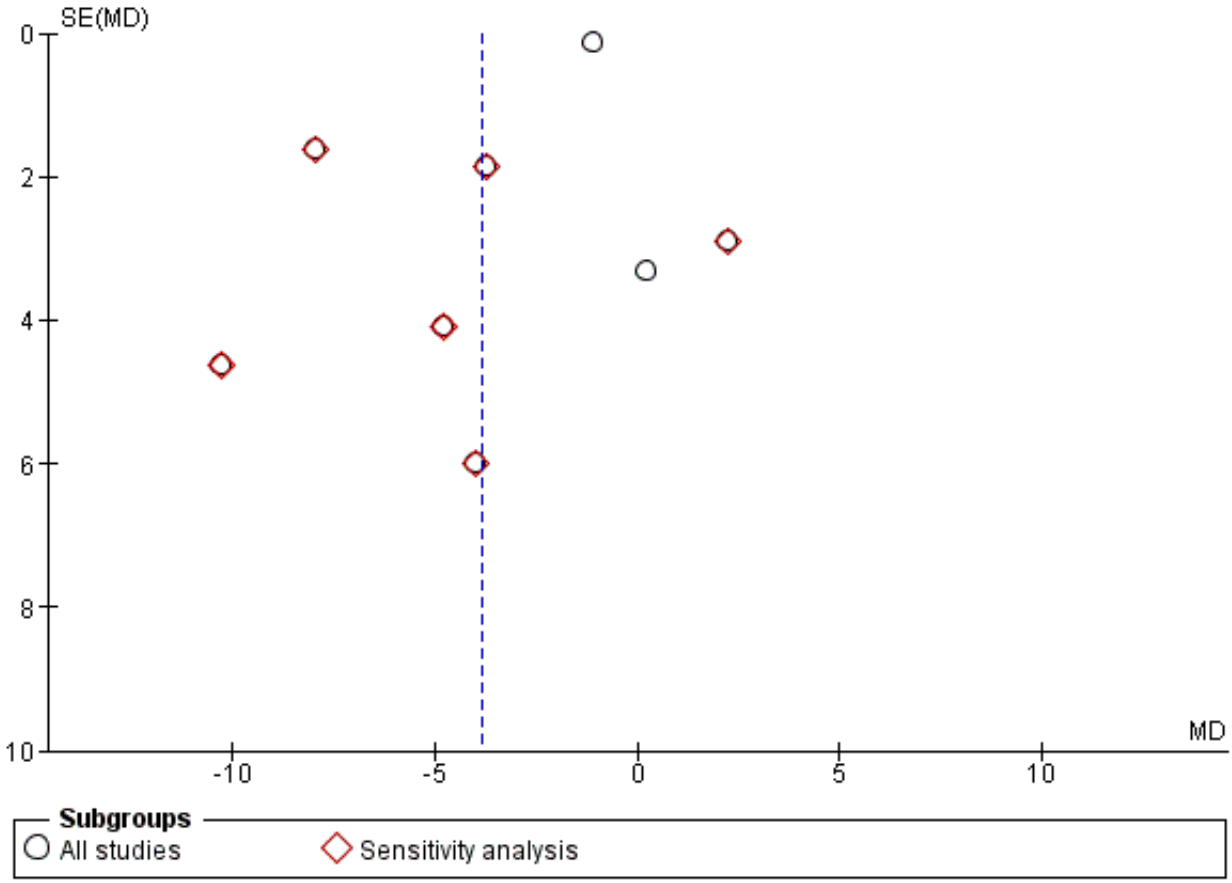
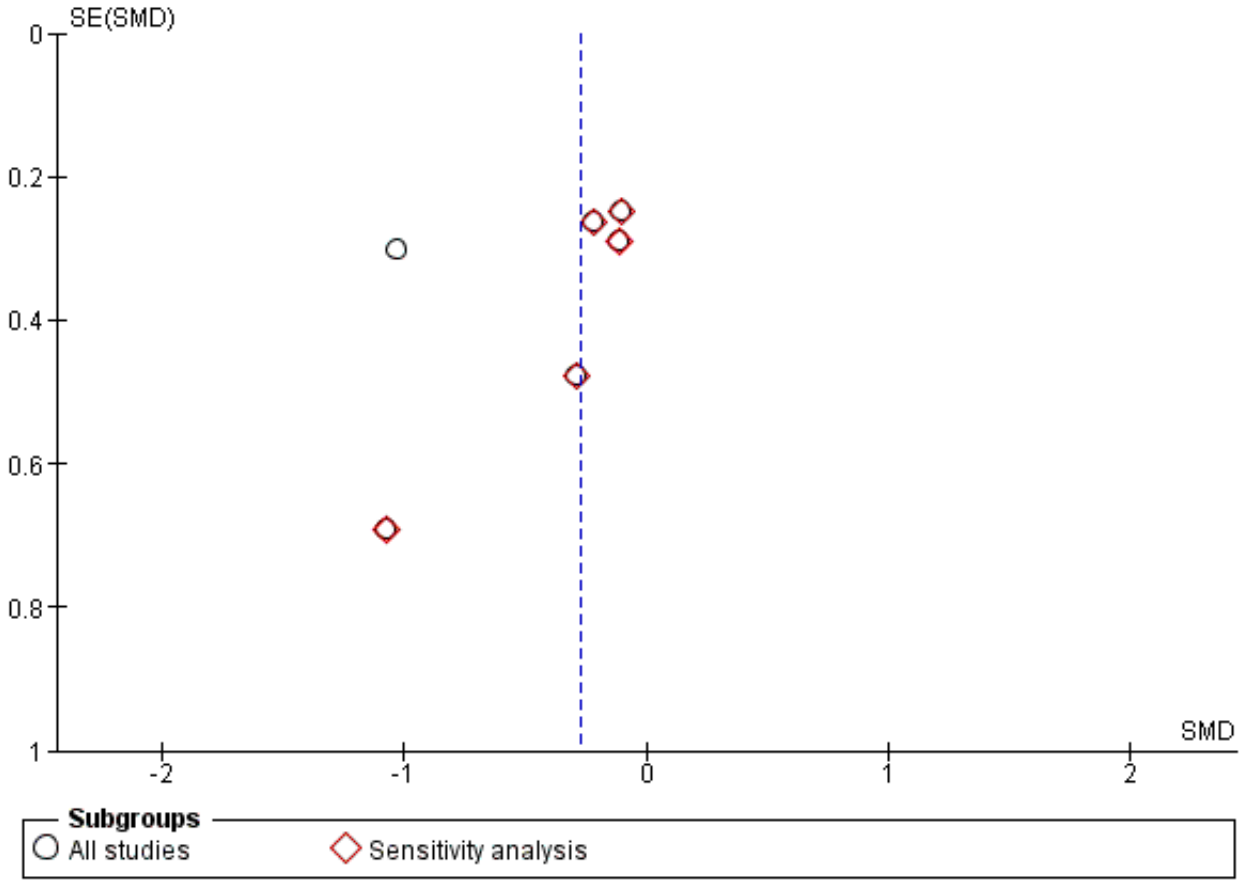


Figure 8. Funnel plot of comparison: 1 Music intervention plus standard care versus standard care alone, outcome: 1.13 Fatigue.



Other potential sources of bias

We did not identify any other potential sources of bias in the studies included in this review.

As a result, only one trial was at low risk of bias (Bradt 2015). Two additional trials were at low risk of bias for objective outcomes, as they satisfied all criteria used to assess risk of bias (Duocastella 1999; Nguyen 2010). Forty-six trials were at high risk of bias. Three trials were at moderate risk of bias (Binns-Turner 2008; Hilliard 2003; Palmer 2015). 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 the studies compare the music intervention with another active 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 they have adequately addressed all other risk factors (e.g. randomization, allocation concealment, etc.).

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.

Effects of interventions

See: **Summary of findings for the main comparison** Music interventions compared to standard care for psychological and physical outcomes in cancer patients

Comparison 1: Music intervention plus standard care versus standard care alone

Primary outcomes

Psychological outcomes

State anxiety

Twenty-three trials examined the effects of music interventions plus standard care compared to standard care alone for anxiety in participants with cancer. Fifteen trials measured anxiety by means of the Spielberger State-Trait Anxiety Inventory - State Anxiety form (STAI-S) (Binns-Turner 2008; Bufalini 2009; Bulfone 2009; Chen 2013; Danhauer 2010; Harper 2001; Jin 2011; Kwekkeboom 2003; Li 2012; Lin 2011; O'Callaghan 2012; Smith 2001; Vachiramon 2013; Wan 2009; Zhou 2015); one trial used the STAI-short form (Nguyen 2010); and eight trials reported mean anxiety measured by other scales, such as a numeric rating scale or a visual analogue scale (Cai 2001; Cassileth 2003; Ferrer 2005; Hanser 2006; Li 2004; Palmer 2015; Yates 2015; Zhao 2008). We could not include the data from Burns 2008 because it did not report post-test or follow-up scores. The author did provide follow-up

scores (4 weeks postintervention), but we could not combine these with the post-test scores of the other trials. Moreover, Burns 2008 reported a large moderating effect of pre-intervention affect state scores on post-test scores and follow-up scores. We also did not include the data from Kwekkeboom 2003 in the meta-analysis because this study was affected by 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. Finally, we report the data from Hanser 2006 narratively but do not include them in the meta-analysis because of the high attrition rate (40%). In addition, the researchers experienced serious issues with intervention implementation within the predetermined implementation timeframe (three sessions were implemented over a 15-week period), and the authors concluded that the intervention was significantly diluted because of this.

A meta-analysis of 13 trials that used the full STAI-S (score range: 20 to 80) to examine state anxiety in 1028 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: −8.54, 95% CI −12.04 to −5.05, P < 0.0001; Analysis 1.1). Statistical heterogeneity across the trials (I^2 = 93%) was due to some trials reporting much larger beneficial effects of music interventions than others (Binns-Turner 2008; Harper 2001; Wan 2009). In Kwekkeboom 2003, 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 excluding the trials that used inadequate methods of randomization (Bulfone 2009; Chen 2013), or for which the method of randomization was unclear (Bufalini 2009), had minimal impact on the pooled effect size (MD: −8.64, 95% CI −12.50 to −4.79, P < 0.0001, I^2 = 94%; Analysis 1.1).

The standardized mean difference (SMD) of trials that reported post-test anxiety scores on measures other than the full-form STAI-S (N = 449) also suggested a moderate to large anxiety-reducing effect of music (SMD: −0.71, 95% CI −0.98 to −0.43, P <.00001; Analysis 1.2; Cai 2001; Ferrer 2005; Li 2004; Nguyen 2010; Zhao 2008; Yates 2015). The results were consistent across the trials (I^2 = 41%). We did not include the data of two trials in the meta-analysis because change scores and final scores should not be combined for the computation of a SMD (Cassileth 2003; Palmer 2015). However, the data by Cassileth 2003 were consistent with the results of the meta-analysis, 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) on the POMS-anxiety subscale (score range: 0 to 36). Likewise, the data from Palmer 2015 indicated a beneficial effect of music therapy (mean change score: −30.9, SD 36.3) versus standard care (mean change score: 0, SD 22.7) on the Global Anxiety-VAS (score range: 0 to 100 mm). A sensitivity analysis to examine the impact of randomization method, excluding the data of Cai 2001, Ferrer 2005 and Li 2004, resulted in a larger SMD of −0.80 (95% CI −1.44 to −0.16, P = 0.01; Analysis 1.2), but the results were no longer consistent across studies (I^2 = 66%).

Next, we conducted several a priori determined subgroup analyses as outlined in the Methods.

First, we compared the treatment benefits of music therapy versus music medicine studies for anxiety. We only included studies that reported post-test scores in this analysis to allow for computation of a standardized mean difference across studies. The pooled effect of three music therapy studies (SMD: −0.62, 95% CI −1.01 to −0.24, P = 0.001, I^2 = 0%; Bufalini 2009; Ferrer 2005; Yates 2015) was smaller than of the music medicine studies (SMD: −1.00, 95% CI −1.45 to −0.55, P < 0.0001, I^2 = 93%; Binns-Turner 2008;Bulfone 2009; Cai 2001; Danhauer 2010; Jin 2011; Li 2004; Li 2012; Lin 2011; Nguyen 2010; O'Callaghan 2012; Smith 2001; Vachiramon 2013; Wan 2009; Zhao 2008; Zhou 2015). However, this difference was not statistically significant (P = 0.21). It is worth noting that the results of the music therapy studies were consistent across studies, whereas the results of the music medicine studies were highly heterogeneous (Analysis 1.3).

Second, we compared studies that used patient-preferred music with studies that used researcher-selected music. For this comparison, we only included studies that used listening to pre-recorded music as the intervention. Music preference did not appear to impact the treatment benefits for anxiety. The use of patient-preferred music resulted in a SMD of −0.86 (95% CI −1.38 to −0.34, P = 0.001, I^2 = 92%) whereas researcher-selected music resulted in a SMD of −0.89 (95% CI −1.43 to −0.35, P = 0.001, I^2 = 71%) (Analysis 1.4).

Finally, we compared the music medicine studies by type of intervention (e.g. music-guided relaxation, music listening alone, etc.). We could not conduct this subgroup analysis for music therapy studies because of an insufficient number of trials. The majority of the music medicine studies used listening to pre-recorded music. Four studies, however, embedded relaxation or imagery instructions within the pre-recorded music (Jin 2011; Lin 2011; Wan 2009; Zhou 2015). The pooled effect of these four studies (SMD: −1.61, 95% CI −2.56 to −0.65, P = 0.0009, I^2 = 95%) was much larger than that of music listening only studies (SMD: −0.71, 95% CI −1.16 to −0.26, P = 0.002, I^2 = 89%) but because of the large heterogeneity, this difference was not statistically significant (P = 0.10) (Analysis 1.5).

Depression

Seven trials examined the effects of music plus standard care compared to standard care alone on depression in 723 participants (Cai 2001; Cassileth 2003; Clark 2006; Li 2012; Wan 2009; Yates 2015; Zhou 2015). Their pooled estimate indicated a moderate treatment effect of music (SMD: −0.40, 95% CI −0.74 to −0.06, P = 0.02; Analysis 1.6), but the results were inconsistent across trials (I^2 = 77%). A sensitivity analysis examining the impact of randomization method did not have much impact on the pooled effect size (SMD: −0.37, 95% CI −0.79 to 0.05, P = 0.08, I^2 = 81%; Analysis 1.6).

A subgroup analysis revealed that there was no statistically significant difference between music therapy and music medicine studies for the outcome of depression (P = 0.12) (Analysis 1.7). We also examined the impact of music preference in studies that used listening to pre-recorded music. Although the difference between studies that used patient-preferred versus researcher-selected music was not statistically significant (P = 0.25), allowing patients to select music from a variety of styles offered by the researcher resulted in a large effect size that was statistically significant (SMD: −0.88, 95% CI −1.67 to −0.09, P = 0.003, I^2 = 89%;

Analysis 1.8). In contrast, the use of researcher-selected music resulted in a small effect size that was not statistically significant (SMD: −0.32, 95% CI −0.84 to 0.19, P = 0.22, I^2 = 61%).

Distress

Clark 2006 compared standard care plus music-guided relaxation versus standard care alone and reported a reduction of −2.03 (SD 2.46) on a 0 to 10 numeric rating scale in the music therapy intervention group. Participants in the control group reported an average reduction in distress of −2.44 (SD 2.55).

Mood

The pooled estimate of five trials (N = 236) resulted in a moderate effect of music interventions for mood in participants with cancer (SMD: 0.47, 95% CI −0.02 to 0.97, P = 0.06; Analysis 1.9; Beck 1989; Burrai 2014; Cassileth 2003; Moradian 2015; Ratcliff 2014).The results were inconsistent across studies (I^2 = 70%), with Burrai 2014 reporting much larger treatment benefits than the other studies. A sensitivity analysis based on randomization method slightly increased the pooled effect (SMD: 0.57, 95% CI −0.03 to 1.18, P = 0.06, I^2 = 74%; Analysis 1.9). We could not include the data from Burns 2001a 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) scoring guide (McNair 1971). The results of the meta-analysis were robust to Burns 2001a, which 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.

A subgroup analysis comparing music therapy (SMD: 0.37, 95% CI −0.13 to 0.87, P = 0.15) with music medicine (SMD: 0.55, 95% CI −0.37 to 1.47, P = 0.24) found no statistically significant differences between the two types of studies (P = 0.73), but the results of the music therapy studies were consistent across studies (I^2 = 37%), whereas the music medicine studies were inconsistent across studies (I^2 = 82%) (Analysis 1.10).

Resilience

One music therapy study in 80 adolescents and young adults undergoing hematopoietic stem cell transplant (HSCT) included resilience as an outcome and reported a small effect for the music therapy intervention (SMD: 0.21), although this effect was not statistically significant (P = 0.35) (Robb 2014). The authors reported that the study was underpowered to detect medium and small effect sizes.

Coping

Robb 2014 also examined the effect of music therapy on coping. They reported a moderate effect size for courageous coping immediately post-transplant. At the same time, they found no change in the use of defensive coping strategies, suggesting that adolescents and youth in the music therapy treatment arm increased their use of positive coping strategies.

Physical symptoms

Pain

Eleven trials compared the effects of music versus standard care on pain (Beck 1989; Binns-Turner 2008; Clark 2006; Danhauer 2010; Fredenburg 2014a; Huang 2006; Kwekkeboom 2003; Li 2012; Moradian 2015; Nguyen 2010; Wan 2009). We could not include the data from Beck 1989, Clark 2006 or Moradian 2015 in the meta-analysis because of the use of change scores. Kwekkeboom 2003 compared the effects of music listening, audiotape and standard care on procedural pain and anxiety, finding that participants did not like wearing the headsets as it prevented them from hearing the surgeon, causing greater anxiety. The literature suggests that increased anxiety leads to increased pain perception (McCracken 2009); therefore, we excluded these data from the meta-analysis. The pooled effect of the remaining seven studies with 528 participants resulted in a large effect for music on pain perception (SMD: −0.91, 95%CI −1.46 to −0.36, P = 0.001; Analysis 1.11; Cohen 1988). There was disagreement between the trials on the size of the effect (I^2 = 88%), but this was due to Li 2012 reporting much larger treatment benefits than the other trials.

Using a 0 to 10 numeric rating scale, Clark 2006 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). Likewise, Beck 1989 reported a greater pain reduction for the music listening group as measured by a 100mm VAS (mean change score: −9.27, SD 18.86) than for the control group (mean change score: −5.69, SD 17.9). In contrast, Moradian 2015 reported similar improvements in pain for the treatment (mean change score: −12.96, SD 24.16) and the control group (mean change score: −13.58, SD 28.51).

For this outcome, we were able to examine the impact of music preference on treatment effect (Analysis 1.12). Although the difference between the use of patient-preferred music and researcher-selected music was not statistically significant (P = 0.42), the use of patient-preferred music led to a much larger and statistically significant pooled effect (SMD: −1.06, 95% CI −1.93 to −0.2, P = 0.02, I^2 = 91%) than the use of researcher-selected music (SMD: −0.59, 95% CI −1.34 to 0.15, P = 0.12, I^2 = 75%). The large heterogeneity was due to some studies reporting a much larger beneficial effect than others.

Fatigue

Six trials examined the effects of music interventions on fatigue in 253 participants (Cassileth 2003; Clark 2006; Ferrer 2005; Fredenburg 2014b; Moradian 2015; Rosenow 2014). The pooled estimate of their change scores indicated a small to moderate effect for music interventions (SMD: −0.38, 95% CI −0.72 to −0.04, P = 0.03; Analysis 1.13), with consistent results across studies (I^2 = 38%). Burns 2008 also collected data on fatigue; however, investigators did not report postintervention data. Burns 2008 also provided us with four-week postintervention follow-up scores, but could not provide the immediate post-test scores. This prevented us from pooling their data with data from the other three studies. A sensitivity analysis based on randomization method suggested that use of proper methods of randomization resulted in a smaller pooled effect that was no longer statistically significant (SMD: −0.20, 95% CI −0.48 to 0.08, P = 0.16, I^2 = 0%).

Physical functioning

Five trials examined the effects of music on participants' physical functioning (Hanser 2006; Hilliard 2003; Liao 2013; Moradian 2015; Xie 2001). We could not include the results of Hanser 2006 in the pooled estimate because of the use of change scores and the high attrition rate. The pooled estimate of the remaining studies indicated no evidence for an effect of music on physical status

in 493 participants with cancer (SMD: 0.78, 95% CI −0.74 to 2.31, P = 0.31; Analysis 1.14). The results were highly inconsistent (I^2 = 98%), with Xie 2001 reporting a much larger beneficial effect. In Hanser 2006, music therapy led to a greater improvement in physical well-being (FACT-G Physical Well-Being Subscale, score range: 0 to 28)(mean change score: 2.0, SD 4.6) than standard care (mean change score: −0.4, SD 3.7), but this difference was not statistically significant.

Removing Xie 2001 because of improper randomization method resulted in a small effect that was consistent across studies (SMD: 0.08, 95% CI −0.18 to 0.34, P = 0.54, I^2 = 0%; Analysis 1.14)

Anesthetic and analgesic intake

Two studies included use of anesthesia and analgesics as an outcome. Palmer 2015 examined the amount of propofol needed to reach a sedation score of 70 on the Bispectral Index (BIS) in women undergoing breast surgery. A BIS reading of 70 represents moderate sedation. The average propofol needed in the live music group (n = 67) was 67.2 mg (SD 53.7), 61.9 mg (SD 34.1) in the recorded music group (n = 65), and 70.5 mg (SD 35.2) in the usual care group (n = 62). However, the difference between the groups was not statistically significant. Wang 2015 examined the impact of music-guided relaxation compared to standard care on postoperative consumption of the sufentanil, a narcotic medicine, and use of a patient-controlled analgesia (PCA) pump. Participants in the music treatment arm consumed a significantly smaller amount of sufentanil (52.68 µg, SD 7.07) than the standard care treatment arm (82.65 µg, SD 6.19). PCA use was also significantly lower in the music treatment arm (19.06, SD 3.49) than in the control group (30.96, SD 4.0).

Length of hospital stay and recovery time

Palmer 2015 also examined the effect of music on recovery time following breast surgery. Recovery time was defined as the interval between surgery end time and the time when the patient had met all discharge criteria determined by the recovery nurse. The results indicated that there was no statistically significant difference in recovery time between the two types of music interventions (live music by a music therapist and listening to pre-recorded music) and the usual care group, suggesting that the addition of music intervention did not increase patient time commitment. A statistically significant difference was found between the live music group (52.4 minutes, SD 21.6) and the recorded music group (64.8 minutes, SD 35.3), with the live music group getting discharged approximately 12 minutes faster than the recorded music group. However, the authors suggest a careful interpretation of these results as other factors could have contributed to this difference.

Li 2012 tracked the length of women's hospital stay after radical mastectomy. Women in the music listening treatment arm stayed an average of 13.62 days (SD 2.04), whereas women in the usual care control arm stayed an average of 15.53 days (SD 2.75). This difference between the treatment arms was statistically significant (P < 0.001).

Secondary outcomes

Physiological outcomes

Heart rate

Eight trials examined the effects of music on heart rate in 589 participants (Binns-Turner 2008; Burrai 2014; Chen 2013; Ferrer 2005; Harper 2001; Jin 2011; Nguyen 2010; Zhao 2008). All of the studies except for Ferrer 2005 were music medicine studies.Their pooled estimate showed a decrease in heart rate, favoring music interventions over standard care (MD: −3.32, 95% CI −6.21 to −0.44, P = 0.02; Analysis 1.15). However, the results were inconsistent across studies (I^2 = 73%). A sensitivity analysis excluding Ferrer 2005 and Chen 2013 because of an unknown randomization method and a lack of proper randomization, respectively, resulted in a larger effect with less heterogeneity (MD: −4.63, 95% CI −8.18 to −1.09, P = 0.01, I^2 = 56%; Analysis 1.15).

A subgroup analysis for music preference indicated that researcher-selected music led to greater reductions in heart rate (MD: −7.94, 95% CI −15.10 to −0.78, P = 0.03, I^2 = 0%) than patient-preferred music (MD: −3.13, 95% CI −6.54 to 0.27, P = 0.07, I^2 = 82%; Analysis 1.16), but this difference was not statistically significant (P = 0.23).

One cross-over trial compared the effect of music and imagery with imagery alone (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 dropped 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 dropped 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 four trials (N = 437) did not provide evidence of an effect for music interventions on respiratory rate (MD: −1.24, 95% CI −2.54 to 0.06, P = 0.06; Analysis 1.17; Chen 2013; Jin 2011; Nguyen 2010; Zhao 2008), and the studies did not agree on the size of effect (I^2 = 80%). A sensitivity analysis excluding Chen 2013 because of failure to use a proper method of randomization resulted in a larger pooled effect that was statistically significant (MD: −1.83, 95% CI −3.36 to −0.30, P = 0.02, I^2 = 52%; Analysis 1.17)

We could not conduct a subgroup analysis based on music preference for this outcome due to an insufficient number of trials differentiating music type.

Systolic blood pressure

We found a pooled estimate of −5.40 mmHg (95% CI −8.32 to −2.49, P = 0.0003; N = 559; Analysis 1.18) for systolic blood pressure (SBP), favoring music interventions (Burrai 2014; Chen 2013; Ferrer 2005; Harper 2001; Jin 2011; Nguyen 2010; Zhao 2008). The results were slightly inconsistent across studies (I^2 = 54%). However, excluding Chen 2013 and Ferrer 2005 because of lack of proper randomization resulted in a larger effect that was consistent across studies (MD: −7.63 mmHg, 95% CI −10.75 to −4.52, P < 0.00001, I^2 = 11%; Analysis 1.18). All of the studies except for Ferrer 2005 were music medicine studies.

We conducted a subgroup analysis based on music preference (Analysis 1.19), and in contrast to the findings for heart rate, this

analysis suggested that patient-preferred music led to greater SBP reduction (MD: −6.65, 95% CI −10.07 to −3.23, P = 0.0001, I^2 = 64%) than researcher-selected music (MD: −4.72, 95% CI −10.80 to 1.37, P = 0.13, I^2 = 0%). This difference was not statistically significant (P = 0.59).

Diastolic blood pressure

We found a pooled estimate of −2.35 mmHg (95% CI −5.88 to 1.18; Analysis 1.20) for diastolic blood pressure (DBP) in 559 participants (Burrai 2014; Chen 2013; Ferrer 2005; Harper 2001; Jin 2011; Nguyen 2010; Zhao 2008).The results were inconsistent across studies (I^2 = 91%). Similar to the SBP analysis, excluding Chen 2013 and Ferrer 2005 in a sensitivity analysis resulted in a larger MD of −4.94 mmHg (95% CI −7.78 to −2.09) that was statistically significant (P = 0.0007), and less heterogeneous (I^2 = 60%; Analysis 1.20). All of the studies except for Ferrer 2005 were music medicine studies.

Patient-preferred music resulted in somewhat greater reductions in DBP (MD: −4.10, 95% CI −8.78 to 0.59, P = 0.09, I^2 = 95%; Analysis 1.21) than researcher-selected music (MD: −2.01, 95% CI −6.26 to 2.25, P = 0.36, I^2 = 0%), but this difference was not statistically significant (P = 0.52).

Mean arterial pressure

Binns-Turner 2008 reported on the effects of music on mean arterial pressure (MAP) in 30 participants and found a large decrease in MAP for the music group (mean change score: −15.1 mmHg, 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 mmHg, SD 15.3, 95% CI −3.25 to 12.25).

Oxygen saturation level

Three trials with 292 participants reported no effects for music listening on oxygen saturation levels (MD: 0.50%, 95% CI −0.18 to 1.18, P = 0.15, I^2 = 78%; Analysis 1.22; Burrai 2014; Chen 2013; Nguyen 2010).

Immune system functioning

Two trials examined the effects of music on immune system functioning. In one trial in 30 children, Duocastella 1999 found that live music making with children led to a greater increase in Immunoglobin A (IgA) levels (mean change score: 7.07 mg/l, SD 34.52) than engaging children in activities that did not involve music (mean change score: 4.13 mg/l, SD 41.02), but this difference was not statistically significant. Another trial compared music listening to standard care in 46 participants and found post-test differences for the following indicators of immune system functioning: 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

Spiritual well-being

Two trials under this comparison assessed spiritual well-being (Cook 2013; Hanser 2006). One trial compared music therapy to usual care using the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being subscale (FACIT-Sp, score range: 0 to 48) (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). Cook 2013 compared music therapy with standard care and reported a greater improvement in the music therapy treatment arm (mean change score: 4.4, SD 4.84) than the control arm (mean change score: 2.0, SD 6.08) on the FACIT-Sp.

Social support

Robb 2014 examined the effect of music therapy on perceived social support in adolescents and young adults during stem cell transplant. At 100 days post-transplant, participants in the music therapy treatment arm reported significantly greater improvements in perceived social support (SMD: 0.54, P = 0.028) and family environment (i.e. family cohesion, family adaptation, family communication, and family strength) (SMD: 0.66, P = 0.008) than participants in the control group. Qualitative analysis of the music videos that accompanied the songs written by the participants revealed that study participants were "identifying peers (i.e., social integration), family members (i.e., family environment), and faith/spirituality (i.e., spiritual perspective) as important sources of support" (p 916).

Quality of life

Seven trials compared the impact of music interventions to standard care on QoL (Burns 2001a; Hanser 2006; Hilliard 2003; Liao 2013; Moradian 2015; Ratcliff 2014; Xie 2001). We did not include Hanser 2006 in the meta-analysis for reasons discussed above. Meta-analysis of the remaining six trials (N = 545) resulted in a heterogeneous SMD of 0.98 (95% CI −0.36 to 2.33, P = 0.15, I^2 = 98%; Analysis 1.23; Burns 2001a; Hilliard 2003; Liao 2013; Moradian 2015; Ratcliff 2014; Xie 2001), with Xie 2001 reporting a much larger beneficial effect than the other trials. Removal of this outlier resulted in a small effect size that was homogeneous (SMD: 0.29, 95% CI 0.05 to 0.53, P = 0.02, I^2 = 0%).

We conducted a sensitivity analysis removing all studies that used improper methods of randomization. This resulted in a moderate effect size that was statistically significant (SMD: 0.52, 95% CI 0.01 to 1.02, P = 0.04, I^2 = 66%; Analysis 1.23).

A subgroup analysis per intervention type resulted in a homogeneous, moderate effect of music therapy on QoL (SMD: 0.42 , 95% CI 0.06 to 0.78, P = 0.02, I^2 = 4%; Analysis 1.24) that was statistically significant and consistent across studies (Cohen 1988). In Hanser 2006, music therapy resulted in a greater improvement in QoL (FACT-G, 0-108) (mean change score: 3.5, SD 13.75) than standard care (mean change score: 0.9, SD 15.8), but this difference was not statistically significant. The pooled effect of the music medicine studies was large but very heterogeneous and not statistically significant (SMD: 1.33, 95% CI −0.96 to 3.63, P = 0.26, I^2 = 99%). The large heterogeneity was due to the outlying values of Xie 2001; removing it from the analysis resulted in a small effect for the music medicine studies that was consistent across studies but not statistically significant (SMD: 0.20, 95% CI −0.11 to 0.51, P = 0.21, I^2 = 0%). The difference in treatment effect between the music therapy studies and the music medicine studies was statistically significant when we excluded Xie 2001 from the analysis (P = 0.01). With the Xie study included, the difference was not statistically significant (P = 0.44).

Comparison 2: Music therapy plus standard care versus music medicine plus standard care

Only two studies reported on the direct comparison between music therapy and music medicine interventions.

Primary outcomes

Psychological outcomes

Anxiety

Two trials directly compared the effects of music therapy with music medicine on cancer patients' anxiety using a 100mm visual analogue scale (Bradt 2015; Palmer 2015). Both interventions resulted in reduction of anxiety. Whereas music therapy interventions resulted in a greater average anxiety reduction than music medicine intervention, this difference was not statistically significant (MD: −3.67, 95% CI −11.68 to 4.35, P = 0.37, I^2 = 0%; Analysis 2.1). However, 77.4% of the participants in the cross-over trial by Bradt 2015 expressed a preference for receiving music therapy sessions for the remainder of their cancer treatment or future treatments. The main reasons cited by participants for this preferences were that they felt cared for by the music therapist, enjoyed the interactive and creative music making, and valued the opportunity for emotional expression and processing.

Comparison 3: Music interventions plus standard care versus standard care plus alternative relaxation interventions

Several studies compared music interventions with other relaxation interventions such as progressive muscle relaxation, guided imagery and relaxation, and verbal relaxation instructions. At this time, only single studies were identified per outcome. This precluded meta-analysis is results.

Primary outcomes

Psychological outcomes

Anxiety

Straw 1991 compared music listening to guided imagery and relaxation training and found that both interventions significantly reduced state anxiety as measured by the STAI-S (score range 20 to 80) (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 a co-variate indicated that the difference in effect of the two interventions on state anxiety was not statistically significant.

Depression

Stordahl 2009 compared music-assisted relaxation with verbal relaxation instructions in 20 women with breast cancer and reported a lower level of depression on the Center for Epidimiologic Diseases - Depression Scale (CES-D, score range 0 to 60) following treatment in the music-assisted relaxation treatment arm (n = 10; post-test mean: 6.6, SD 5.02) than in the verbal relaxation treatment arm (n = 10; post-test mean: 9.20, SD 10.96).

Mood

Stordahl 2009 also compared the impact of music-assisted relaxation with verbal relaxation instructions on mood in women with breast cancer and found that music-assisted relaxation resulted in lower scores (i.e. better mood) on the POMS-SF (score range 14 to 70 as reported in this thesis) (post-test mean: 6.5, SD 5.19) than verbal relaxation instructions (post-test mean = 8.64, SD 6.42).

Physical symptoms

Pain

Shaban 2006 compared the effects of progressive muscle relaxation (PMR) to music listening and found that PMR was more effective in reducing pain (100mm VAS) (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.

Secondary outcomes

Quality of life

Straw 1991 compared a guided imagery and relaxation intervention to music listening and found that music listening led to a greater increase in QoL (Functional Living Index, score range 22 to 154) (mean change score: 16.33, SD 20.73) than the guided imagery and relaxation group (mean change score: 4.6, SD 20.49).

Comparison 4: Music interventions plus standard care versus standard care plus placebo control

Only a few trials compared music therapy or music medicine to a placebo control, The trials examined a limited number of outcomes, which we describe below.

Primary outcomes

Psychological symptoms

Distress

Two trials examined the effects of music therapy on reduction of distress, comparing a music video intervention with an audiobook control condition in adolescents and young adults during stem cell transplantation (Burns 2009; Robb 2014). In the music video, participants wrote songs and created accompanying music videos in collaboration with a music therapist. The pooled effect of the two trials did not provide support for an effect of music therapy (SMD: −0.08, 95% CI −0.42 to 0.25, P = 0.62, I^2 = 0%; Analysis 3.1). In Burns 2009, both groups reported an increase in distress post-intervention scores, which were used in the meta-analysis. However, 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).

Secondary outcomes

Social and spiritual support

Spiritual well-being

Burns 2009 and Robb 2014 also examined the effect of a music video intervention versus audiobook control condition on spiritual well-being in adolescents and young adults. Their pooled estimate did not find support for an effect of music therapy on spiritual well-being (SMD: 0.31, 95% CI −0.11 to 0.73, P = 0.15, I^2 = 0%; Analysis 3.2).

Communication

One trial in children with cancer compared the effects of one session of active music making to music listening and audio storybooks on levels of active engagement and initiation in 55 children (Robb 2008). 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 storybooks (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 behaviour 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

Burns 2009 compared music therapy to an audiobook control, finding a small increase in QoL in the music therapy group (Index of Well-Being, score range 9 - 63) (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.

DISCUSSION

Summary of main results

The results of 19 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 8.54 units, on average, on the STAI-S (score range: 20 to 80) scale and −0.71 standardized units on other anxiety scales which is considered a moderate to large effect. 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 three other Cochrane systematic reviews on the use of music with coronary heart disease patients (Bradt 2013a), with mechanically ventilated patients (Bradt 2014), and for pre-operative anxiety (Bradt 2013b). A comparison of music therapy with music medicine trials for anxiety reduction in people with cancer suggest a moderate treatment effect for music therapy studies (SMD: −0.62) that was consistent across studies. Music medicine trials resulted in a larger effect (SMD: −1.0) but results were highly inconsistent across studies. Cohen 1988 suggested that an effect size of 0.20 be considered a small effect, an effect size of 0.50 medium, and an effect size of 0.80 large. A direct comparison of music therapy with music medicine interventions for anxiety reduction in two studies indicated greater anxiety reduction of music therapy interventions. It is noteworthy that a large majority of the patients in one of the comparative studies expressed a preference for the music therapy intervention.

The results of seven studies suggest that music intervention may reduce depression in people with cancer. The results of a single study suggest that music therapy may help adolescents and young adults employ positive coping strategies during stem cell transplant, a high risk and high intensity treatment. We found no evidence of effect for distress or mood.

As for the effect of music on physical symptoms, the results of seven trials suggest that music has a large pain-reducing effect of −0.91 standardized units. The results of single studies suggest that music listening may reduce the need for anesthetics and analgesics. Music interventions also had a small to moderate effect on fatigue (−0.38 standardized units). We found no evidence for an effect of music on physical status. Reduction of anxiety, depression, fatigue and pain are important outcomes for people with cancer, as they have an impact on health and overall QoL.

It is important that careful consideration is given to the implementation of music listening interventions. The results of Kwekkeboom 2003 indicate that listening to music through headphones may be contraindicated during painful procedures because it prevents the patient from hearing the surgeon's instructions and comments. 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 three to four beats per minute and respiratory rate by an average of two 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 2013a), which reported a heart rate reduction of 3.4 bpm and a respiratory rate reduction of 2.5 breaths per minute. Similar results were reported in a Cochrane review on music interventions for mechanically ventilated patients (Bradt 2014), namely a mean heart rate reduction of 3.95 bpm and a mean respiratory rate reduction of 2.87 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, it might be in the case of a tachycardiac rate. In a study examining the quantitative relationship between resting heart rate reduction and clinical benefit, Cucherat 2007 found that each 10 bpm reduction in heart rate is estimated to reduce the relative risk of cardiac death by 30%. The results of this review also indicate that listening to music may have a beneficial effect on SBP, although we found no evidence of an effect for DBP. Trials on music listening with cardiac patients and mechanically ventilated patients have also reported reductions in systolic blood pressure (Bradt 2013a; Bradt 2014). The reduction of heart rate, respiratory rate, and blood pressure corresponds with the anxiety-reducing effects found by subjective outcome measures in this review.

No evidence of support was found for an effect of music interventions on oxygen saturation level. Single trials included in this review found support for a beneficial effect of music on mean arterial pressure and immunologic function.

Music therapy interventions had a moderate effect of 0.42 standardized units on quality of life, whereas we found no support for an effect for music medicine studies. Two studies that compared music therapy with audiobook control in adolescents and young adults did not find support for spiritual well-being. Two music therapy studies with adults reported conflicting results for this outcome. Finally, a single study with adolescents and young adults during stem cell transplant reported beneficial effects of music therapy on perceived social support and the family environment.

Subgroup analyses of treatment effects between music therapy and music medicine studies was possible for four outcomes, namely anxiety, depression, mood and quality of life. There was a difference for quality of life, with music therapy studies contributing to a larger pooled treatment effect than music medicine studies; we found no difference between music therapy and music medicine studies for the other outcomes. However, it is worth noting that for all outcomes, music therapy interventions resulted in consistent findings across studies whereas the results of music medicine studies were highly heterogeneous for these outcomes.

We could examine the impact of music preference for anxiety, depression, pain, heart rate, systolic and diastolic blood pressure. Music preference did not impact the effect of music on anxiety. For the other outcomes, even though there was no difference between the use of patient-preferred versus researcher-selected music, the results show some interesting trends. For pain, the use of patient-preferred music had a much larger impact on pain reduction. In contrast, no evidence of pain-reducing effect was found for researcher-selected music. For heart rate, researcher-selected music resulted in a larger and more consistent treatment effect than patient-preferred music. Interestingly, for blood pressure, patient-preferred music resulted in a larger treatment effect, but the results were highly inconsistent across studies. In contrast, researcher-selected music resulted in smaller effect.

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 52 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). We were able to compare the treatment effects of music therapy studies with music medicine studies for four outcomes. For the other outcomes this was not possible due to insufficient number of music therapy and music medicine studies per outcome.

This review included both music therapy and music medicine studies, as defined in the Background. 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 a sense of control, and improve physical well-being in patients with cancer. Comparative analyses suggest that music therapy interventions are more effective than music medicine interventions in improving quality of life. We found no differences between music therapy and music medicine interventions for other outcomes, but it is worth noting that the results of music therapy studies were much less heterogeneous than those of music medicine studies. This is likely due to the fact that music therapists are trained to meet the individual needs of patients through music interventions (e.g. meeting the patient's in-the-moment needs when offering live music) rather than offering a limited selection of pre-recorded music, which may not be suitable for all patients. Participants in a cross-over trial who experienced both music therapy and music medicine interventions overwhelmingly preferred the music therapy sessions because of the personal attention and care, the creativity of the interactive music making, and the opportunity for emotional expression through singing and playing instruments.

In general, the trials that used listening to pre-recorded music provided little 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 varied widely across the trials. 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, we cannot provide data regarding cost or cost-effectiveness of music therapy or music medicine applications in the care of cancer patients, as the reviewed trials did not provide these data.

Quality of the evidence

Because of the large number of trials at high risk of bias, readers should interpret the findings of this review with caution. Often blinding of participants is not possible in music medicine or music therapy studies unless a comparative design is used (e.g. Bradt 2015). Many of the trials in this review included subjective outcomes, such as anxiety, pain, mood and quality of life. 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 principal 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, there were moderate to large effects across studies. For anxiety, the trials did not agree on the size of effect, with some reporting much larger beneficial effects than others, resulting in a large confidence interval. In summary, the quality of evidence was low for the outcomes (i.e. anxiety, mood, pain, fatigue and quality of life) and very low for depression (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. 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.

Although we cannot completely rule out the possibility that we missed some published and unpublished trials, 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).

One of the included trials (Bradt 2015) was conducted by the lead author of this review. As for all new studies included in this update, the risk of bias was assessed by CD and LM. Data extraction was completed independently by AT.

Agreements and disagreements with other studies or reviews

The findings of this review are consistent with the results of a review (32 RCTs and controlled clinical trials) assessing the effect of music interventions on psychological and physical outcomes in cancer patients (Zhang 2012). Zhang and colleagues reported a mean difference of −12.3 for anxiety (STAI-S, score range 20 to 80), −6.23 for depression (Self-Rating Depression Scale, score range 20 to 80), −0.52 for pain (0 to 10 numeric rating scale) and 13.32 for quality of life (Quality of Life - Cancer, score range 0-100). The authors also reported that the effects of music on vital signs, especially blood pressure, were small. In contrast, Nightingale 2013 (a review of four RCT studies) evaluated the effects of music on anxiety in adult cancer patients, reporting no evidence of an effect for music on anxiety. This was likely due to the small number of studies included in this review. In addition, reviewers included Kwekkeboom 2003 in the meta-analysis, which was a quite problematic trial in terms of the implementation of the music listening interventions, as discussed in the Results section of our review. Study participants reported that the use of headphones while undergoing painful medical procedures was anxiety-provoking because it prevented them from hearing the surgeon. In addition, Nightingale 2013 included Hanser 2006 in the meta-analysis, whereas we included this study in the narrative only. Our decision was based on a very high attrition rate (40%) and the inability to implement the music therapy intervention within the a priori set timeframe, thereby highly diluting the intervention, as reported by the authors.

AUTHORS' CONCLUSIONS

Implications for practice

This systematic review indicates that music interventions may have beneficial effects on anxiety, pain, fatigue 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. Results from single trials suggest that music listening in cancer patients undergoing surgery may reduce anesthetic and analgesic consumption and reduce the length of hospital stay, but more research is needed before drawing solid conclusions. Results from a single study furthermore suggest that post-surgery recovery time may be shortened when a music therapist offers live, individualized music before and during surgery. Overall, evidence of the trials included in this review suggest that music interventions may be offered as a complementary treatment to people with cancer.

No evidence of effect was found for distress, mood, physical functioning, spiritual well-being or oxygen saturation. However, only a small number of trials investigated the effects of music on these outcomes. More research is needed. We cannot draw any conclusions at this time regarding the effects of music interventions on coping, resilience, mean arterial pressure, immunologic functioning or communication behaviours because the results of the studies that included these outcomes could not be pooled or because we could only identify one trial.

Implications for research

This systematic review provides evidence that music interventions may have beneficial effects on anxiety, pain, fatigue, QoL, heart rate, respiratory rate and blood pressure in patients with cancer. Comparative analyses between music therapy and music medicine interventions indicate that music therapy is more effective in improving QoL than music medicine interventions. At this time, more RCTs are needed to determine the effectiveness of music medicine versus music therapy for outcomes other than quality of life. 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. It is important to note that Bradt 2015 undertook such a comparative study based on the recommendation of the original systematic review, concluding that both music therapy and music medicine interventions were similarly effective for symptom management. However, the results of their mixed methods research study clearly indicated that even listening to pre-recorded music can evoke strong emotions and existential issues in people with cancer and that the participants in this study were grateful for the presence of a music therapist to process these emotions and fears. Participants furthermore emphasized the importance of interactive music making, as it allowed them to access their creativity; this is considered an important resource for the facilitation of resilience in the face of life's challenges.

Future research should explore patient characteristics as moderators of treatment benefits of music therapy interventions versus listening to pre-recorded music. For example, Bradt 2015 suggested that listening to music may cause distress in patients who have a negative outlook on life. It is possible that these patients are at greater risk for music's powerful capacity to access sad and traumatic memories, and such patients may be better served by listening to music in the presence of a music therapist who can help them process their emotions. On the other hand, Bradt and colleagues emphasize that some patients have a great need for stability and emotional security during this challenging time in their life and may therefore prefer the familiarity of their own music. Self selected music presents predictable musical and emotional content and may therefore provide a much needed holding environment for the patient.

We recommend that future research efforts aim to enhance understanding of how each of music therapy and music medicine interventions can be optimized for symptom management, how music interventions can best serve patients along the cancer treatment trajectory, and what unique aspects of music therapy and music medicine interventions contribute to the care of patients (Bradt 2015).

As stated in other reviews, it is important that investigators consider qualitative and mixed methods research, 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 (Bradt 2013a; Bradt 2010; Bradt 2014).

Future trials that use listening to pre-recorded music should report more 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 in order to use adequate sample sizes.

More studies are needed on the use of music interventions in pediatric patients with cancer. Of the 52 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 cost-benefit evaluations of music medicine and music therapy are needed.

ACKNOWLEDGEMENTS

We would like to thank and acknowledge Clare Jess (Managing Editor), Chris Williams and Jo Morrison (Co-ordinating Editors), Barbara Wheeler, Claudia Lazado-Can, Megan Prictor, 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; Minjung Shim, research assistant at Drexel University, for her help with data input; and Denise Grocke for her contribution as an author on the original review. For the review update we would like to thank Kelly L By and Johanna Dwinells, graduate students at Drexel University, for their help with screening of database outputs and Karola Bryl, doctoral student at Drexel University, for her help with data extraction.

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

This project was supported by the National Institute for Health Research, via Cochrane Infrastructure funding to the Cochrane Gynaecological, Neuro-oncology and Orphan Cancer Group. The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Systematic Reviews Programme, NIHR, NHS or the Department of Health.

REFERENCES

References to studies included in this review

Beck 1989 *{published and unpublished data}*

* Beck SLC. The Effect of Therapeutic Use of Music on Cancer Related Pain [PhD thesis]. Salt Lake City, UT: University of Utah, 1989.

Beck SLC. The therapeutic use of music for cancer-related pain. *Oncology Nursing Forum* 1991;**18**(8):1327-37.

Binns-Turner 2008 *{unpublished data only}*

* Binns-Turner PG. Perioperative Music and its Effects on Anxiety, Hemodynamics, and Pain in Women Undergoing Mastectomy [PhD thesis]. Tuscaloosa, Alabama: University of Alabama, 2008.

Bradt 2015 *{published data only}*

* Bradt J, Potvin N, Kesslick A, Shim M, Radl D, Schriver E, et al. The impact of music therapy versus music medicine psychological outcomes and pain in cancer patients: a mixed methods study. *Support Care Cancer* 2015;**23**:1261-71.

Bufalini 2009 *{published data only}*

* Bufalini A. Role of interactive music in oncological paediatric patients undergoing painful procedures. *Minerva Pediatrica* 2009;**61**(4):379-89.

Bulfone 2009 *{published and unpublished data}*

* Bulfone T, Quattrin R, Zanotti R, Regattin L, Brusaferro S. Effectiveness of music therapy for anxiety reduction in women with breast cancer in chemotherapy treatment. *Holistic Nursing Practice* 2009;**23**(4):238-42.

Burns 2001a *{published data only}*

* Burns DS. The effect of the Bonny Method of Guided Imagery and Music on the mood and life quality of cancer patients. *Journal of Music Therapy* 2001;**38**(1):51-65.

Burns 2008 *{published data only}*

* Burns DS, Azzouz F, Sledge R, Rutledge C, Hincher K, Monahan PO, et al. Music imagery for adults with acute leukemia in protective environments: a feasibility study. *Support Care Cancer* 2008;**16**(5):507-13.

Burns 2009 *{published and unpublished data}*

* Burns DS, Robb SL, Haase JE. Exploring the feasibility of a therapeutic music video intervention in adolescents and young adults during stem-cell transplantation. *Cancer Nursing* 2009;**32**(5):E8-16.

NCT00305851. Music therapy or book discussion in improving quality of life in young patients undergoing stem cell transplant. http://clinicaltrials.gov/ct2/show/NCT00305851. [CDR0000463879; COG-ANUR0631; NCT00305851]

Burrai 2014 *{published data only}*

* Burrai V, Micheluzzi V, Bugani V. Effects of live sax music on various physiological parameters, pain level, and mood level in cancer patients. *Holistic Nursing Practice* 2014;**28**:301-11.

Cai 2001 *{published data only}*

Cai GR, Li PW, Jiao LP. Clinical observation of music therapy combined with anti-tumor drugs in treating 116 cases of tumor patients. *Zhongguo Zhongxiyi Jiehe Zqzhi [Chinese Journal of Integrated Traditional & Western Medicine]* 2001;**21**(12):891-4.

* Cai GR, Yi Q, Peiwen, L, Liping J, Liang L. Music therapy in treatment of cancer patients. *Zhongguo Xinli Weisheng Zazhi [Chinese Mental Health Journal]* 2001;**15**(3):179-81. Chinese.

Cassileth 2003 *{published data only}*

* Cassileth BR, Vickers AJ, Magill LA. Music therapy for mood disturbance during hospitalisation for autologous stem cell transplantation: a randomised controlled trial. *Cancer* 2003;**98**(12):2723-9.

Chen 2004 *{published data only}*

* Chen LZ, Xie Z, Feng ZH, Huang G, Yin ZM, Yu ZH. Effect of cognitive behavioral intervention therapy on immunological function of patients with breast cancer. *Chinese Journal of Clinical Rehabilitation* 2004;**8**(29):6310-11.

Chen 2013 *{published data only}*

* Chen LC, Wang TF, Shih YN, Wu LJ. Fifteen-minute music intervention reduces pre-radiotherapy anxiety in oncology patients. *European Journal of Oncology Nursing* 2013;**17**(4):436-41.

Clark 2006 *{published data only}*

* Clark M, Isaacks-Downton G, Wells N, Redlin-Frazier S, Eck C, Hepworth JT, et al. Use of preferred music to reduce emotional distress and symptom activity during radiation therapy. *Journal of Music Therapy* 2006;**43**(3):247-65.

Cook 2013 *{published data only}*

* Cook E L, Silverman M J. Effects of music therapy on spirituality with patients on a medical oncology/hematology unit: a mixed-methods approach. *The Arts in Psychotherapy* 2013;**40**(2):239-44.

Danhauer 2010 *{unpublished data only}*

* Danhauer SC, Vishnevsky T, Campbell CR, McCoy TP, Tooze JA, Kanipe KN, et al. Music for patients with hematological malignancies undergoing bone marrow biopsy: a randomised controlled study of anxiety, perceived pain, and patient satisfaction. *Journal of the Society for Integrative Oncology* 2010;**8**(4):140-7.

Duocastella 1999 *{published data only}*

* Duocastella AC. Effect of music on children with cancer. *Revista de Enfermeria* 1999;**22**(4):293-8.

Ferrer 2005 *{published and unpublished data}*

* Ferrer A. The Effect of Live music on Decreasing Anxiety in Patients Undergoing Chemotherapy Treatment [MSc/MA thesis]. Tallahassee, FL: Florida State University, 2005.

Ferrer AJ. The effect of live music on decreasing anxiety in patients undergoing chemotherapy treatment. *Journal of Music Therapy* 2007;**44**(3):242-55.

Fredenburg 2014a *{published data only}*

* Fredenburg HA, Silverman MJ. Effects of music therapy on positive and negative affect and pain with hospitalised patients recovering from a blood and marrow transplant: A randomised effectiveness study. *The Arts in Psychotherapy* 2014;**41**(2):174-80.

Fredenburg 2014b *{published data only}*

Fredenburg HA. Effects of Cognitive-behavioral Music Therapy on Fatigue with Patients on a Blood and Marrow Transplantation Unit: A Convergent Parallel Mixed Methods Effectiveness Study [MA Thesis]. Minneapolis-St Paul, MN: University of Minnesota, 2013.

* Fredenburg HA. Effects of cognitive-behavioral music therapy on fatigue in patients in a blood and marrow transplantation unit: A mixed-method pilot study. *The Arts in Psychotherapy* 2014;**41**:433–44.

Gimeno 2008 *{unpublished data only}*

* Gimeno M. The Effect of Music and Imagery to Induce Relaxation and Reduce Nausea and Emesis in Cancer Patients Undergoing Chemotherapy Treatment [PhD thesis]. Stockton, CA: University of the Pacific, 2008.

Hanser 2006 *{published data only}*

* Hanser SB, Bauer-Wu S, Kubicek L, Healey M, Manola J, Hernandez M, et al. Effects of a music therapy intervention on quality of life and distress in women with metastatic breast cancer. *Journal of the Society for Integrative Oncology* 2006;**4**(3):116-24.

Harper 2001 *{unpublished data only}*

* Harper EI. Reducing Treatment-related Anxiety in Cancer Patients: Comparison of Psychological Interventions [PhD thesis]. Dallas, TX: Southern Methodist University, 2001.

Hilliard 2003 *{published data only}*

* Hilliard RE. The Effects of Music Therapy on Quality of Life and Length of Life of Hospice Patients Diagnosed with Terminal Cancer [PhD thesis]. Tallahassee, FL: Florida State University, 2002.

Hilliard RE. The effects of music therapy on the quality and length of life of people diagnosed with terminal cancer. *Journal of Music Therapy* 2003;**40**(2):113-37.

Huang 2006 *{published and unpublished data}*

Huang S. The Effects of Music on Cancer Pain [PhD thesis]. Cleveland, OH: Case Western Reserve University, 2006.

* Huang S, Good M, Zauszniewski JA. The effectiveness of music in relieving pain in cancer patients: a randomised controlled trial. *International Journal of Nursing Studies* 2010;**47**(11):1354-62. [DOI: 10.1016/j.ijnurstu.2010.03.008]

Jin 2011 *{published data only}*

* Jin F, Zhao Y. Influence of music relaxation therapy on vital signs and anxiety of liver cancer patients accepting transcatheter hepatic arterial chemoembolization. *Huli Yanjiu [Chinese Nursing Research]* 2011;**16**:1429-31.

Kwekkeboom 2003 *{published data only}*

* Kwekkeboom KL. Music versus distraction for procedural pain and anxiety in patients with cancer. *Oncology Nursing Forum* 2003;**30**(3):433-40.

Li 2004 *{published data only}*

* Li S. Applying Chinese classical music to treat preoperative anxiety of patients with gastric cancer. *Huli Yanjiu [Chinese Nursing Research]* 2004;**18**(3B):471-2.

Li 2012 *{published data only}*

Li XM, Yan H, Zhou KN, Dang SN, Wang DL, Zhang YP. Effects of music therapy on pain among female breast cancer patients after radical mastectomy: results from a randomised controlled trial. *Breast Cancer Research and Treatment* 2011;**128**(2):411-9.

* Li XM, Zhou KN, Yan H, Wang DL, Zhang YP. Effects of music therapy on anxiety of patients with breast cancer after radical mastectomy: a randomised clinical trial. *Journal of Advanced Nursing* 2012;**68**(5):1145-55.

Zhou K, Li XM, Yan H, Dang SN, Wang DL. Effects of music therapy on depression and duration of hospital stay of breast cancer patients after radical mastectomy. *Zhonghua Yixue Zazhi [Chinese Medical Journal]* 2011;**124**(15):2321-7.

Liao 2013 *{published data only}*

* Liao J, Yang YF, Cohen I, Zhao YC, Xu Y. Effects of Chinese medicine five-element music on the quality of life for advanced cancer patients: A randomized controlled trial. *Chinese Journal of Integrated Medicine* 2013;**19**(10):736-40.

Lin 2011 *{published data only}*

* Lin MF, Hsieh YJ, Hsu YY, FetzerS, Hsu MC. A randomised controlled trial of the effect of music therapy and verbal relaxation on chemotherapy-induced anxiety. *Journal of Clinical Nursing* 2011;**20**(7-8):988-99.

Moradian 2015 *{published data only}*

* Moradian S, Walshe C, Shahidsales S, Nasiri M, Pilling M, Molassiotis A. Nevasic audio program for the prevention of chemotherapy induced nausea and vomiting: a feasibility study using a randomised controlled trial design. *European Journal of Oncology Nursing* 2015;**19**:282-91.

Nguyen 2010 *{published data only}*

* Nguyen TN, Nilsson S, Hellstrom A, Bengtson A. Music therapy to reduce pain and anxiety in children with cancer undergoing lumbar puncture: a randomised clinical trial. *Journal of Pediatric Oncology Nursing* 2010;**27**(3):146-55.

O'Callaghan 2012 *{published data only}*

* O'Callaghan C, Sproston M, Wilkinson K, Willis D, Milner A, Grocke D, et al. Effect of self-selected music on adults' anxiety and subjective experiences during initial radiotherapy

treatment: a randomised controlled trial and qualitative research. *Journal of Medical Imaging and Radiation Oncology* 2012;**56**(4):473-7.

Palmer 2015 *{published data only}*

* Palmer J, Lane D, Mayo D, Schluchter M, Leeming R. Effects of music therapy on anaesthesia requirements and anxiety in women undergoing ambulatory breast surgery for cancer diagnosis and treatment: a randomised controlled trial. *Journal of Clincal Oncology* 2015;**33**(28):3162-8.

Pinto 2012 *{published data only}*

* Pinto Junior FEL, Ferraz DLM, Cunha EQ, Santos IRM, Batista MDC. Influence of music on pain and anxiety due to surgery in patients with breast cancer [Influência da música na dor e na ansiedade decorrentes de cirurgia em pacientes com câncer de mama]. *Revista Brasileira de Cancerologia* 2012;**58**(2):135-41.

Ratcliff 2014 *{published data only}*

* Ratcliff CG, Prinsloo S, Richardson M, Baynham-Fletcher L, Lee R, Chaoul A, Cohen MZ, de Lima M, Cohen L. Music therapy for patients who have undergone hematopoietic stem cell transplant. *Evidence-based Complementary and Alternative Medicine* 2014;**2014**:1-9.

Robb 2008 *{published data only}*

* Robb SL, Clair AA, Watanabe M, Monahan PO, Azzous F, Stouffer JW, et al. A non-randomised controlled trial of the active music engagement (AME) intervention on children with cancer. *Psycho-Oncology* 2008;**17**(7):699-708.

Robb 2014 *{published data only}*

* Robb SL, Burns DS, Stegenga KA, Haut PR, Monahan PO, Meza J, et al. Randomized clinical trial of therapeutic music video intervention for resilience outcomes in adolescents/young adults undergoing hematopoietic stem cell transplant. *Cancer* 2014;**120**(6):909-17.

Romito 2013 *{published data only}*

* Romito F, Lagattolla F, Costanzo C, Giotta F, Mattioli V. Music therapy and emotional expression during chemotherapy. How do breast cancer patients feel?. *European Journal of Integrative Medicine* 2013;**5**(5):438-42.

Rosenow 2014 *{published data only}*

* Rosenow SC, Silverman MJ. Effects of single session music therapy on hospitalized patients recovering from a bone marrow transplant: Two studies. *The Arts in Psychotherapy* 2014;**41**(1):65-70.

Shaban 2006 *{published data only}*

* Shaban M, Rasoolzadeh N, Mehran A, Moradalizadeh F. Study of two non-pharmacological methods, progressive muscle relaxation and music on pain relief of cancerous patients. *The Journal of Tehran Faculty of Nursing & Midwifery* 2006;**12**(3):87.

Smith 2001 *{published data only}*

* Smith M, Casey L, Johnson D, Gwede C, Riggin OZ. Music as a therapeutic intervention for anxiety in patients receiving radiation therapy. *Oncology Nursing Forum* 2001;**28**(5):855-62.

Stordahl 2009 *{unpublished data only}*

* Stordahl JJ. The Influence of Music on Depression, Affect, and Benefit Finding Among Women at the Completion of Treatment for Breast Cancer [PhD thesis]. Miami, FL: University of Miami, 2009.

Straw 1991 *{published data only}*

* Straw GW. The Use of Guided Imagery and Relaxation for the Quality of Life of Cancer Patients Undergoing Chemotherapy [Master's thesis]. Ontario: Lakehead University, 1991.

Vachiramon 2013 *{published data only}*

* Vachiramon V, Sobanko JF, Rattanaumpawan P, Miller CJ. Music reduces patient anxiety during Mohs surgery: an open-label randomized controlled trial. *Dermatologic Surgery* 2013;**39**(2):298-305.

Wan 2009 *{published data only}*

* Wan Y, Mao Z, Qiu Y. Influence of music therapy on anxiety, depression and pain of cancer patients. *Huli Yanjiu [Chinese Nursing Research]* 2009;**23**(5A):1172-5. Chinese.

Wang 2015 *{published and unpublished data}*

* Wang Y, Tang H, Guo Q, Liu J, Liu X, Luo J, et al. Effects of intravenous patient-controlled sufentanil analgesia and music therapy on pain and haemodynamics after surgery for lung cancer: a randomised parallel study. *The Journal of Alternative and Complementary Medicine* 2015;**21**(11):667-72.

Xie 2001 *{published data only}*

* Xie Z, Wang G, Yin Z, Liao S, Lin J, Yu Z, et al. Effect of music therapy and inner image relaxation on quality of life in cancer patients receiving chemotherapy. *Zhongguo Xinli Weisheng Zazhi [Chinese Mental Health Journal]* 2001;**15**(3):176-8.

Yates 2015 *{published data only}*

* Yates G, Silverman M. Immediate effects of single-session music therapy on affective state inpatients on a post-surgical oncology unit: a randomised effectiveness study. *The Arts in Psychotherapy* 2015;**44**:57-61.

Zhao 2008 *{published data only}*

* Zhao PT, Liang J, Shao QJ, Liang F, Yuan HQ, You FS. Interventional effects of musical therapy to physiological and psychological conditions in process of radiotherapy for patients with cancer. *Zhonghua Zhongliu Fangzhi Zazhi [Chinese Journal of Cancer Prevention and Treatment]* 2008;**15**(14):1097-9.

Zhou 2015 *{published data only}*

* Zhou K, Li X, Li J, Liu M, Dang S, Wang D, et al. A clinical randomised controlled trial of music therapy andprogressive muscle relaxation training in female breast cancerpatients after radical mastectomy: results on depression, anxiety andlength of hospital stay. *European Journal of Oncology Nursing* 2015;**19**:54-9.

References to studies excluded from this review

Akombo 2006 *{unpublished data only}*

* Akombo D. Effects of Listening to Music as an Intervention for Pain and Anxiety in Bone Marrow Transplant Patients [PhD thesis]. Gainesville, FL: University of Florida, 2006.

Allen 2010 *{unpublished data only}*

* Allen J. The Effectiveness of Group Music and Imagery on Improving the Self-concept of Breast Cancer Survivors [PhD thesis]. Philadelphia, PA: Temple University, 2010.

Ardila 2010 *{published data only}*

* Ardila E. Complementary medicine and cancer [Las medicinas complementarias y el cáncer]. *Revista Colombiana de Cancerología* 2010;**12**(3):127-8.

Augé 2015a *{published data only}*

* Augé PM, Mercadal-Brotons M, Resano CS. The effect of music therapy on mood and quality of life in female breast cancer survivors [Efecto de la musicoterapia en el estado anímico y calidad de vida de un grupo de mujeres supervivientes de cáncer de mama]. *Psicooncología* 2015;**12**(1):105-28.

Augé 2015b *{published and unpublished data}*

* Augé P, Mercadal-Brotons M, Resano C. The effect of music therapy on mood and quality of life in colorectal cancer patients [Efecto de la musicoterapia en el estado de ánimo y calidad de vida de pacientes con cáncer colorectal]. *Psicooncología* 2015;**12**(2-3):259-82.

Bailey 1983 *{published data only}*

* Bailey LM. The effects of live music versus tape-recorded music on hospitalised cancer patients. *Music Therapy* 1983;**3**(1):17-28.

Barrera 2002 *{published data only}*

* Barrera ME, Rykov MH, Doyle SL. The effects of interactive music therapy on hospitalised children with cancer: A pilot study. *Psycho-Oncology* 2002;**11**:379-88.

Barry 2010 *{published data only}*

* Barry P, O'Callaghan C, Wheeler G, & Grocke D. Music therapy CD creation for initial paediatric radiation therapy: a mixed methods analysis. *Journal of Music Therapy* 2010;**47**(3):233-63.

Boldt 1996 *{published data only}*

* Boldt S. The effects of music therapy on motivation, psychological well-being, physical comfort, and exercise endurance of bone marrow transplant patients. *Journal of Music Therapy* 1996;**33**(3):164-88.

Bozcuk 2006 *{published data only}*

* Bozcuk H, Artac M, Kara A, Ozdogan M, Sualp Y, Topcu Z, et al. Does music exposure during chemotherapy improve quality of life in early breast cancer patients? A pilot study. *Medical Science Monitor* 2006;**12**(5):200-5.

Bunt 1995 *{published data only}*

* Bunt L, Marston-Wyld J. Where words fail music takes over: a collaborative study by a music therapist and a counsellor in the context of cancer care. *Music Therapy Perspectives* 1995;**13**(1):46-50.

Burke 1997 *{published data only}*

* Burke M. Effects of physioacoustic intervention on pain management of postoperative gynaecological patients. Music Vibration and Health. Cherry Hill, NJ: Jeffrey Books, 1997.

Burns 2001b *{published data only}*

* Burns SJI, Harbuz MS, Hucklebrideg F, Bunt L. A pilot study into the therapeutic effects of music therapy at a self-help cancer center. *Alternative Therapies in Health Medicine* 2001;**7**(1):48-56.

Canga 2012 *{published data only}*

* Canga B, Hahm CL, Lucido D, Grossbard ML, Loewy JV. Environmental music therapy apilot study on the effects of music therapy in a chemotherapy infusion suite. *Music and Medicine* 2012;**4**(4):221-30.

Capitulo 2015 *{published data only}*

* Capitulo KL. Music therapy to reduce pain and anxiety in children with cancer undergoing lumbar puncture: a randomised clinical trial. *The American Journal of Maternal/Child Nursing* 2015;**40**(4):268.

Cermak 2005 *{unpublished data only}*

* Cermak AM. The Effect of Music Therapy and Songwriting on Anxiety, Depression, and Quality of Life in Cancer Patients and their Family as Measured by Self-report [Master's thesis]. Tallahassee, FL: Florida State University, 2005.

Chi 2009 *{unpublished data only}*

* Chi G. Music Relaxation Video and Pain Control: A Randomised Controlled Trial for Women Receiving Intracavitary Brachytherapy for Gynecological Cancer [PhD thesis]. Denton, TX: Texas Women's University, 2009.

Cuenot 1994 *{unpublished data only}*

* Cuenot LR. Effects of Brief Adjunctive Music Therapy on Chronic Cancer Pain Intensity [PhD thesis]. Gainesville, FL: University of Florida, College of Nursing, 1994.

Domingo 2015 *{published data only}*

* Domingo JP, Escudé Matamoros NE, Danés CF, Abelló HV, Carranza JM, Ripoll AR, et al. Effectiveness of music therapy in advanced cancer patients admitted to a palliative care unit: a non-randomised controlled, clinical trial. *Music & Medicine* 2015;**7**(1):23-31.

Dvorak 2015 *{published and unpublished data}*

* Dvorak A. Music therapy support groups for cancer patients and caregivers: A mixed methods approach. *Canadian Journal of Music Therapy* 2015;**21**(1):69-105.

Ezzone 1998 *{published data only}*

* Ezzone S, Baker C, Rosselet R, Terepka E. Music as an adjunct to antiemetic therapy. *Oncology Nursing Forum* 1998;**25**(9):1551-6.

Flaugher 2002 *{unpublished data only}*

* Flaugher M. The Intervention of Music on Perceptions of Chronic Pain, Depression, and Anxiety in Ambulatory Individuals with Cancer [PhD thesis]. Birmingham, AL: The University of Alabama at Birmingham, 2002.

Frank 1985 *{published data only}*

* Frank JM. The effects of music therapy and guided visual imagery on chemotherapy induced nausea and vomiting. *Oncology Nursing Forum* 1985;**12**(5):47-52.

Furioso 2002 *{unpublished data only}*

* Furioso MM. The Effect of Group Music Therapy on Coping, Psychosocial Adjustment, and Quality of Life for Women with Breast Cancer [PhD thesis]. East Lansing, MI: Michigan State University, 2002.

Hasenbring 1999 *{published data only}*

* Hasenbring M, Schulz-Kindermann F, Hennings U, Florian M, Linhart D, Ramm G, et al. The efficacy of relaxation/imagery, music therapy and psychological support for pain relief and quality of life: first results from a randomised controlled clinical trial. *Bone Marrow Transplantation* 1999;**23**:166.

Hogenmiller 1986 *{published and unpublished data}*

* Hogenmiller JR. The effect of selected classical music on acute pain related to bone marrow aspiration and biopsy in the cancer patient. *Oncology Nursing Forum* 1986;**13**(2):86.

Huang 2000 *{unpublished data only}*

* Huang SH. Effects of Music Therapy on Relieving Pain and Symptom Distress among Hospice Cancer Patients [Master's thesis]. Taipei: Taipei Medical College, 2000.

Jourt-Pineau 2012 *{published data only}*

* Jourt-Pineau C. Music therapy in oncology: an evaluation of the effects of music therapy on pain and anxiety in hospitalized oncology patients [La musicotherapie en oncologie: evalutaion des effets de la musicotherapie sur la douleur et l'anxiete chez les patients hospitalises et/ou suivis en service d'oncologie]. *La Revue Francaise de Musicotherapie* 2012;**32**(1):4-108.

Jourt-Pineau 2013 *{published data only}*

* Jourt-Pineau C, Guetin S, Vedrine L, Le Moulec S, Poirier JM, Ceccaldi B. Effects of music therapy on pain and anxiety in treating cancer patients: a feasibility study. *Douleurs* 2013;**14**(4):200-7.

Karagozoglu 2013 *{published data only}*

* Karagozoglu S, TekyasarF, Yilmaz FA. Effects of music therapy and guided visual imagery on chemotherapy-induced anxiety and nausea-vomiting. *Journal of Clinical Nursing* 2013;**22**(1-2):39-50.

Kemper 2008 *{published data only}*

* Kemper KJ, Hamilton CA, McLean TW, Lovato J. Impact of music on paediatric oncology outpatients. *Pediatric Research* 2008;**64**(1):105-9.

Lee 2000 *{unpublished data only}*

* Lee YJ. Effects of Music Therapy on Pain Level, Physiological Response and Psychological Perception of Cancer Patients [Master's thesis]. Taipei: Chang-Gung University, 2000.

Lee 2012 *{published data only}*

* Lee EJ, Bhattacharya J, Sohn C, Verres R. Monochord sounds and progressive muscle relaxation reduce anxiety and improve relaxation during chemotherapy: a pilot EEG study. *Complementary Therapies in Medicine* 2012;**20**(6):409-16.

Liu 2014 *{published data only}*

* Liu X, Yang H, Zou R, Tang F, Tang H, Lou Y. The effect of music therapy and countermeasures design during cancer therapy in China. *Psycho-oncology* 2014;**23**(S3):193.

Na Cholburi 2004 *{published data only}*

* Na Cholburi JS, Hanucharurnkul S, Waikakul W. Effects of music therapy on anxiety and pain in cancer patients. *Thai Journal of Nursing Research* 2004;**8**(3):173-81.

Nakayama 2009 *{published data only}*

* Nakayama H, Kikuta F, Takeda H. A pilot study on effectiveness of music therapy in hospice in Japan. *Journal of Music Therapy* 2009;**46**(2):160-72.

Pfaff 1989 *{published data only}*

* Pfaff VK, Smith KE, Gowan D. The effects of music-assisted relaxation on the distress of paediatric cancer patients undergoing bone marrow aspirations. *Children's Health Care* 1989;**18**(4):232-6.

Pienta 1998 *{published data only}*

* Pienta D. The effects of guided imagery & music on the self esteem and well-being of cancer survivors. Unpublished paper 1998.

Robinson 2009 *{unpublished data only}*

* Robinson A. Music During Chemotherapy. Effects on Patients with Gynecologic Malignancies with Emphasis on Physical Symptoms and Coping: Results of a Prospective Study. [Musik während der Chemotherapie. Effekte auf Patientinnen mit Gynäkologischen Malignomen unter Besonderer Berücksichtigung von Körperlichen Beschwerden und Krankheitsverarbeitung: Ergebnisse einer Prospektiven Studie] [PhD thesis]. Berlin: Universitätsmedizin, Berlin, 2009.

Rose 2008 *{published data only}*

* Rose JP, Weis J. Sound meditation in oncological rehabilitation: a pilot study of a receptive music therapy group using the monochord. *Forschende Komplementarmedizin* 2008;**15**(6):335-43.

Sadat 2009 *{published data only}*

* Sadat Hoseini AAS. Effect of music therapy on chemotherapy nausea and vomiting in children with malignancy. *Journal of Hayat* 2009;**15**(2):5-14.

Sahler 2003 *{published data only}*

NCT00032409. The effects of music therapy-based stress reduction on bone marrow transplant recipients. http://clinicaltrials.gov/ct2/show/NCT00032409.

* Sahler OJZ, Hunter BC, Liesveld JL. The effect of using music therapy with relaxation imagery in the management of patients undergoing bone marrow transplantation: a pilot feasibility study. *Alternative Therapies in Health and Medicine* 2003;**9**(6):70-4.

Schur 1987 *{published data only}*

* Schur JM. Alleviating behavioral distress with music or Lamaze pant-blow breathing in children undergoing bone marrow aspirations and lumbar punctures. Dissertation Abstracts International, 48(3-B)889 1987.

Sedei 1980 *{unpublished data only}*

* Sedei C. The Effectiveness of Music Therapy on Specific Statements Verbalized by Cancer Patients [Master's thesis]. Fort Collins, CO: Colorado State University, 1980.

Standley 1992 *{published data only}*

* Standley JM. Clinical applications of music and chemotherapy: the effects on nausea and emesis. *Music Therapy Perspectives* 1992;**10**(1):27-35.

Stark 2012 *{unpublished data only}*

* Stark JC. Perceived Benefits of Group Music Therapy for Breast Cancer Survivors: Mood, Psychosocial Wellbeing, and Quality of Life [PhD thesis]. Michigan, USA: Michigan State University, 2012.

Tan 2008 *{published data only}*

* Tan BL, Sin ACF, Ho SM, Lee KH, Poh J, Chua GP, et al. Effect of music in reducing anxiety levels among patients who receive their first dose of chemotherapy treatment. Singapore General Hospital Proceedings. 2008; Vol. 17, issue 1:46-56.

Thompson 2011 *{unpublished data only}*

* Thompson S. The Effect of Group Music Therapy on Anxiety, Depression, Quality of Life and Coping with Women with Stage I and Stage II Breast Bancer: a Mixed Methods study [PhD thesis]. Melbourne: The University of Melbourne, 2011.

Tilch 1999 *{published data only}*

* Tilch S, Haffa-Schmidt U, Wandt H, Kappauf H, Schafer K, Birkmann J, et al. Supportive music therapy improves mood state in patients undergoing myeloablative chemotherapy. *Bone Marrow Transplantation* 1999;**23**:170.

Vohra 2011 *{published data only}*

* Vohra S, Nilsson S. Does music therapy reduce pain and anxiety in children with cancer undergoing lumbar puncture?. *Focus on Alternative and Complementary Therapies* 2011;**16**(1):66-7.

Walden 2001 *{published data only}*

* Walden EG. The effects of group music therapy on mood states and cohesiveness in adult oncology patients. *Journal of Music Therapy* 2001;**38**(3):212-38.

Washington 1990 *{unpublished data only}*

* Washington DR. The Effect of Music Therapy on Anxiety Levels of Terminally Ill Cancer Patients: A Pilot Atudy [Master's thesis]. Philadelphia, PA: Hahnemann University, USA, 1990.

Weber 1997 *{published data only}*

* Weber S, Nuessler V, Wilmanns W. A pilot study on the influence of receptive music listening on cancer patients during chemotherapy. *International Journal of Arts Medicine* 1997;**5**(2):27-35.

Whitney 2013 *{unpublished data only}*

* Whitney Q. The Effect of Music Therapy on Five-year Disease-free Survival Rates in Pediatric Neuroblastoma [Master's thesis]. Ithaca, NY: Weill Medical College of Cornell University, 2013.

Wurr 2000 *{unpublished data only}*

* Wurr CJ. Evaluation of music therapy in pediatric oncology - a pilot study. Academic Unit of Child & Adolescent Mental Health, University of Leeds, UK 2000.

Yildirim 2007 *{published data only}*

* Yildirim S, Gurkan A. The influence of music on anxiety and the side effects of chemotherapy [Muzigin, kemoterapi yan etkilerine ve kaygi duzeyine etkisi]. *Anadolu Psikiyatri Dergisi* 2007;**8**(1):37-45.

Zimmernam 1989 *{published data only}*

* Zimmerman L, Pozehl B, Duncan K, Schmitz R. Effects of music in patients who had chronic cancer pain. *Western Journal of Nursing Research* 1989;**11**(3):293-309.

References to studies awaiting assessment

Bro 2013 *{unpublished data only}*

* Bro ML. Live Music During Chemotherapy: Randomized Study of the Effect of Live Music During Chemotherapy Treatment [PhD thesis]. Aarhus: University of Aarhus, 2013.

Dileo 2015 *{unpublished data only}*

* Dileo C. Music entrainment with cancer patients with chronic pain. http://www.temple.edu/boyer/community/aqlresearch.asp (accessed 23 January 2016).

Duong 2013 *{unpublished data only}*

* Duong HK, Bates D, Rybicki LA, Kalaycio M, Steven A, Sobecks R, et al. A randomised study of music therapy in patients undergoing autologous stem cell transplant: Decrease in narcotic medication use for pain control. 55th Annual Meeting of the American Society of Hematology; New Orleans, LA December 7-10, 2013. New Orleans, LA, 2013.

NCT00086762 *{unpublished data only}*

* NCT00086762. Mindfulness relaxation compared with relaxing music and standard symptom management education in treating patients who are undergoing chemotherapy for newly diagnosed solid tumors. ClinicalTrials.gov.

NCT02150395 *{unpublished data only}*

* NCT02150395. Impact of music therapy on anxiety in patients with cancer: Undergoing simulation for radiation therapy. http://clinicaltrials.gov.

Rossetti A, Chadha M, Lucido D, Hylton D, Loewy J, Harrison, L. The impact of music therapy on anxiety and distress in patients undergoing simulation for radiation therapy. *International Journal of Radiation Oncology Biology Physics* 2014;**90**(1):S708-9.

NCT02639169 *{unpublished data only}*

* NCT02639169. The impact of music therapy on mood control in hospitalized patients for transplant. http://clinicaltrials.gov.

O'Brien 2010 *{unpublished data only}*

* O'Brien E. The Effect of the Guided Original Lyrics and Music (GOLM) Songwriting Protocol on Cancer Patients' Mood, Distress Levels, Quality of Life, and Satisfaction with Hospital Stay [PhD thesis]. Melbourne: University of Melbourne, in progress.

References to ongoing studies

NCT02261558 *{unpublished data only}*

* NCT02261558. Effects of clinical music improvisation on resiliency of adults undergoing infusion therapy. http://clinicaltrials.gov.

NCT02583126 *{unpublished data only}*

* Sanfi I. The effect and meaning of a designed guided imagery and music intervention on anticipatory, acute, and delayed side effects of chemotherapy in teenagers with cancer: a randomized controlled multisite study. http://clinicaltrials.gov/ct2/show/NCT02583126 (accessed 23 January 2016).

NCT02583139 *{unpublished data only}*

* Sanfi I. The effect and meaning of designed music narratives on anticipatory, acute, and delayed side effects of chemotherapy in children (7-12 years) with cancer: a randomized controlled multisite study. http://clinicaltrials.gov.

Additional references

Bradt 2010

Bradt J, Dileo C. Music therapy for end-of-life care. *Cochrane Database of Systematic Reviews* 2010, Issue 1. [DOI: 10.1002/14651858.CD007169.pub2]

Bradt 2013a

Bradt J, Dileo C, Potvin N. Music for stress and anxiety reduction in coronary heart disease patients. *Cochrane Database of Systematic Reviews* 2013, Issue 12. [DOI: 10.1002/14651858.CD006577]

Bradt 2013b

Bradt J, Dileo C, Shim M. Music interventions for preoperative anxiety. *Cochrane Database of Systematic Reviews* 2013, Issue 6. [DOI: 10.1002/14651858.CD006908.pub2]

Bradt 2014

Bradt J, Dileo C, Grocke D. Music interventions for mechanically ventilated patients. *Cochrane Database of Systematic Reviews* 2014, Issue 12. [DOI: 10.1002/14651858.CD006902.pub3]

Burns 1999

Burns DS. The Effect of the Bonny Methods of Guided Imagery and Music on the Quality of Life and Cortisol Levels of Cancer Patients [unpublished PhD thesis]. University of Kansas. [DAI-A 61/01]

Cohen 1988

Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd Edition. Hillsdale, NJ: Lawrence Earlbaum Associates, 1988.

Cucherat 2007

Cucherat M. Quantitative relationship between resting heart rate reduction and magnitude of clinical benefits in post-myocardial infarction: a meta-regression of randomized clinical trials. *European Heart Journal* 2007;**28**(24):3012-9.

Deeks 2001

Deeks JJ, Altman DG, Bradburn MJ. Statistical methods for examining heterogeneity and combining results from several studies in meta-analysis. In: Egger M, Davey Smith G, Altman DG editor(s). Systematic Reviews in Health Care: Meta-Analysis in Context. 2nd Edition. London: BMJ Publication Group, 2001:285-312.

Dileo 1999

Dileo C. A classification model for music and medicine. Applications of Music in Medicine. National Association of Music Therapy, 1999:1-6.

Dileo 2005

Dileo C, Bradt J. Medical Music Therapy: A Meta-analysis & Agenda for Future Research. Cherry Hill: Jeffrey Books, 2005.

Dileo 2006

Dileo C. Effects of music and music therapy on medical patients: A meta-analysis of the research and implications for the future. *Journal of the Society of Integrative Oncology* 2006;**4**(2):67-70.

Dileo 2007

Dileo C, Bradt J. Music therapy: Applications to Stress Management. In: Lehrer, Woolfolk editor(s). Principles and Practice of Stress Management. 3rd Edition. New York: Guilford Press, 2007.

Haun 2001

Haun M, Mainous R, Looney S. Effect of music on anxiety of women awaiting breast biopsy. *Behavioral Medicine* 2001;**27**(3):127-32.

Higgins 2002

Higgins JPT, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine* 2002;**21**:1539-58.

Higgins 2011

Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions 5.1.0 [updated March

2011].. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org. The Cochrane Collaboration.

King 2003

King CR, Hinds BS. Quality of life from nursing and patient perspectives: theory, research and practice. Sudbury: Jones and Bartlett Publishers, 2003.

Magill 2009

Magill L. Meaning of the music: the role of music in palliative care music therapy as perceived by bereaved caregivers of advanced cancer patients. *American Journal of Hospice and Palliative Medicine* 2009;**26**(1):33-9.

Magill 2011

Magill L, O'Callaghan C. Music Therapy in Supportive Cancer Care. *Music and Medicine* 2011;**3**:7-8.

Magill 2015

Magill L. Music therapy in oncology. In: Holland C, Breitbart WS, Butow PN, Jacobsen PB, Loscalzo M, et al. editor(s). Psycho-Oncology. 3rd Edition. New York: Oxford University Press, 2015:499-502.

Massie 2004

Massie MJ. Prevalence of depression in patients with cancer. *Journal of the National Cancer Institute. Monographs* 2004;**32**:57-71.

McAuley 2000

McAuley L, Pham B, Tugwell P, Moher D. Does the inclusion of grey literature influence estimates of intervention effectiveness reported in meta-analyses?. *Lancet* 2000;**356**(9237):1228-31.

McClean 2012

McClean S, Bunt L, Daykin N. The healing and spiritual properties of music therapy at a cancer care centre. *Journal of Alternative and Complementary Medicine* 2011;**18**(4):402-7.

McCracken 2009

McCracken LM, Keogh E. Acceptance, mindfulness, and values-based action may counteract fear and avoidance of emotions in chronic pain: an analysis of anxiety sensitivity. *Journal of Pain* 2009;**10**(4):408-15.

McKinney 2002

McKinney CH. Quantitaive research in guided imagery and music (GIM): A review. In: Bruscia KE, Grocke DE editor(s). Guided imagery and music: The Bonny Method and beyond. Gilsum, New Hampshire, US: Barcelona, 2002:449-466.

McNair 1971

McNair DM, Lorr M, Droppleman LF. Manual for the Profile of Mood States. Manual for the Profile of Mood States. San Diego, CA: Educational and Industrial Testing Services, 1971.

Montgomery 2000

Montgomery GH, Bovbjerg DH. Pre-infusion expectations predict post-treatment nausea during repeated adjuvant chemotherapy infusion for breast cancer. *British Journal of Health Psychology* 2000;**5**(2):105-19.

NCI 2010

National Cancer Institute. SEER Cancer Statistics Review, 1975-2007. Available from: http://seer.cancer.gov/csr/1975_2007/results_merged/topic_lifetime_risk_diagnosis.pdf 2010.

Nightingale 2013

Nightingale CJ, Rodriguez C, Carnaby G. The impact of music interventions on anxiety for adult cancer patients: a meta-analysis and systematic review. *Integrative Cancer Therapies* 2013;**12**(5):393-403.

Norton 2004

Norton TR, Manne SL, Rubin S, Carlson J, Hernandez E, Edelson MI, et al. Prevalence and predictors of psychological distress among women with ovarian cancer. *Journal of Clinical Oncology* 2004;**22**(5):919-26.

O'Callaghan 2015

O'Callaghan C, Magill L. Music therapy with adults diagnosed with cancer and their families. In: Edwards J editor(s). Oxford Handbook of Music Therapy. Oxford University Press, 2015:112-34.

Parle 1996

Parle M, Jones B, Maguire P. Maladaptive coping and affective disorders among cancer patients. *Psychological Medicine* 1996;**26**(4):735-44.

Raison 2003

Raison CL, Miller AH. Depression in cancer: New developments regarding diagnosis and treatment. *Biological Psychiatry* 2003;**54**(3):283-94.

Review Manager 2014 [Computer program]

Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration. Review Manager (RevMan) [Computer program]. Version 5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014.

Sellick 1999

Sellick SM, Crooks DL. Depression and cancer: An appraisal of the literature for prevalence, detection, and practice guideline development for psychological interventions. *Psycho-Oncology* 1999;**8**(4):315-33.

Spielberger 1983

Spielberger CD, Gorsuch RL, Lushene PR, Vagg PR, Jacobs AG. Manual for the State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists Press, Inc, 1983.

Thune-Boyle 2006

Thune-Boyle IC, Myers LB, Newman SP. The role of illness beliefs, treatment beliefs, and perceived severity of symptoms in explaining distress in cancer patients during chemotherapy treatment. *Behavioral Medicine* 2006;**32**(1):19-29.

van't Spijker 1997

van't Spijker A, Trijsburg RW, Duivenvoorden HJ. Psychological sequelae of cancer diagnosis: a meta-analytical review of 58 studies after 1980. *Psychosomatic Medicine* 1997;**59**(3):280-93.

Weber 1996

Weber A, Nuessler V, Wilmanns W. A pilot study on the influence of receptive music listening on cancer patients during chemotherapy. *International Journal of Arts Medicine* 1996;**5**(2):27-35.

Zhang 2012

Zhang JM, Wang P, Yao J, Zhao L, Davis MP, Walsh D, Yue GH. Music interventions for psychological and physical outcomes in cancer: a systematic review and meta-analysis. *Supportive Care in Cancer* 2012;**20**(12):3043-53.

CHARACTERISTICS OF STUDIES

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

Beck 1989

Methods	RCT Cross-over trial
Participants	Adults with documented cancer-related pain Type of cancer: breast (n = 7, 46.5%), multiple myeloma (n = 4, 26.5%), rectal (n = 1, 6.75%), prostate (n = 1, 6.75%), sarcoma (n = 1, 6.75%), lymphoma (n = 1, 6.75%) Total N randomized: 15 Total N analyzed: 15 Mean age: 55.6 years Sex: 12 (80%) females, 3 (20%) males Ethnicity: 15 (100%) white Setting: patients' home Country: USA
Interventions	2 study groups 1. Music condition: listening to music via headphones 2. Control condition: listening to 60-cycle hum via headphones Music provided: the researcher asked a registered music therapist to select relaxing music in 7 categories including classical, jazz, folk, rock, country and western, easy listening and new age. Participants were asked to select from these music options. Number of sessions: 3 Length of sessions: 45 min Categorized as music medicine trial
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	

References to other published versions of this review

Bradt 2011

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. [DOI: 10.1002/14651858.CD006911.pub2]

* Indicates the major publication for the study

Beck 1989 *(Continued)*

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	Low 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	6 dropouts (28.6%) because of hospitalisation (n = 1), deterioration (n = 2), inadequate baseline (n = 2), or withdrawal during baseline (n = 1)
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

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
	Sex: 30 (100%) females, 0 (0%) males
	Ethnicity: 24 (80%) white, 6 (20%) black
	Setting: inpatient

Binns-Turner 2008 *(Continued)*

	Country: USA
Interventions	2 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 h 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	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "[T]he 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)" (p. 53).
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.
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Outcome 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 dropouts
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting

Binns-Turner 2008 *(Continued)*

Other bias	Low risk	No report of conflict of interest

Bradt 2015

Methods	RCT Cross-over trial
Participants	Adults receiving cancer treatment Type of cancer: breast (n = 6, 19.4%), head and neck (n = 3, 9.7%), gastrointestinal (n = 3, 9.7%), gynecological (n = 3, 9.7%), hematologic (n = 7, 22.6%), lung (n = 4, 12.9%), other (n = 5, 16%) Total N randomized: 39 with 5 patients lost prior to initiation of treatment Total N analyzed: 31 Age: 53.8 years Sex: 21 (67.7%) females, 10 (32.3%) males Ethnicity: 23 (74.2%) black, 1 (3.2%) Asian, 6 (19.4%) white, 1 (3.2%) other Setting: inpatient and outpatient Country: USA
Interventions	2 study conditions: 1. Music therapy condition: music therapist offered live and interactive music making based on patient needs 2. Music medicine condition: participants listed to iPod with the patient's playlist Number of sessions: 2 of each condition Length of sessions: 30-45 min Categorized as music therapy
Outcomes	Anxiety (VAS), mood (VAS), relaxation (VAS), pain (NRS): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Using a list of random numbers, participants were randomized to one of two treatment sequences consisting of two MT sessions followed by two MM sessions or vice versa" (p.1262)
Allocation concealment (selection bias)	Low risk	"The use of sequentially numbered, opaque, sealed envelopes ensured allocation concealment" (p.1262).
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Study participants were blinded: "We minimized expectation effects of participants throughout the study by referring to both treatment conditions as music sessions rather than referring to one intervention as music therapy" (p1263). The music therapist could not be blinded.

Bradt 2015 *(Continued)*

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	No objective outcomes were included in this study.
Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Self report measures were used for subjective outcomes but participants were blinded to the study hypotheses.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate: 13% (p.1264)
Selective reporting (reporting bias)	Low risk	No indication of selective reporting
Other bias	Low risk	Study was funded by Drexel University's College of Medicine

Bufalini 2009

Methods	Controlled clinical trial (CCT) (randomization method unclear) 2-arm parallel group design
Participants	Children with cancer who had previously undergone more than 2 painful, invasive procedures (e.g. osteomedullar biopsy, lumbar puncture) and who were scheduled to undergo a painful medical procedure Type of cancer: acute lympathic leukemia (n = 18, 47% of music group, n = 25, 65% of control group), non-Hodgkin's lymphoma (n = 12, 32% of music group, n = 8, 20% of control group), neuroblastoma (n = 4, 11% of music group, n = 4, 10% of control group), osteosarcoma (n = 2, 5% of music group, n = 2, 5% of control group), medulloblastoma (n = 2, 5% of music group, 0% of control group) 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%) white (Italian) Setting: inpatient Country: Italy
Interventions	2 study groups: 1. Music therapy group: conscious sedation and music listening phase followed by an interactive music therapy phase 2. Control group: conscious sedation alone Music selections provided: during the initial music listening phase, the following music was used: lullabies (e.g. Brahms); children's 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.

Bufalini 2009 *(Continued)*

	Number of sessions: 1 Length of sessions: 15 min for phase 1 (music listening); length of active music making is not specified Categorized as music therapy
Outcomes	Anxiety (STAI-S): post-test scores Induction compliance (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	Low 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	Low 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	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Bulfone 2009

Methods	CCT 2-arm parallel group design
Participants	Women with breast cancer waiting for adjuvant chemotherapy Type of cancer: breast (n = 60, 100%) Total N randomized: 60 N randomized to music group: 30

Bulfone 2009 *(Continued)*

	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%) white (Italian) Setting: inpatient Country: Italy
Interventions	2 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 selections 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 min Categorized as music medicine
Outcomes	Anxiety (STAI-S): post-test scores
Notes	The principal investigator provided us with standard deviations as these were not given in the study report

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Alternate assignment using order of admission (personal communication with principal investigator)
Allocation concealment (selection bias)	High risk	Alternate assignment prohibited allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	It is unclear whether personnel were blinded; participants were not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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)	Low risk	No attrition

Bulfone 2009 *(Continued)*

All outcomes		
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Burns 2001a

Methods	RCT 2-arm parallel group design
Participants	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 (SD 6.56) years Sex: 8 (100%) females Ethnicity: no information provided Setting: outpatient Country: USA
Interventions	2 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 selections 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 min Categorized as music therapy
Outcomes	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): change scores were computed by JB to allow for computation of pooled effect size (SMD) with other studies that reported change scores
Notes	—

Burns 2001a *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with principal investigator)
Allocation concealment (selection bias)	Low risk	Statisticalprogram Aleator (personal communication with principal investigator)
Blinding of participants and personnel (performance bias) All outcomes	Low 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	Low 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	No evidence of selective reporting
Other bias	Low risk	Study was supported by Trustees of the Paul Jenkins fund

Burns 2008

Methods	CCT 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

Burns 2008 *(Continued)*

	Country: USA
Interventions	2 study groups: 1. Music therapy group: participants received music-guided imagery sessions 2. Control group: standard care Music selections provided: classical music and new age music based on patient preference was used Number of sessions: 8 Length of sessions: 45 min Categorized as music therapy
Outcomes	Anxiety (STAI-S): 4-weeks postintervention scores Fatigue (The Functional Assessment of Chronic Illness Therapy—Fatigue scale, FACIT-F): 4-week post-intervention scores Positive and negative affect (Affect and Negative Affect Schedule, PANAS): 4 week post-intervention scores (not used in this review)
Notes	Post-test scores were not reported in this study report. Values were obtained from the principal investigator. However, she could only provide us with the 4-week 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	Low 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	Low 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.

Burns 2008 *(Continued)*

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%) white, other information not provided Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music therapy group: music therapy group created therapeutic music video with a board-certified music therapist 2. Control group: listened to audiobook with certified child life specialist. Delivered during the acute phase of SCT Music selections provided: music videos of 10 songs from 5 music styles including pop, rock, rap, country, and rhythm and blues Number of sessions: 6 Length of sessions: 60 min 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

Burns 2009 *(Continued)*

Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with principal investigator)
Allocation concealment (selection bias)	Unclear risk	Central randomizations was used, but author is unsure how information was transferred to field investigators (personal communication with principal investigator)
Blinding of participants and personnel (performance bias) All outcomes	Low 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 (personal communication with principal investigator)
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	2 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. 1 participant withdrew from the study after learning randomizations status
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	Supported by American Cancer society IRG-84-002-19

Burrai 2014

Methods	RCT 2-arm parallel group design
Participants	Adults who met the eligibility criteria for diagnosis of cancer receiving chemotherapy treatment Type of cancer: metastatic cancer (n = 45, 86.6%), non-metastatic cancer (n = 7, 13.4%) Total N randomized: 52 Total N analyzed: 52 N randomized to music group: 26 N randomized to control group: 26 N analyzed in music group: 26 N analyzed in control group: 26

Burrai 2014 *(Continued)*

	Mean age: 64.5 years Sex: 43 (82.7%) females, 9 (17.3%) males Ethnicity: not reported Setting: inpatient Country: Italy
Interventions	2 study groups: 1. Music group: listening to live saxophone music provided by a nurse 2. Control group: standard care Music selections provided: participant was asked to select 5 or 6 musical pieces from a playlist that included music from a wide variety of styles Number of sessions: 3 Length of sessions: 30 min Categorized as music medicine
Outcomes	SBP, DBP: change score HR, oxygen saturation: post-test scores Mood (VAS): post-test scores Glycemia: not included in this review Pain (VAS): not included in this review. Baseline levels indicated that participants were barely experiencing pain.
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"For the randomisation sequence generation for allocation of the participants, a computer-generated list of random numbers was used. For the randomisation type, participants were randomly assigned following simple randomisation procedures (computerized random numbers) to 1 of 2 groups" (p. 304).
Allocation concealment (selection bias)	Low risk	"As for the allocation concealment mechanism, the allocation sequence was concealed from the researcher enrolling and assessing participants in sequentially numbered, opaque, sealed, and stapled envelopes. Envelopes were opened only after the enrolled participants completed all baseline assessments, and it was time to allocate the intervention" (p. 304).
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Live music was used; therefore blinding was not possible
Blinding of outcome assessment (detection bias) Objective outcomes	Unclear risk	Not reported

Burrai 2014 *(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	Flow chart (p. 305) indicates 0% dropouts
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	"The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article" (p. 301)

Cai 2001

Methods	CCT 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%), 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	2 study groups: 1. Music group: listening to pre-recorded music 2. Control group: standard care Music selections provided: Chinese classical music Number of sessions: 30 Length of sessions: 30 min Categorized as music medicine
Outcomes	Depression (Zung Self Rating Depression Scale): post-test scores

Cai 2001 *(Continued)*

	Anxiety (Zung Self Rating Anxiety Scale): post-test scores
Notes	—

Risk of bias

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	Low 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	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

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's (n = 8, 12%), non-Hodgkin's lymphoma (n = 31, 45%), myeloma/amyloidosis (n = 30, 43%) Total N randomized: 69 Total N analyzed: 60 N randomized to music group: 36 N randomized to control group:33 N analyzed in music group: 34

Cassileth 2003 *(Continued)*

	N analyzed in control group: 26 Mean age: 52 years Sex: 37 (54%) females, 32 (46%) males Ethnicity: not provided Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music therapy group: live bedside music therapy provided by trained music therapist 2. Control group: standard care Music selections 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 min Categorized as music therapy
Outcomes	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)
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "[R]andomized by telephone using the MSKCC clinical research database" (p. 2724) 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)." (p. 2724).
Allocation concealment (selection bias)	Low risk	Quote: "[T]he use of telephone registration and randomisation ensured concealment of treatment allocation"
Blinding of participants and personnel (performance bias) All outcomes	Low 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	Low 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

Cassileth 2003 *(Continued)*

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	No evidence of selective reporting
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	2 study groups: 1. Music group: listening to music and guided imagery 2. Control group: standard care Music selections 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 min Categorized as music medicine
Outcomes	CD3, CD4, CD8, CD4/CD8, NK cell activity: post-test scores
Notes	—
Risk of bias	

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	Low 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	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Chen 2013

Methods	CCT 2-arm parallel group design
Participants	Adult oncology patients Type of cancer: head and neck (n = 67, 33.5%), gynecological (n = 23, 11.5%), breast (n = 38, 19%), digestive tract (n = 37, 18.5%), lung (n = 12, 6%), prostate (n = 18, 9%) (Numbers do not add up to total N of 200 but are reported as such in the published article) Total N randomized: 200 Total N analyzed: 200 N randomized to music group: 100 N randomized to control group: 100 N analyzed in music group: 100 N analyzed in control group: 100 Mean age: 55.4 years Sex: 79 (39.5%) females, 121 (60.5%) males Ethnicity: not provided

Chen 2013 *(Continued)*

	Setting: outpatient Country: Taiwan
Interventions	2 study groups: 1. Music condition: music listening via headphones 2. Control condition: sitting quietly Music selections provided: slow-paced, soft, melodic music at low volume with consistent tempo and dynamics and an average 60-80 beats per minute. Subjects chose their own music tracks from a selection of songs in Mandarin, Mandarin pop, traditional Taiwanese songs, Western music (country and western), and classical music (e.g. chamber music with string instruments). Number of sessions: 1 Length of sessions: 15 min Categorized as music medicine trial
Outcomes	Anxiety (STAI): change scores HR, RR, SBP, DBP, oxygen saturation: change scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	"The 200 patients were randomly assigned by simple random sampling (every other patient) into two groups" (p. 437)
Allocation concealment (selection bias)	High risk	Alternate assignment prohibited allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were blinded to the study hypothesis. Personnel were not blinded.
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	Low risk	"A total of 209 patients who met the inclusion criteria were enrolled. Nine of these patients withdrew at the early stage for reasons of severe clinical condition or personal reasons, and 200 patients were retained for analysis" (p. 437). Attrition rate: 4.4%.
Selective reporting (reporting bias)	Unclear risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

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 and 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%) white, 7 (11%) black, 2 (3%) other Setting: not stated in study report Country: USA
Interventions	2 study groups: 1. Music therapy group: music therapist provided instructions on how to use music for relaxation and distraction 2. Control group: standard care Music selections provided: a personalized tape was created for each patient to use at any time during the course of therapy. Number of sessions: 2-4 times per week for approximately 4-5 weeks Length of sessions: unknown Categorized as music therapy
Outcomes	Depression (Hospital Anxiety and Depression Scale, HADS): post-test scores Fatigue (POMS): post-test scores Pain (Numeric Rating Scale, NRS): change scores Distress (NRS): change scores
Notes	No standard deviations were reported for post-test scores in the publication. Standard deviations were obtained from the author.

Risk of bias

Bias	Authors' judgement	Support for judgement

Clark 2006 *(Continued)*

Random sequence generation (selection bias)	Low risk	Quote: "Patients were randomised using a minimization procedure in which the first subject is assigned to a group with a coin toss. Subsequent subjects were assigned based upon covariate (tumor site, gender and pain) and assignment of previous subjects using a computer program." (p. 251)
Allocation concealment (selection bias)	Low risk	Minimization procedure as described above
Blinding of participants and personnel (performance bias) All outcomes	Low risk	The music therapist and participants could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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) or did not return for radiation therapy treatment (n = 1)
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Cook 2013

Methods	RCT 2-arm parallel group design
Participants	Adult oncology patients Type of cancer: leukemia (n = 7, 41.2%), unspecified or other (n = 10, 58.8%) Total N randomized: 34 Total N analyzed: 17 N randomized to music group: 21 N randomized to control group: 13 N analyzed in music group: 10 N analyzed in control group: 7 Mean age: 59.8 years Sex: 9 (52.9%) females, 8 (47.1%) males Ethnicity: not reported Setting: inpatient

Cook 2013 *(Continued)*

	Country: USA
Interventions	2 study groups: 1. Music therapy: music therapist played patient-preferred live music 2. Control group: standard care Music selections provided: not reported Number of sessions: 3 Length of sessions: 15-30 min Categorized as music therapy
Outcomes	Spiritual well-being (Functional Assessment of Chronic Illness Therapy-Spiritual Well Being Scale, FACIT-Sp.): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"...and after they signed the consent form, they were randomly assigned to a controlled condition or an experimental music therapy condition via a computer program" (p. 241).
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Music therapist and participants could not be blinded.
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	Ten participants were lost in music therapy group, seven in the control group. Attrition rate: 50%.
Selective reporting (reporting bias)	Unclear risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Danhauer 2010

Methods	RCT

Danhauer 2010 *(Continued)*

	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: 29 N randomized to control group: 30 N analyzed in music group: 29 N analyzed in control group: 30 Mean age: 50.9 years Sex: not provided Ethnicity: 46 (78%) white, 13 (22%) black Setting: outpatient Country: USA
Interventions	2 study groups: 1. Music group: listening to pre-recorded music for the duration of the procedure 2. Control group: standard care Music selections 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 min 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 principal investigator)
Allocation concealment (selection bias)	Low risk	Researcher was blind to randomized blocks (personal communication with principal investigator)
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported
Blinding of outcome assessment (detection bias)	Low risk	This study did not address objective outcomes

Danhauer 2010 *(Continued)*

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	No evidence of selective reporting
Other bias	Low risk	No report of conflict of interest

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 Total N analyzed: 30 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	2 study groups: 1. Music therapy group: music therapy interventions were adapted for in-the-moment needs of the child. 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. Music selections provided: cultural and ethnic characteristics were considered in selecting songs and instruments. Number of sessions: 1

Duocastella 1999 *(Continued)*

	Length of sessions: 45 min
	Categorized as music therapy
Outcomes	Mood (Patient Opinion Likert Scale, OPEL): post-test scores
	Immunoglobulin A (IgA) levels: change scores
Notes	—

Risk of bias

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	Low risk	The music therapist and the participants could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Staff responsible for analysing 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	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Ferrer 2005

Methods	CCT
	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

Ferrer 2005 *(Continued)*

	N analyzed in music group: 25 N analyzed in control group: 25 Mean age: 55 years Sex: 26 (52%) females, 24 (48%) males Ethnicity: not provided Setting: outpatient Country: USA
Interventions	2 study groups: 1. Music group: music therapist provided patient-preferred live music 2. Control group: standard care Music selections provided: patient-preferred music with guitar accompaniment Number of sessions: 1 Length of sessions: 20 min 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	Low 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)	High risk	Self report measures were used for subjective outcomes

Ferrer 2005 *(Continued)*

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	No evidence of selective reporting
Other bias	Low risk	No funding was received

Fredenburg 2014a

Methods	RCT 2-arm parallel group design
Participants	Adult cancer patients recovering from a blood and marrow transplant Type of cancer: acute myelogenous leukemia (n = 3, 8.0%), acute lymphoblastic leukemia (n = 2, 5.9%), chronic lymphocytic leukemia (n = 3, 8.0%), non-Hodgkin's lymphoma (n = 5, 14.7%), myelodysplastic syndromes (n = 2, 5.9%), multiple myeloma (n = 7, 20.6%), leukemia (not specified) (n = 6, 17.6%), lymphoma (not specified) (n = 1, 2.9%), other (n = 3, 8.0%) Total N randomized: 34 Total N analyzed: 32 N randomized to music group: 14 N randomized to control group: 20 N analyzed in music group: 12 N analyzed in control group: 20 Mean age: 53.5 Sex: 17 (55.9%) female, 15 (44.1%) male Ethnicity: Asian (n = 1, 2.9%), Latino (n = 3, 8%), white (n = 23, 67.6%), other (n = 5, 14.7%) Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music therapy group: music therapist provided live music based on patient's stated preferences with voice and guitar 2. Control group: standard care Music selections provided: patient's preferred music Number of sessions: 1 Length of sessions: 30 min Categorized as music therapy

Fredenburg 2014a *(Continued)*

Outcomes	Positive and negative affect (PANAS), pain (NRS): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Participants were randomly assigned via a computer program to either the experimental group (n = 12) or wait-list control group (n = 20)" (p. 176).
Allocation concealment (selection bias)	High risk	No allocation concealment used (personal communication with chief investigator)
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Music therapist and participants could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	"2 participants did not complete measures" (p. 177). Attrition rate:6%
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Fredenburg 2014b

Methods	RCT 2-arm parallel group design
Participants	Adults in bone marrow transplant unit Type of cancer: acute myelogenous leukemia (n = 2, 18.2%), acute lymphoblastic leukemia (n= 2, 18.2%), chronic lymphocytic leukemia (n = 2, 18.2%), Hodgkin's disease (n = 1, 9.1%), multiple myeloma (n = 1, 9.1%), non-Hodgkin's lymphoma (n = 2, 18.2%), and lymphoma (n = 1, 9.1%) Total N randomized: 13 Total N analyzed: 11 N randomized to music group: 8 N randomized to control group: 5 N analyzed in music group: 7

Fredenburg 2014b *(Continued)*

	N analyzed in control group: 4 Mean age: 49.69 Sex: n = 3 (27.3%) female, n = 8 (72.7%) male Ethnicity: white: n = 10 (90.9%), other: n = 1 (9.1%) Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music therapy group: music therapist played patient-preferred music 2. Control group: standard care Music selections provided: patient-preferred live music Number of sessions: 3-5 Length of sessions: 30-45 min Categorized as music therapy
Outcomes	Fatigue (Multidimensional Fatigue Inventory, MFI): change scores
Notes	Means and standard errors are reported in the journal article. Standard deviations were obtained from the primary author. Because of large baseline differences between the groups, JB computed change scores and associated SDs.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"The participants were randomly assigned via a computer program to either the experimental (n = 7) or wait-list control (n = 4) groups " (p.436).
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Music therapist and participants could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	Flowchart reported that 13 participants consented and randomized; 11 analyzed (p. 435). Attrition rate: 16%.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting

Fredenburg 2014b *(Continued)*

Other bias	Low risk	No conflict of interest reported

Gimeno 2008

Methods	CCT 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%) white, 1 (5%) black, 1 (5%) Latino, 9 (45%) Asian Setting: outpatient Country: USA
Interventions	2 study groups: 1. Music therapy condition: adapted Bonny Method of Guided Imagery and Music intervention (BMGIM) 2. Control condition: imagery only Music selections provided: new age music Number of sessions: 3 BMGIM sessions and 3 imagery-only sessions Length of sessions: 60-90 min 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
Allocation concealment (selection bias)	Low risk	Cross-over trial; all patients received both sessions.
Blinding of participants and personnel (performance bias)	Low risk	Blinding of participants and music therapist was not possible given the interactive nature of the music therapy sessions

Gimeno 2008 *(Continued)*

All outcomes		
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. Principal investigator mentions other reasons for withdrawal but does not provide specific numbers
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

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%) white, 7 (10%) black, 1 (2%) Latino Setting: outpatient Country: USA
Interventions	2 study groups: 1. Music therapy group: music therapy sessions consisted of live music, improvisation, and songwriting 2. Control group: standard care Music provided: live music based on participant's preferences and needs Number of sessions: 3 Length of sessions: 45 min

Hanser 2006 *(Continued)*

	Categorized as music therapy
Outcomes	Depression (HADS): post-test scores Anxiety (HADS): post-test scores Physical well-being (the Functional Assessment of Cancer Therapy-General, FACT-G Physical Wellbeing Subscale): 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	The 3 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 and that because of this spread, the intervention was highly diluted. Therefore, the data of this study are not included in the meta-analysis of this review.

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" (p. 117).
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" (p. 117)
Blinding of participants and personnel (performance bias) All outcomes	Low risk	The music therapist and the participants could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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 initiation of the study (too busy, n = 5); from baseline to first follow-up (too busy, n = 2; no interest, n = 2; moved, n = 1; health limits, n = 1; lost, n = 1); and from first to second follow-up (health limits, n = 1; died, n = 1; lost, n = 1). Control group participants cancelled before the initiation of the study (too busy, n = 2; died, n = 2); from baseline to first follow-up (not interested, n = 1; moved, n = 1; died, n = 2); and from first to second follow-up (died, n = 2; lost, n = 3)
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	High risk	The 3 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.

Hanser 2006 *(Continued)*

	No report of conflict of interest

Harper 2001

Methods	RCT 4-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 N randomized to problem-focused visualization group: 10 (not included in this review) N randomized to emotion-focused visualization group: 10 (not included in this review) 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%) white, 4 (10%) black, 4 (10%) Latino Setting: outpatient Country: USA
Interventions	2 study groups: 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 selections provided: new age music, namely Health Journeys: Cancer Image Path Number of sessions: 1 Length of sessions: 30 min Categorized as music medicine
Outcomes	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

Harper 2001 *(Continued)*

	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
Notes	—

Risk of bias

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 principal 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 principal 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	No evidence of selective reporting
Other bias	Low risk	—

Hilliard 2003

Methods	RCT 2-arm parallel group design
Participants	Adults with terminal cancer Diagnosis: cancer of lung (n = 27, 33.75%), colon (n = 7, 8.75%), kidney (n = 3, 3.75%), nasopharynx (n = 1, 1.25%), prostate (n = 1, 1.25%), liver (n = 2, 2.5%), esophogeal (n = 3, 3.75%), breast (n = 5, 6.25%), pancreas (n = 5, 6.25%), brain (n = 5, 3.75%), oral cavity (n = 1, 1.25%), ovary (n = 2, 2.5%), stomach (n = 2, 2.5%), endometrium (n = 1, 1.25%), sinus (n = 1, 1.25%), larynx (n = 1, 1.25%), leukemia (n = 2, 2.5%), melanoma (n = 2, 2.5%), multiple myeloma (n = 3, 3.75%), lymphoma (n = 1, 1.25%), head, neck and face (n = 1, 1.25%) and unspecified cancer (n = 3, 3.75%) Total N randomized: unclear N randomized to music group: unclear N randomized to control group: unclear

Hilliard 2003 *(Continued)*

	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%) white, 20 (25%) black Setting: home hospice care Country: USA
Interventions	2 study groups: 1. Music therapy group: cognitive-behavioural music therapy included singing, lyric analysis, instrument playing, song parody, planning of funerals, song gifts. 2. Control group: standard care Music provided: music therapy interventions were selected based on the participant's in-the-moment needs 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
Outcomes	QoL (Hospice QoL Index-Revised): change scores were computed by JB to allow for computation of pooled effect size (SMD) with other studies that reported change 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 randomisation" (personal communication with principal 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 principal investigator)
Blinding of participants and personnel (performance bias) All outcomes	Low risk	The music therapists and participants could not be 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

Hilliard 2003 *(Continued)*

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 data set of 80 participants was obtained" (personal communication with principal investigator)
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No report of conflict of interest

Huang 2006

Methods	RCT 2-arm parallel group design
Participants	Adult cancer patients with pain Diagnosis of sample included in final analysis (n = 126): cancer of head or neck (n = 51, 41%), gastrointestinal (n = 25, 20%), hematological (n = 16, 13%), genitourinary (n = 15, 12%), lung (n = 7, 6%), bone (n = 1, 1%), other (n = 11, 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
Interventions	2 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 4 audiotapes: 2 with Taiwanese music (Taiwanese folk songs and Buddhist music) and 2 with American music (harp music and piano music). Number of sessions:1 Length of sessions: 30 min Categorized as music medicine
Outcomes	Pain (VAS): post-test scores

Huang 2006 *(Continued)*

Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A computerized minimization program was used to randomise and conceal the allocation until after assignment and to stratify the groups on hospital unit" (p.2)
Allocation concealment (selection bias)	Low risk	Quote: "A computerized minimization program was used to randomise and conceal the allocation until after assignment and to stratify the groups on hospital unit" (p.2
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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: 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	No evidence of selective reporting
Other bias	Low risk	No report of conflict of interest

Jin 2011

Methods	RCT 2-arm parallel group design
Participants	Adults with primary liver cancer Type of cancer: liver (n = 102, 100%) Total N randomized: 102 N randomized to music group: 50 N randomized to control group: 52 N analyzed in music group: 50 N analyzed in control group: 52 Mean age: 56.7

Jin 2011 *(Continued)*

	Sex: not reported Ethnicity: 100% Chinese Setting: inpatient Country: China
Interventions	2 study groups: 1. Music group: participants listened to taped music-guided relaxation 2. Control group: standard care Music selections provided: This study used the Gaotian-Music relaxation series, which is recorded by the Center of Music Therapy and published by the people's Liberation Army Health Audio Video Publishing House. The participants could choose any music they liked from the following 4 CDs: *The Sea Reverie*, *Mountain Language*, *The Stream Chant*, *Grassland Meditation* Number of sessions: 1 Length of sessions: for duration of surgery Categorized as music medicine
Outcomes	HR, RR, SBP, DBP: post-test scores Anxiety (STAI): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Translation sheet: Table of random numbers
Allocation concealment (selection bias)	Unclear risk	Translation sheet: not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported
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 data
Incomplete outcome data (attrition bias) All outcomes	Low risk	No subject loss
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting

Jin 2011 *(Continued)*

Other bias	Low risk	No conflict of interest reported

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 of sample that was included in final analysis (n = 58): breast cancer (n = 17, 29%), lymphoma (n = 17, 29%), leukemia (n = 9, 16%), colorectal cancer (n = 3, 5%), other (n = 12, 21%). 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%) white Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music group: listening to pre-recorded music just prior to and during the procedure 2. Control group: standard care Music selections provided: participants selected preferred music from a variety of music styles offered by the researcher and listened to music through headphones Number of sessions: 1 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"

Kwekkeboom 2003 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated number list (personal communication with principal investigator)
Allocation concealment (selection bias)	Low risk	Opaque sealed envelopes (personal communication with principal 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	Low 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%). 1 participant was excluded because he was randomized to the audiobook group but requested music; 1 from the control group was excluded because the surgeon requested that music be played.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	This work was funded by a 2001 grant from the Univeristy of Iowa, Central Investment Fund for Research Enhancement

Li 2004

Methods	CCT 2-arm parallel group design
Participants	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

Li 2004 *(Continued)*

	Setting: inpatient Country: China
Interventions	2 study groups: 1. Music group: listening to pre-recorded music 2. Control group: standard care Music selections provided: Chinese classical music (6 different compositions) (no further detailed provided) Number of sessions: 2 sessions/day for 4 days pre-operatively, totaling 8 sessions Length of sessions: 20-30 min Categorized as music medicine
Outcomes	Anxiety (Zung State Anxiety Scale, SAS): post-test scores
Notes	—

Risk of bias

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	Low 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	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Li 2012

Methods	RCT

Li 2012 *(Continued)*

	2-arm parallel group design
Participants	Adult patients with breast cancer after radical mastectomy Type of cancer: breast (n = 120, 100%) Total N randomized: 120 N randomized to music group: 60 N randomized to control group: 60 N analyzed in music group: 60 at 1st post-test; 54 at 3rd post-test N analyzed in control group: 60 at 1st post-test; 51 at 3rd post-test Mean age: 42 years Sex: 120 (100%) female Ethnicity: not reported Setting: inpatient Country: China
Interventions	2 study groups: 1. Music listening group: music listening via headphone 2. Control group: routine nursing care Music selections provided: patients selected their preferred music and controlled the music volume Number of sessions: twice daily Length of sessions: 30 min Categorized as music medicine trial
Outcomes	Anxiety (STAI): post-test score Pain (Short-Form of McGill Pain Questionnaire - Chinese version): post-test score Depression (Zung Self rating Depression Scale): change score (computed by JB) Length of hospital stay (days)
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"The randomisation procedure was performed with 120 random numbers produced by a computer program and all patients were randomly allocated to two groups: an experimental group (n = 60) and a control group (n = 60)" (p. 1178).
Allocation concealment (selection bias)	Unclear risk	Not reported

Li 2012 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were not blinded. "Because of the specificity of the study, no blinding was used" (p. 1147)
Blinding of outcome assessment (detection bias) Objective outcomes	High risk	"Because of the specificity of the study, no blinding was used" (p. 1147)
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	"None of the participants in the experimental and control groups was lost at the first post-test. Fifty-four participants remained in the experimental group (six participants lost) and 51 participants remained in the control group (nine participants lost) at the second and third post-tests, respectively. A total of 15 patients (12.5%) were lost to follow-up" (p. 1150).
Selective reporting (reporting bias)	Low risk	The reporting of outcomes was divided over three publications but there is no indications that some outcomes may have not been reported
Other bias	Low risk	No conflict of interest reported

Liao 2013

Methods	RCT 3-arm parallel group design
Participants	Advanced tumor node metastasis cancer patients Type of cancer: tumor node metastasis Total N randomized: 160 N randomized to Chinese Medicine (CM) 5-element music group: 66 N randomized to Western music group: 63 (not included in this review) N randomized to control group: 31 N analyzed in Chinese Medicine (CM) 5-element music group: 57 N analyzed in Western music group: 58 (not included in this review) N analyzed in control group: 31 Mean age: 63.1 years Sex: 83 (51.9%) female, 77 (48.1%) male Ethnicity: not reported although likely that the majority of the participants were Chinese Setting: inpatient Country: China
Interventions	3 study groups:

Liao 2013 *(Continued)*

	1. CM 5-Element music group: listening to CM 5-element music, a Chinese type of folk music 2. Western music group (not included in this review): listening to Western music 3. Control group: standard care Music selections provided: participants in the CM 5-element music group were offered CM 5-element music composed by Prof Shi Feng Number of sessions: 1 session/day for 5 days/week for a total duration of 3 weeks Length of sessions: 30 min Categorized as music medicine
Outcomes	Quality of life (Hospice Quality of Life Index-Revised (HQLI-R)) and physical functioning (KPS): change scores
Notes	Change scores were computed by JB because of significant baseline differences between the groups

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"SAS 9.2 statistical software was used to generate random sequence numbers based on the 2:2:1 ratio" (p. 737)
Allocation concealment (selection bias)	Low risk	"The random allocation scheme was put into a brown envelope. When a patient accorded with the inclusion criteria, implementers opened the envelope to obtain the subject's random allocation" (p. 737). "The randomized scheme was sealed in an opaque envelope" (p. 737-738).
Blinding of participants and personnel (performance bias) All outcomes	High risk	"A single-blind design was adopted in the trial, that is, the subject remained blinded, while the researcher knew the intervention program" (p. 738). However, participants knew whether they were listening to music or not thus participants in the control group were not blinded.
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	No objective measures were included
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	"A single-blind design was adopted in the trial, that is, the subject remained blinded, while the researcher knew the intervention program" (p. 738).However, participants knew whether they were listening to music or not thus participants in the control group were not blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	"Fourteen patients dropped out of the study. 7 patients dropped out because of aggravation to the disease condition. 7 patients withdrew voluntarily during the study" (p. 738). Attrition rate: 8.75%
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	Study was supported by the project of the Chinese geriatric oncology society of the "eleventh-5 year: plan of ministry of civil affairs" (no 2008-47-2-45).

Lin 2011

Methods	RCT

Lin 2011 *(Continued)*

	3-arm parallel group design
Participants	Adult cancer patients receiving chemotherapy Type of cancer: lung (n = 14, 14.3%), breast (n = 40, 40.8%), other (n = 44, 44.9%) Total N randomized: 123 N randomized to music group: not reported N randomized to the verbal relaxation group: not reported N randomized to control group:not reported N analyzed in music group: 34 N analyzed in the verbal relaxation group: 30 (not used in this review) N analyzed in control group: 34 Mean age: 53 years Sex: 65 (66.3%) female, 33 (33.7%) male Ethnicity: not reported Setting: outpatient Country: Taiwan
Interventions	3 study groups: 1. Music group: the music intervention followed a 3-step guided imagery process (GIM) (McKinney 2002): a preparation period (10 min), deep relaxation period (12 min) and music listening period (38 min) provided by a trained practitioner 2. Verbal relaxation group (not used in this review) 3. Control group: standard care Music selections provided: during the preparation period, participants listened to *Songs of the Pacific* ('Ambient Moods-Whale Song') including the sound of sea waves, seabirds and whales. During the deep relaxation period, a meditation-relaxation with taped recorded verbal instructions guides the patient. In the deep relaxation period, light music,*Forest Piano* with sounds of nature, such as wind, birds and piano were played. In the music listening period, *Violin Rain* and *Aroma Lavender* were played. Number of sessions: 1 Length of sessions: 60 min Categorized as music medicine. Although the authors write that the intervention used GIM, a music therapy intervention, the explanations provided indicate that participants listened through a pre-recorded tape with verbal instructions rather than the intervention being implemented by a trained music therapist.
Outcomes	Anxiety (C-STAI): post-test scores Skin temperature and behavioural state: no means and SDs reported, therefore not included in this review
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement

Lin 2011 *(Continued)*

Random sequence generation (selection bias)	Low risk	"To maintain good balance, a permuted block randomisation was used to randomise patients who met the inclusion criteria into experimental, comparison or control group. A random number sequence is generated. Each possible permuted block is assigned a number. Using each number in the random number sequence in turn selected the next block, determining the next participant allocations. The six block design contained equal proportions in each group with randomisation to remove sequence bias" (p. 991).
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	"Head phones were then applied for the intervention and comparison groups" (p. 992). Appears that personnel may have been blinded but this was not clearly reported
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	High risk	"Equipment malfunction occurring in 12 subjects resulted in incomplete data. Thirteen subjects withdrew during the study owing to complaints of music preference or personal needs (e.g. toileting). Ninety-eight subjects provided data for analysis" (pp. 992-993). Attrition rate: 20.3%
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

Moradian 2015

Methods	RCT 3-arm parallel group design
Participants	Adults diagnosed with breast cancer Type of cancer: breast cancer Total N randomized: 99 N randomized to Nevasic audio group: 34 N randomized to music group: 32 N randomized to control group: 33 N analyzed in Nevasic audio group: 34 (not used in this review) N analyzed in music group: 32 N analyzed in control group: 33 Mean age: 49.6 years

Moradian 2015 *(Continued)*

	Sex: n = 99 (100%) females Ethnicity: not reported Setting: inpatient Country: Iran
Interventions	3 study groups: 1. Nevasic Audio Program: listening to the Nevasic music program, an audio program that uses specially constructed audio signals postulated to generate an antiemetic reaction (not used in this review) 2. Music group: listening to pre-recorded music 3. Control group: standard care Music selections provided: pre-selected music via CD player with headphones Number of sessions: Participant daily self administered music listening Length of sessions: not reported Categorized as music medicine
Outcomes	Mood (EORTC), QoL (EORTC - Global Health Status), fatigue (EORTC), nausea (EORTC), pain (EORTC), physical functioning (EORTC): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"The participants were randomly assigned to one of the three treatment groups using a list (generated by nQuery Advisor program), done by a statistician who was independent of this study" (p. 283).
Allocation concealment (selection bias)	Unclear risk	Not reported
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	Low risk	No objective measures were included
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	Intention to treat analysis was used. However, by day 5, there was loss to follow-up for 30 participants representing an attrition rate of 30%.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting

Moradian 2015 *(Continued)*

Other bias	Unclear risk	"The authors declare no conflicts of interest." "This work was supported in part by funding from the Cancer Experiences Collaborative (CECo), a Research Collaborative funded by the National Cancer Research Institute in the UK; and Mashhad University of Medical Sciences in Iran. We are grateful to DAVAL Ltd, UK for providing us with Nevasic CDs and CD players free of charge for the purposes of this study" (p. 290).

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	2 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 selections provided: traditional Vietnamese songs and children's songs Number of sessions: 1 Length of sessions: music started 10 min before LP and continued for the length of the procedure. Duration of the procedure was on average 23 min 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

Nguyen 2010 *(Continued)*

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' (p. 147)
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." (p. 147)
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Personnel were blinded. Quote: "The researcher and the physician did not know to which group the patient belonged" (p. 148). 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" (p. 148).
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	No evidence of selective reporting
Other bias	Low risk	The authors declared no conflicts of interest with respect to the authorship or publication of this article. The authors received no financial support for the research or authorship of this article.

O'Callaghan 2012

Methods	RCT 2-arm parallel group design
Participants	Adult cancer patients during initial radiotherapy treatment Type of cancer: prostate (n = 42, 42%), cervix (n = 10, 10%), endometrium (n = 9, 9%), breast (n = 7, 7%), lung (n = 5, 5%), other (n = 27, 27%) Total N randomized: 100 N randomized to music group: 50 N randomized to control group: 50 N analyzed in music group: 48

O'Callaghan 2012 *(Continued)*

	N analyzed in control group: 49 Mean age: 52.5 years Sex: 41 (41%) female, 59 (59%) male Ethnicity: not reported Setting: outpatient Country: Australia
Interventions	2 study groups: 1. Music group: standard radiotherapy session with listening to pre-recorded music 2. Control group: standard radiotherapy session without music listening Music selections provided: participants were asked to bring their own preferred music to the first radiotherapy session Number of sessions: 1 Length of sessions: duration of the radiotherapy treatment Categorized as music medicine
Outcomes	Anxiety (STAI): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"After obtaining informed consent from participants at radiotherapy planning stage, 100 participants were randomized into control (standard radiotherapy; no music) or intervention (standard radiotherapy plus self selected music) arms balanced by gender using a computer-generated minimisation technique" (p. 474).
Allocation concealment (selection bias)	Low risk	Use of computer-generated minimization technique
Blinding of participants and personnel (performance bias) All outcomes	High risk	"The triangulation mixed method convergence model design comprised a single centre, non-blinded parallel group, randomized controlled trial" (p. 474).
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	"One control group and two music group participants withdrew prior to initial radiotherapy" (p. 474). Attrition rate = 3%

O'Callaghan 2012 *(Continued)*

Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	"Conflict of interest: The authors have no financial disclosures" (p. 473).

Palmer 2015

Methods	RCT 3-arm parallel group design
Participants	Female cancer patients Type of cancer: breast cancer Total N randomized: 207 N randomized to live music group: 69 N randomized to recorded music group: 70 N randomized to control group: 68 N analyzed in live music group: 68 N analyzed in recorded music group: 68 N analyzed in control group: 65 Mean age: 59.4 years Sex: 207 (100%) females Ethnicity: 150 (74.6%) white, 46 (22.9%) black, 3 (1.5%) Asian, 2 (1%) Latino Setting: inpatient Country: USA
Interventions	3 study groups: 1. Live music group: music therapist played preferred music pre-operatively; intraoperatively, music therapist played therapist-selected music 2. Recorded music group: patient listened to self selected preferred music on MP3 player before the surgery; intraoperatively, the music therapist selected the pre-recorded music 3. Control group: received usual pre-operative care. Control patients wore noise-blocking earmuffs during surgery to cancel any possible music played by the surgeon, until the conclusion of surgery Music selections provided: patient-preferred music Number of sessions: 1 Length of sessions: 5 min Catogorized as: music therapy
Outcomes	Anesthesia requirements: the amount of propofol needed to reach sedation of Bispectral Index (BIS) score of 70 Anxiety (Global Anxiety-VAS): change scores

Palmer 2015 *(Continued)*

	Recovery time: recorded as the interval between surgery end time and the time when the patient had met discharge criteria according to hospital policy and procedure, determined by the recovery nurse. Patient satisfaction: measured with a 5-item questionnaire administered to participants orally by a staff member before discharge, with use of a Likert scale. The questions were constructed from points on the Consumer Assessment of Health Providers and Systems (CAHPS) Surgical Care Survey.
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Participants were randomly assigned at a 1:1:1 ratio to a control or one of two experimental groups with use of an online randomisation module, which ensured adequate concealment" (p. 3163).
Allocation concealment (selection bias)	Low risk	"Participants were randomly assigned at a 1:1:1 ratio to a control or one of two experimental groups with use of an online randomisation module, which ensured adequate concealment" (p. 3163). "A permuted block randomisation scheme was used with random block sizes to prevent personnel from guessing the next assignment" (p. 3163).
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Music therapist and participants could not be 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	Low risk	Intention-to-treat analysis was used for all analyses. 137 patients were randomized to the live music or the SC group; 133 completed all measurements. This represents a dropout rate of 3%.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	"Supported by Grant No. J0251, from The Kulas Foundation. Assistance with REDCap was provided through Clinical and Translational Science Collaborative Grant No. UL1TR 000439 at Case Western Reserve University. The Kulas Foundation had no role in the design or conduct of the study; the collection, management, analysis, or interpretation of the data; the preparation, review, or approval of the manuscript; or the decision to submit the manuscript for publication."

Pinto 2012

Methods	CCT 2-arm parallel group design

Pinto 2012 *(Continued)*

Participants	Adult breast cancer patients after surgery Type of cancer: breast Total N randomized: 29 N randomized to music group: 15 N randomized to control group: 14 N analyzed in music group: 15 N analyzed in control group: 14 Mean age: 58 years Sex: 29 (100%) female Ethnicity: Brazilians (n = 29, 100%) Setting: inpatient Country: Brazil
Interventions	2 study groups: 1. Music group: listened to recorded music via headphones 2. Control group: treatment as usual Music selections provided: recording of *The Four Seasons* by Vivaldi Number of sessions: 2 Length of sessions: 20-40 min Categorized as music medicine trial
Outcomes	Anxiety (STAI), temperature, blood pressure, heart rate, respiratory rate: only means are reported. Since no SDs are reported, we were not able to include this study in the meta-analysis.
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	[translation] Patients whose hospital records ending with even numbers were grouped in the experimental group.
Allocation concealment (selection bias)	High risk	Allocation concealment was not possible because of systematic method of group allocation.
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	High risk	No blinding was used.

Pinto 2012 *(Continued)*

Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	This study did not include subjective outcomes.
Incomplete outcome data (attrition bias) All outcomes	Low risk	There were no withdrawals.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting.
Other bias	Low risk	No conflict of interest reported.

Ratcliff 2014

Methods	CCT 3-arm parallel group design
Participants	Adult cancer patients who have undergone hematopoietic stem cell transplant Type of cancer: leukemia (n = 57, 63.3%), lymphoma (n = 13, 14.4%), other (n = 20, 22.2%) Total N randomized: 90 N randomized to music therapy group: 29 N randomized to unstructured music group: 30 (not used in this review) N randomized to control group: 31 N analyzed in music therapy group: 29 N analyzed in unstructured music group: 30 (not used in this review) N analyzed in control group: 31 Mean age: 44.3 years Sex: 47 (52%) female, 43 (48%) male Ethnicity: 59 (65.5%) white, 7 (7.8%) African-American, 11 (12.2%) Latino, 4 (4.4%) Asian, 9 (10%) other Setting: outpatient or inpatient in transition to outpatient setting. Country: USA
Interventions	3 study groups: 1. Music therapy group: participants met with music therapist to select music from a researcher-provided database and music therapist created 2 CDs. The first CD was designed to transition the patient from an anxious/tense state to a relaxed state and the second was designed to transition the patient from a sad/depressed state to an energized state. Participants reviewed and edited CDs with the music therapist and in the final session listened to 1 of the 2 CDs. 2. Unstructured music group: patients met with a mental health therapist and created 2 CDs with music selected from 15 music tracks from the same database as the MT group that made them feel relaxed. In session 2, patients selected music that made them feel energized. The tracks were organized into two 30 min CDs (1 including relaxing songs and the second including energising songs) based on personal preference with little input from the therapist. 3. Control condition: standard care

Ratcliff 2014 *(Continued)*

	Music selections provided: patient-preferred music selected from a researcher provided database Number of sessions: 4 Length of sessions: 50 min Categorized as music therapy trial
Outcomes	Mood (POMS-Short Form): change score (computed by JB) Quality of Life (FACIT-G and FACIT-BMT): change scores Cancer-related symptoms (MD Anderson Symptom Inventory): not included in meta-analysis
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Patients were randomly assigned to one of three groups: (1) ISO-principle music therapy (MT) group, (2) unstructured music (UM) group, and (3) usual care (UC) control group" (p. 2).
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Blinding of music therapist and participants was not possible.
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	This study did not include 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	At the 1 week follow-up, there was 8.4% attrition. At the 4 week follow-up, there was 27% attrition (additional data received from Dr. Lorenzo)
Selective reporting (reporting bias)	High risk	"...blood samples were drown but results will be reported in future manuscript." (p. 3).
Other bias	Low risk	"This research was funded in part by a grant from The Maurice Amado Foundation, by Cancer Center Support Grant CA016672 from the National Institutes of Health, and by a cancer prevention fellowship for Chelsea Ratcliff supported by the National Cancer Institute Grant R25T CA057730, Shine Chang, Ph.D., Principal Investigator" (p. 8).

Robb 2008

Methods	CCT

Robb 2008 *(Continued)*

	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 (not included in this review) 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	2 study groups: 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), instrument playing (choice of hand-held rhythm instruments played to live music), action songs (finger puppets, props, and sound effect instruments used with the songs 'Five Little Speckled Frogs' and 'Five Little Monkeys'), illustrated songs in storybook form ('Wheels on the Bus' and 'Down by the Bay'), and closing song (an original song 'Time to Say Good-Bye', which included choice of sound effects) 2. Audiobook control group: listening to 2 audiobooks with illustrated storybooks Music selections provided: children's songs Number of sessions: 1 Length of sessions: 30 min 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	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Quote: "[P]articipants were not allocated to the research conditions at random, but were sequentially assigned to one of three study conditions" (Erratum published online).

Robb 2008 *(Continued)*

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	Low 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	Low 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 principal investigator)
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	"This research study was sponsored through a National Academy of Recording Arts and Sciences (NARAS) grant awarded to the American Music Therapy Association (AMTA). This study received additional support through an institutional post-doctoral fellowship, CA 117865-O1A1.

Robb 2014

Methods	RCT 2-arm parallel group design
Participants	Adolescents and young adults undergoing hematopoietic stem cell transplant Type of cancer: leukemia (n = 53, 46.4%), lymphoma (n = 28, 25.0 %), solid tumor (n = 32, 28.6%) Total N randomized: 113 N randomized to music group: 59 N randomized to control group: 54 N analyzed in music group: 40 N analyzed in control group: 40 Mean age: 17.3 years Sex: 42.5% female, 57.5% male Ethnicity: 12 (10.6%) African-American, 66 (58.4%); white, 23 (20.4%); mixed ethnicity, 7 (6.2%); other, 5 (4.4%); Setting: inpatient Country: USA

Robb 2014 *(Continued)*

Interventions	2 study groups: 1. Music therapy group: participants engaged in a therapeutic music video intervention that involved writing songs and creating accompanying music videos 2. Control group: participants listened to fiction or non-fiction audiobooks Music selections provided: participants created their own songs with the music therapist Number of sessions: 6 Length of sessions: not reported Categorized as music therapy
Outcomes	Illness-related distress (McCorkle Symptom Distress Scale), coping (Jalowiec Coping Scale-Revised), spiritual perspective (Reed Spiritual Perspective Scale); social integration (Perceived Social Support), family environment (Family Adaptability/Cohesion Scale), hope-derived meaning (Herth Hope Index), self transcendence (Reed Self Transcendence Scale), and resilience (Haase Resilience in Illness Scale): effect sizes
Notes	Effect sizes were reported in the publication. No means or SDs were reported.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Participants were randomised to the TMV or low-dose, control group using 24 strata (8 sites individually stratified by 3 age groups: 11-14, 15- 18, and 19-24 years)" (p. 911).
Allocation concealment (selection bias)	Low risk	"We used central randomisation by a third party. So after a participant completed the baseline measures, the computer triggered randomisation. The project manager is then notified electronically (e-mail generation) about the participant's group assignment" (personal communication with investigator).
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Music therapist and participants could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	"An intent-to-treat analysis was performed in which all available questionnaire data at T2 and T3 were used, and participants were analysed according to their assigned group regardless of their degree of adherence to the protocols for the intervention and low-dose control groups" (p. 913-914). Dropout rate was 28% at T2 and 41% at T3.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting

Robb 2014 *(Continued)*

Other bias	Low risk	"This work as funded by the National Institute of Nursing Research (R01NR008583) and the National Cancer Institute (U10CA098543 and U10CA095861)" (p 916)

Romito 2013

Methods	CCT 2-arm parallel group design
Participants	Adult breast cancer patients receiving chemotherapy Type of cancer: localized tumor (n = 50, 80.6%), metastatic tumor (n = 12, 19.4%) Total N randomized: 62 Total N analyzed: 62 N randomized to music group: 31 N randomized to control group: 31 N analyzed in music group: 31 N analyzed in control group: 31 Mean age: 54.2 years Sex: 62 (100%) female Ethnicity: not reported Setting: outpatient Country: Italy
Interventions	2 study groups: 1. Music therapy group: active singing 2. Control group: treatment as usual Music selections provided: active singing using vocal holding techniques Number of sessions: 1 Length of sessions: 150 min Categorized as music therapy
Outcomes	Depression, anxiety, anger, stress, need for help: only means were reported (no standard deviations). Therefore the results could not be included in the meta-analysis.
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	"The patients gave informed consent to participate and were quasi-randomly assigned to the experimental and control arms of the study" (p. 439).

Romito 2013 *(Continued)*

		"On Mondays and Wednesdays of each week, the first consecutive eligible patients of the day who gave their informed consent to participate in the study were placed in the same room for chemotherapy infusion and took part in the experimental group. On Tuesdays and Thursdays the same procedure was followed and these patients were assigned to the control groups. 31 patients were allocated to the experimental group and 31 to the control group" (p. 439).
Allocation concealment (selection bias)	High risk	Alternate assignment prohibited allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Blinding of music therapist and participants was not possible
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	Not reported
Selective reporting (reporting bias)	Unclear risk	No evidence of selective reporting
Other bias	Low risk	"The authors declare that there is no conflict of interest" (p 443)

Rosenow 2014

Methods	RCT 2-arm parallel group design
Participants	Adult patients recovering from a bone marrow transplant Type of cancer: leukemia (n = 12, 66.7%), multiple melanoma (n = 5, 27.8%), unknown (n = 1, 5.6%) Total N randomized: 18 N randomized to music group: 8 N randomized to control group: 10 N analyzed in music group: 8 N analyzed in control group:10 Mean age: 53.6 years Sex: 100% female Ethnicity: 2 (11.1%) African-American, 1 (5.6%) Asian-American, 14 (77.8%) white, 1 (5.6%) Latino Setting: inpatient

Rosenow 2014 *(Continued)*

	Country: USA
Interventions	2 study groups: 1. Music therapy group: patient-preferred music 2. Control group: standard care Music selections provided: music therapist played patient-preferred live music with guitar and voice Number of sessions: 1 Length of sessions: 45 min Categorized as music therapy
Outcomes	Fatigue (The Brief Fatigue Inventory): change scores
Notes	This manuscript included 2 studies. Only the second study is used in this review as the first study was not an RCT or CCT

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"After obtaining consent to participate in the study, the researchers consulted a randomized list to ascertain each participant's condition in the study" (p. 68).
Allocation concealment (selection bias)	High risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Blinding of music therapist and participants was not possible.
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	Not reported
Selective reporting (reporting bias)	Unclear risk	No evidence of selective reporting.
Other bias	Low risk	No conflict of interests reported

Shaban 2006

Methods	CCT

Shaban 2006 *(Continued)*

	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%) white Setting: unclear if inpatient or outpatient (treatment provided in hospital) Country: Iran
Interventions	2 study groups: 1. Music group: listening to pre-recorded music 2. Control group: progressive muscle relaxation (taught by the investigator) Music selections provided: 3 types of music (no further detail provided in translation of study report) Number of sessions: 3 Length of sessions: 30 min Categorized as music medicine
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 principal 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	Low risk	This study did not address objective outcomes

Shaban 2006 *(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	Unclear risk	No dropouts reported. However, it is unlikely that no attrition occurred in a study with this sample size.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
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	Adults with cancer receiving radiation therapy 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%) Total N randomized: 44 N randomized to music group: 20 N randomized to control group:24 N analyzed in music group: 19 N analyzed in control group: 23 Mean age: 62.8 years Sex: 42 (100%) males Ethnicity: 31 (74%) white, 5 (12%) black, 5 (12%) Latino, and 1 (2%) other Setting: outpatient Country: USA
Interventions	2 study groups: 1. Music group: listening to pre-recorded music selected by the participants 2. Control group: standard care Music selections provided: participants were asked to select from rock and roll, big band, country and western, classical, easy listening, Spanish, or religious music Number of sessions: daily for duration of treatment Length of sessions: 30 min Categorized as music medicine
Outcomes	Anxiety (STAI-S): post-test scores after 1 week of music interventions

Smith 2001 *(Continued)*

Notes	Post-test scores for week 3 and week 5 are also reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A biostatistician prepared a randomisation list using a computer. Only one member of the research team had access to this list of case numbers and randomisation assignments, which was maintained in a locked filing cabinet" (p. 856).
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 randomisation group."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Participants were not blinded. It is unclear whether the personnel were blinded.
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	No evidence of selective reporting.
Other bias	Low risk	This study was supported, in part, by a grant from Sigma Theta Tau, Delta Beta Chapter, of the College of Nursing at the University of South Florida.

Stordahl 2009

Methods	CCT 2-arm parallel group design
Participants	Women at the completion of treatment for breast cancer Type of cancer: breast (n = 20, 100%) Total N randomized: 20 Total N analyzed: 20 N randomized to music group: 10 N randomized to control group: 10

Stordahl 2009 *(Continued)*

	N analyzed in music group: 10 N analyzed in control group: 10 Mean age: 48.35 years Sex: n = 20 (100%) females Ethnicity: n = 9 (45%) Latino, n = 6 (30%) white, n = 5 (25%) African-American/Caribbean black Setting: outpatient Country: USA
Interventions	2 treatment conditions: 1. Music therapy condition: music-assisted relaxation 2. Relaxation condition: relaxation directive Music selections provided: contemporary sedative music was paired with standard spoken relaxation directives Number of sessions: 4 Length of sessions: 20-30 min Categorized as music therapy trial
Outcomes	Depression [Center for Epidimiologic Diseases - Depression Scale (CES-D)]: post-test scores Mood (POMS - Short Form): 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	Low risk	Participants and personnel could not be blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	This study did not include objective measures
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	Not reported

Stordahl 2009 *(Continued)*

Selective reporting (reporting bias)	Low risk	No indication of selective reporting
Other bias	Low risk	No indication of conflict of interest

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	2 study groups: 1. Music group: listening to pre-recorded music 2. Control group: listening to guided imagery and relaxation tape Music selections 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 min Categorized as music medicine
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	

Straw 1991 *(Continued)*

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	Low 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	No evidence of selective reporting
Other bias	Low risk	—

Vachiramon 2013

Methods	RCT 2-arm parallel group design
Participants	Adults with skin cancer Type of cancer: skin (100%) Total N randomized: 100 Total N analyzed: 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: 64.3 years Sex: 33 (33%) female, 67 (67%) male Ethnicity: not reported

Vachiramon 2013 *(Continued)*

	Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music group: music listening via open speaker for duration of procedure 2. Control group: standard care Music selections provided: patients chose a musical genre, artist, or track, which was entered into internet radio (Pandora Media, Inc., Oakland, CA), which creates a mix of music according to the listener's preferences Number of sessions: 1 Length of sessions: 15-60 min Categorized as music medicine trial
Outcomes	Anxiety (STAI): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Using a randomisation table (a table of random numbers), eligible subjects were randomly assigned into one of two groups: a control group with no music or a treatment group that listened to the music of their choice during surgery" (p. 299).
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participant was not possible. Personnel was not blinded. "This study was designed as an open-labelled randomized controlled trial" (p. 299).
Blinding of outcome assessment (detection bias) Objective outcomes	Low 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	No attrition
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No conflict of interest reported

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 Total N analyzed: 136 N randomized to music group: unclear N randomized to control group: unclear 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
Interventions	2 study groups: 1. Music group: music and imagery 2. Control group: standard care Music selections provided: no details on the music reported Number of sessions: 1 Length of sessions: 30 min Categorized as music medicine
Outcomes	Depression (Center for Epidemiologic Studies Depression Scale, CES-D): post-test scores Anxiety (STAI-S): post-test scores Pain (NRS): post-test scores
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Translation quote: "Simple randomizations"
Allocation concealment (selection bias)	High risk	Not used

Wan 2009 *(Continued)*

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	Low 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	No evidence of selective reporting.
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report

Wang 2015

Methods	RCT 2-arm parallel group design
Participants	Adults after surgery for lung cancer Type of cancer: lung (n = 60, 100%) Total N randomized: 60 Total N analyzed: 60 N randomized to music group: 30 N randomized to control group: 30 N analyzed in music group: 30 N analyzed in control group: 30 Mean age: 53.65 Sex: 25 (41%) females, 35 (58%) males Ethnicity: not reported Setting: inpatient Country: China
Interventions	2 study groups: 1. Music therapy group: music listening with music imagination 2. Control group: standard pre- and postoperative care

Wang 2015 *(Continued)*

	Music selections provided: Western classical music and Chinese music Number of Sessions: 5 pre-surgery music-assisted relaxation and 4 postsurgery in ICU Length of Sessions: pre-surgery 15 min, postsurgery 1 h Categorized as music therapy
Outcomes	Pain Self Rating Anxiety Scale (SAS) and visual analogue scale (VAS): pre-test, post-SBP, DBP, heart rate (HR), pulse oxygen saturation (SpO2), respiratory rate, SAS score, VAS score, drug dose, and total consumption of sufentanil at 4, 8, 12, 16, 20, and 24 h were recorded postoperatively
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Consecutive patients were recruited and randomly assigned to the MT group and control (C) group by using a random-numbers table and sealed sequential envelopes prepared by an independent statistician" (p. 668).
Allocation concealment (selection bias)	Low risk	"Consecutive patients were recruited and randomly assigned to the MT group and control (C) group by using a random-numbers table and sealed sequential envelopes prepared by an independent statistician" (p. 668).
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	Low risk	For objective outcomes, the following is reported: "All postoperative measurements were evaluated and confirmed by two independent observers. Observations were compared between them, and differences were solved by discussion." (p. 669). Therefore rating of low risk for 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	There were no withdrawals
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Unclear risk	"The study was funded by grant no. 2012FJ2004 from the Department of Science and Technology of Hunan Province, China". "No competing financial interests exist" (p. 672)

Xie 2001

Methods	CCT (randomization method unclear) 2-arm parallel group design

Xie 2001 *(Continued)*

Participants	Adults with cancer receiving chemotherapy Diagnosis: no further details available in the translation of the study report Total N randomized: 260 Total N analyzed: 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	2 study groups: 1. Music group: music and imagery 2. Control group: standard care Music selections provided: no details provided Number of sessions: 2 times per day for 20 days Length of sessions: 60 min Categorized as music medicine
Outcomes	Physical functioning (Karnofsky Performance Scale): post-test scores QoL (QoL Questionnaire for Chinese cancer patients): change scores were computed by JB to allow for computation of pooled effect size (SMD) with other studies that reported change 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
Blinding of outcome assessment (detection bias)	Low risk	This study did not address objective outcomes

Xie 2001 *(Continued)*

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	No evidence of selective reporting
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report

Yates 2015

Methods	RCT 2-arm parallel group design
Participants	Adult Type of cancer: appendix (n = 1, 3%), bladder (n = 1, 3%), breast (n = 2, 7%), colon/rectal (n = 5, 19%), liposarcoma (n = 1, 3%), melanoma (n = 1, 3%), ovarian (n = 2, 7%), pancreatic (n = 1, 3%), papillary (n = 1, 3%), tumor (reported as such in article, no further detail is provided) (n = 2, 7%), uterine (n = 3, 11%), other (n = 6, 23%) Total N randomized: 26 Total N analyzed: 22 N randomized to music group: 13 N randomized to control group: 13 N analyzed in music group: 11 N analyzed in control group: 11 Mean age: 57.59 Sex: 22 (84 %) females, 4 (15 %) males Ethnicity: 2 (7%) Latino, 21 (80%) white, 3 (11%) other Setting: inpatient Country: USA
Interventions	2 study groups: 1. Music therapy group: music therapist played patient-preferred live music as a receptive technique 2. Control group: when a participant was randomized to the control group, she or he had no contact with the PI for 20-30 min. Music therapist returned after this time administered the post-test and then provided music therapy Music selections provided: patient-preferred live music Number of sessions:1

Yates 2015 *(Continued)*

	Length of sessions: 20-30 min Categorized as music therapy
Outcomes	6 mood states measured by the Quick Mood Scale (QMS), namely wide awake/drowsy, relaxed/anxious, cheerful/depressed, friendly/aggressive, clearheaded/confused, well-coordinated/clumsy. Only the relaxed/anxious and cheerful/depressed states are included in this review: post-test scores
Notes	Means and standard errors are reported in the journal article. Standard deviations were obtained from the primary author.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"We used a computer program on randomizer.org to create a series of 0 and 1. A 0 meant a participant was in the control group" (personal communication with chief investigator).
Allocation concealment (selection bias)	High risk	No allocation concealment used (personal communication with chief investigator).
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Music therapist and participants could not be blinded.
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	This study did not include 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	Out of 26 participants, 4 were lost: "Four participants were not included in data analyses as two participants fell asleep,one participant had a visit from the doctor, and one participant did not complete the form correctly" (p. 59). Attrition rate: 8.5%.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting.
Other bias	Low risk	No conflict of interest reported.

Zhao 2008

Methods	RCT 2-arm parallel group design
Participants	Adults with cancer undergoing radiation therapy Diagnosis: cancer of the lung, esophogus, gastric, liver, breast, ovary, uterine, renal, bladder, ureter Total N randomized: 95 Total N analyzed: 95

Zhao 2008 *(Continued)*

	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	2 study groups: 1. Music group: listening to pre-recorded music during radiation therapy 2. Control group: standard care Music selections provided: sacred music (Buddhism and Christianity), Chinese classical music, Western classical music, or yoga music Number of sessions: 1 Length of sessions: 30 min Categorized as music medicine
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	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Drawing 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	Low 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

Zhao 2008 *(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	No evidence of selective reporting
Other bias	Unclear risk	Funding information and conflict of interest statement are not provided in the translation of the study report

Zhou 2015

Methods	RCT 2-arm parallel group design
Participants	Adults with breast cancer (n = 170, 100%) Total N randomized: 170 Total N analyzed: 170 N randomized to music group: 85 N randomized to control group: 85 N analyzed in music group: 85 N analyzed in control group: 85 Mean age: 47.01 years Sex: n = 170 (100%) females Ethnicity: not reported Setting: Inpatient Country: PR China
Interventions	2 study groups: 1. Music group: patients selected their preferred music from list compiled by researchers, patient controlled volume and listened through a headphone connected to the MP3 player. 2. Control group: routine nursing care Music selections provided: Chinese relaxation music, classical folk music, religious music Number of sessions: Not reported Length of sessions: 30 min Categorized as music medicine
Outcomes	Depression (Zung Self rating Depression Scale, ZSDS) Anxiety (State Anxiety Inventory, SAI)
Notes	—

Zhou 2015 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"The patients were randomly allocated to two groups using 170 random numbers produced by computer software" (p. 55).
Allocation concealment (selection bias)	Unclear risk	Not reported
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	Low risk	This study did not include 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	There were no withdrawals
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting.
Other bias	Low risk	"We thank the Dreyfus Health Foundation, New York for funding this study" (p 59).

ANC: absolute neutrophil count;**BIS**: Bispectral Index; **BMGIM**: Bonny Method of Guided Imagery and Music **CCT**: controlled clinical trial; **CM**: Chinese medicine; **DBP**: diastolic blood pressure; **EORTC**: European Organization for Research and Treatment on Cancer; **FACIT-BMT/G/Sp**: Functional Assessment of Chronic Illness Therapy-Bone Marrow Transplant/General/Spiritual; **GIM**: guided imagery and music; **HADS**: Hospital Anxiety and Depression Scale; **HAMA**: Hamilton Anxiety Scale;**HR**: heart rate;**ICU**: intensive care unit; **KPS**: Karnofsky Performance Scale; **LP**: lumbar puncture; **MAP**: mean arterial pressure; **MM**: music medicine; **MT**: music therapy; **NRS**: numeric rating scale; **PI**: principal investigator; **POMS**: Profile of Mood States; **QoL**: quality of life; **RBC**: red blood cell; **RCT**: randomized controlled trial; **RR**: respiration rate; **SAS**: State Anxiety Scale; **SBP**: systolic blood pressure; **SC**: standard care;**SCT**: stem-cell transplantation; **SD**: standard deviation; **STAI-S**: Spielberger State-Trait Anxiety Inventory - State Anxiety form; **TMV**: therapeutic music video; **VAS**: visual analogue scale; **WBC**: white blood cell.

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

Study	Reason for exclusion
Akombo 2006	Not RCT/CCT
Allen 2010	Study with cancer survivors - not population of interest
Ardila 2010	Not RCT/CCT
Augé 2015a	Not population of interest
Augé 2015b	Not RCT/CCT

Study	Reason for exclusion
Bailey 1983	Not RCT/CCT
Barrera 2002	Not RCT/CCT
Barry 2010	Standard care control group was allowed to listen to music (authors state that otherwise they would not have been able to obtain ethics approval), and 4 out of 6 pediatric patients did. If all patients had opted to listen to music, we could have included this study in the music therapy versus music medicine comparison.
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 tumours
Burns 2001b	Not RCT/CCT
Canga 2012	Not RCT/CCT
Capitulo 2015	Not RCT/CCT; summary article of the Nguyen 2010 study
Cermak 2005	Severe confounding issues with study design: the music group received 2 sessions whereas the control group only received 1. In addition, only post-test data were obtained in this small scaled study; therefore we could not ascertain baseline equivalence between groups.
Chi 2009	No music intervention
Cuenot 1994	Not RCT/CCT
Domingo 2015	Used non-standardized measurement tools. The authors used a standardized scale (HADS) to measure anxiety and depression but reported a total score for the scale whereas this scale's scoring guidelines explicitly state that only subscale total scores (one for anxiety and one for depression) should be used.
Dvorak 2015	Study included cancer patients and their caregivers. Statistics are reported per treatment arm for patients and caregivers combined. Separate statistics are reported for cancer patients in the experimental group but not for those in the control group.
Ezzone 1998	Insufficient data reporting; attempts to contact authors unsuccessful
Flaugher 2002	Not RCT/CCT
Frank 1985	Not RCT/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, which had 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 lis-

Study	Reason for exclusion
	tened to music was not controlled. The author stated that some patients only listened for 30 seconds prior to procedure.
Huang 2000	Not RCT/CCT
Jourt-Pineau 2012	Not RCT/CCT
Jourt-Pineau 2013	Not RCT/CCT
Karagozoglu 2013	Not intervention of interest
Kemper 2008	Not RCT/CCT
Lee 2000	Not RCT/CCT
Lee 2012	Insufficient data reporting; study report includes graphic representation of results but does not include means and standard deviations
Liu 2014	This is poster abstract. Multiple attempts to contact author to get additional data unsuccessful
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. We sent 3 email requests over a period of 8 months but received no response.
Nakayama 2009	Not RCT/CCT
Pfaff 1989	Not RCT/CCT
Pienta 1998	Not RCT/CCT
Robinson 2009	Not RCT/CCT
Rose 2008	Not RCT/CCT
Sadat 2009	Not RCT/CCT
Sahler 2003	Not RCT/CCT
Schur 1987	Not RCT/CCT
Sedei 1980	Thesis cannot be located; attempts to contact author unsuccessful
Standley 1992	Not RCT/CCT
Stark 2012	Not population of interest
Tan 2008	Unacceptable methodological quality; control group exposed to background music
Thompson 2011	Not RCT/CCT
Tilch 1999	Not RCT or CCT
Vohra 2011	Not RCT/CCT
Walden 2001	Not RCT/CCT

Study	Reason for exclusion
Washington 1990	Not RCT/CCT
Weber 1997	Not RCT/CCT
Whitney 2013	Not RCT/CCT
Wurr 2000	Not RCT/CCT (personal communication with principal investigator)
Yildirim 2007	Not RCT/CCT
Zimmernam 1989	Not RCT/CCT

CCT: controlled clinical trial; **HADS**: Hospital Anxiety and Depression Scale; **RCT**: randomized controlled trial.

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

Bro 2013

Methods	RCT
Participants	Adults newly diagnosed with malignant lymphoma and planned first line chemotherapy treatment
Interventions	Patient-preferred live music during chemotherapy session compared with patient-preferred taped music during chemotherapy compared with usual care during chemotherapy only
Outcomes	Mental health (anxiety and distress), nausea, serum catecholamines, and QoL
Notes	Results are not yet published (personal communication with investigator)

Dileo 2015

Methods	RCT
Participants	Adult cancer patients with chronic pain
Interventions	Music entrainment compared to preferred recorded music
Outcomes	Pain, vital signs, medication usage, quality of life and medication side effects
Notes	Study has been completed but findings are not yet available

Duong 2013

Methods	RCT
Participants	Adult patients with multiple myeloma or lymphoma (Hodgkin's or non-Hodgkin's) who are undergoing ASCT
Interventions	Music therapy versus standard care
Outcomes	Primary outcomes: nausea and pain

Duong 2013 *(Continued)*

	Secondary outcomes: mood disturbance, quality of life, use of morphine-equivalent dose of narcotic medications
Notes	Study has been completed but findings are not yet available (personal communication with co-investigator)

NCT00086762

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
Notes	Study has been completed but findings are still not available (personal communication with PI)

NCT02150395

Methods	RCT
Participants	Newly diagnosed patients with breast cancer, and newly diagnosed patients with head and neck cancer
Interventions	Music therapy compared with no intervention control
Outcomes	Mental health (anxiety and distress)
Notes	Article is in press. Authors cannot provide results at this time because of embargo (Personal communication with authors)

NCT02639169

Methods	RCT
Participants	Adult patients undergoing hematopoietic stem cell transplantation
Interventions	Apply live music in group format compared with standard treatment
Outcomes	Mental health (distress)
Notes	We have been unsuccessful in locating the principal investigator to obtain trial results

O'Brien 2010

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
Notes	Study has been completed but has not yet been published. We attempted multiple times to obtain the full text dissertation from the investigator but have not received this from the investigator.

ASCT: autologous stem cell transplant; **PI**: principal investigator; **QoL**: quality of life; **RCT**: randomized controlled trial.

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

NCT02261558

Trial name or title	Effects of clinical music improvisation on resiliency in adults undergoing infusion therapy
Methods	RCT
Participants	Adults diagnosed with breast cancer, lung cancer, or gastrointestinal cancer
Interventions	Instrumental improvisational music therapy compared with vocal improvisational music therapy compared with standard care
Outcomes	Mental health (resilience, anxiety, stress, and depression), pain
Starting date	June 2011
Contact information	dyakobson@CHPNET.ORG
Notes	Anticipated completion date: June 2018

NCT02583126

Trial name or title	Guided imagery and music for the reduction of side effects of chemotherapy in teenagers
Methods	RCT
Participants	Teenagers receiving chemotherapy for cancer treatment
Interventions	Guided imagery and music, chemotherapy, and standard care compared with chemotherapy and standard care
Outcomes	Acute nausea, distress regarding nausea, amount of nausea reducing medicine consumed, chemotherapy side effects, acute vomiting, pain, days to absolute neutrophil count recovery, duration of fatigue, distress regarding fatigue, food intake, weight, sense of coherence, and satisfaction with music intervention
Starting date	2014
Contact information	ilan@sanfi.dk

NCT02583126 *(Continued)*

Notes	2017

NCT02583139

Trial name or title	The effect and meaning of designed music narratives on anticipatory, acute, and delayed side effect of chemotherapy in children (7-12 years) with cancer: a randomized controlled multisite study
Methods	RCT
Participants	Children (7-12 years old) with cancer who are receiving chemotherapy
Interventions	4 music narratives for children each comprising an introductory relaxation exercise, a resource-oriented narrative including guided imagery suggestions and relaxing nature scenarios plus specially composed music
Outcomes	Duration (min) and intensity of acute nausea, frequency of vomiting, fatigue, pain, food intake, weight
Starting date	2014
Contact information	ilan@sanfi.dk
Notes	Anticipated completion date: 2018

RCT: randomized controlled trial.

DATA AND ANALYSES

Comparison 1. Music intervention plus standard care versus standard care alone

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety (STAI)	13		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 All studies	13	1028	Mean Difference (IV, Random, 95% CI)	-8.54 [-12.04, -5.05]
1.2 Sensitivity analysis	11	929	Mean Difference (IV, Random, 95% CI)	-8.64 [-12.50, -4.79]
2 Anxiety (non-STAI (full version) measures)	6		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
2.1 All studies	6	449	Std. Mean Difference (IV, Random, 95% CI)	-0.71 [-0.98, -0.43]
2.2 Sensitivity analysis	3	157	Std. Mean Difference (IV, Random, 95% CI)	-0.80 [-1.44, -0.16]
3 Anxiety (intervention subgroup)	18	1457	Std. Mean Difference (IV, Random, 95% CI)	-0.94 [-1.34, -0.55]

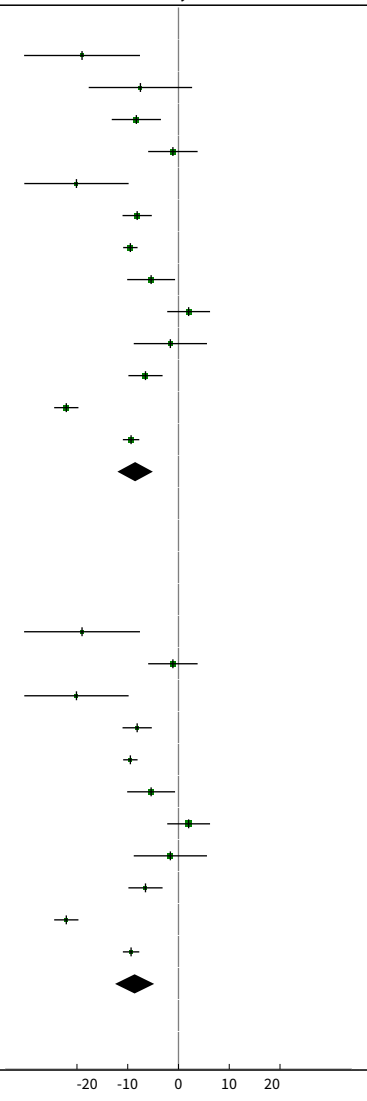
Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
3.1 Music therapy studies	3	111	Std. Mean Difference (IV, Random, 95% CI)	-0.62 [-1.01, -0.24]
3.2 Music medicine studies	15	1346	Std. Mean Difference (IV, Random, 95% CI)	-1.00 [-1.45, -0.55]
4 Anxiety (music preference)	13	1142	Std. Mean Difference (IV, Random, 95% CI)	-0.88 [-1.28, -0.47]
4.1 Patient-preferred music	10	860	Std. Mean Difference (IV, Random, 95% CI)	-0.86 [-1.38, -0.34]
4.2 Researcher-selected music	3	282	Std. Mean Difference (IV, Random, 95% CI)	-0.89 [-1.43, -0.35]
5 Anxiety (music-guided relaxation)	14	1306	Std. Mean Difference (IV, Random, 95% CI)	-0.98 [-1.44, -0.51]
5.1 Music-guided relaxation studies	4	476	Std. Mean Difference (IV, Random, 95% CI)	-1.61 [-2.56, -0.65]
5.2 Listening to music only	10	830	Std. Mean Difference (IV, Random, 95% CI)	-0.71 [-1.16, -0.26]
6 Depression	7		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
6.1 All studies	7	723	Std. Mean Difference (IV, Random, 95% CI)	-0.40 [-0.74, -0.06]
6.2 Sensitivity analysis	6	541	Std. Mean Difference (IV, Random, 95% CI)	-0.37 [-0.79, 0.05]
7 Depression (intervention sub-group)	7	723	Std. Mean Difference (IV, Random, 95% CI)	-0.40 [-0.74, -0.06]
7.1 Music therapy studies	3	130	Std. Mean Difference (IV, Random, 95% CI)	-0.11 [-0.46, 0.24]
7.2 Music medicine studies	4	593	Std. Mean Difference (IV, Random, 95% CI)	-0.57 [-1.03, -0.10]
8 Depression (music preference)	4	505	Std. Mean Difference (IV, Random, 95% CI)	-0.60 [-1.04, -0.16]
8.1 Patient-preferred music	2	275	Std. Mean Difference (IV, Random, 95% CI)	-0.88 [-1.67, -0.09]
8.2 Researcher-selected music	2	230	Std. Mean Difference (IV, Random, 95% CI)	-0.32 [-0.84, 0.19]
9 Mood	5		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
9.1 All studies	5	236	Std. Mean Difference (IV, Random, 95% CI)	0.47 [-0.02, 0.97]
9.2 Sensitivity analysis	4	192	Std. Mean Difference (IV, Random, 95% CI)	0.57 [-0.03, 1.18]
10 Mood (intervention subgroup)	5	236	Std. Mean Difference (IV, Random, 95% CI)	0.47 [-0.02, 0.97]
10.1 Music therapy studies	2	104	Std. Mean Difference (IV, Random, 95% CI)	0.37 [-0.13, 0.87]
10.2 Music medicine studies	3	132	Std. Mean Difference (IV, Random, 95% CI)	0.55 [-0.37, 1.47]
11 Pain	7	528	Std. Mean Difference (IV, Random, 95% CI)	-0.91 [-1.46, -0.36]
12 Pain (music preference)	6	496	Std. Mean Difference (IV, Random, 95% CI)	-0.92 [-1.53, -0.30]
12.1 Patient-preferred music	4	320	Std. Mean Difference (IV, Random, 95% CI)	-1.06 [-1.93, -0.20]
12.2 Researcher-selected music	2	176	Std. Mean Difference (IV, Random, 95% CI)	-0.59 [-1.34, 0.15]
13 Fatigue	6		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
13.1 All studies	6	253	Std. Mean Difference (IV, Random, 95% CI)	-0.38 [-0.72, -0.04]
13.2 Sensitivity analysis	5	203	Std. Mean Difference (IV, Random, 95% CI)	-0.20 [-0.48, 0.08]
14 Physical functioning	4		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
14.1 All studies	4	493	Std. Mean Difference (IV, Random, 95% CI)	0.78 [-0.74, 2.31]
14.2 Sensitivity analysis	3	233	Std. Mean Difference (IV, Random, 95% CI)	0.08 [-0.18, 0.34]
15 Heart rate	8		Mean Difference (IV, Random, 95% CI)	Subtotals only
15.1 All studies	8	589	Mean Difference (IV, Random, 95% CI)	-3.32 [-6.21, -0.44]
15.2 Sensitivity analysis	6	339	Mean Difference (IV, Random, 95% CI)	-4.63 [-8.18, -1.09]
16 Heart rate (music preference)	7	539	Mean Difference (IV, Random, 95% CI)	-3.77 [-6.97, -0.58]
16.1 Patient-preferred music	5	479	Mean Difference (IV, Random, 95% CI)	-3.13 [-6.54, 0.27]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
16.2 Researcher-selected music	2	60	Mean Difference (IV, Random, 95% CI)	-7.94 [-15.10, -0.78]
17 Respiratory rate	4		Mean Difference (IV, Random, 95% CI)	Subtotals only
17.1 All studies	4	437	Mean Difference (IV, Random, 95% CI)	-1.24 [-2.54, 0.06]
17.2 Sensitivity analysis	3	237	Mean Difference (IV, Random, 95% CI)	-1.83 [-3.36, -0.30]
18 Systolic blood pressure	7		Mean Difference (IV, Random, 95% CI)	Subtotals only
18.1 All studies	7	559	Mean Difference (IV, Random, 95% CI)	-5.40 [-8.32, -2.49]
18.2 Sensitivity analysis	5	309	Mean Difference (IV, Random, 95% CI)	-7.63 [-10.75, -4.52]
19 Systolic blood pressure (music preference)	6	509	Mean Difference (IV, Random, 95% CI)	-6.29 [-8.86, -3.72]
19.1 Patient-preferred music	4	449	Mean Difference (IV, Random, 95% CI)	-6.65 [-10.07, -3.23]
19.2 Researcher-selected music	2	60	Mean Difference (IV, Random, 95% CI)	-4.72 [-10.80, 1.37]
20 Diastolic blood pressure	7		Mean Difference (IV, Random, 95% CI)	Subtotals only
20.1 All studies	7	559	Mean Difference (IV, Random, 95% CI)	-2.35 [-5.88, 1.18]
20.2 Sensitivity analysis	5	309	Mean Difference (IV, Random, 95% CI)	-4.94 [-7.78, -2.09]
21 Diastolic blood pressure (music preference)	6	509	Mean Difference (IV, Random, 95% CI)	-3.74 [-7.53, 0.05]
21.1 Patient-preferred music	4	449	Mean Difference (IV, Random, 95% CI)	-4.10 [-8.78, 0.59]
21.2 Researcher-selected music	2	60	Mean Difference (IV, Random, 95% CI)	-2.01 [-6.26, 2.25]
22 Oxygen Saturation	3	292	Mean Difference (IV, Random, 95% CI)	0.50 [-0.18, 1.18]
23 Quality of Life	6		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
23.1 All studies	6	545	Std. Mean Difference (IV, Random, 95% CI)	0.98 [-0.36, 2.33]
23.2 Sensitivity analysis	4	241	Std. Mean Difference (IV, Random, 95% CI)	0.52 [0.01, 1.02]
24 Quality of life (intervention subgroup)	5	568	Std. Mean Difference (IV, Random, 95% CI)	0.99 [-0.34, 2.31]
24.1 Music therapy studies	3	132	Std. Mean Difference (IV, Random, 95% CI)	0.42 [0.06, 0.78]
24.2 Music medicine studies	2	436	Std. Mean Difference (IV, Random, 95% CI)	1.33 [-0.96, 3.63]

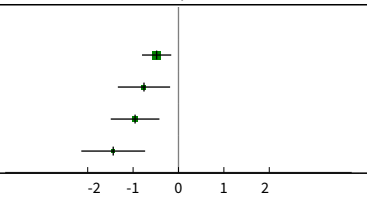
Analysis 1.1. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 1 Anxiety (STAI).

Study or subgroup	Music Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.1.1 All studies							
Binns-Turner 2008	15	30.7 (12.3)	15	49.7 (18.9)		4.72%	-19[-30.41,-7.59]
Bufalini 2009	20	56.7 (14.1)	19	64.2 (18)		5.26%	-7.5[-17.68,2.68]
Bulfone 2009	30	36.3 (8.9)	30	44.6 (10.2)		8.04%	-8.3[-13.14,-3.46]
Danhauer 2010	29	30.4 (7.6)	30	31.5 (11.2)		8.03%	-1.1[-5.97,3.77]
Harper 2001	10	-8.6 (10)	10	11.5 (13.2)		5.22%	-20.1[-30.38,-9.82]
Jin 2011	50	42.9 (8.1)	52	51 (6.6)		8.94%	-8.14[-11.02,-5.26]
Li 2012	54	30.9 (2.7)	51	40.4 (4.4)		9.37%	-9.48[-10.9,-8.06]
Lin 2011	34	29.8 (8.8)	34	35.2 (11)		8.11%	-5.39[-10.11,-0.67]
O'Callaghan 2012	48	33 (11.4)	49	31 (9.7)		8.36%	2[-2.22,6.22]
Smith 2001	19	35.7 (11.5)	23	37.3 (12.3)		6.77%	-1.6[-8.81,5.61]
Vachiramon 2013	50	28.8 (7.3)	50	35.3 (9.7)		8.74%	-6.5[-9.86,-3.14]
Wan 2009	65	33.8 (6.5)	71	55.9 (7.7)		9.11%	-22.1[-24.49,-19.71]
Zhou 2015	85	34 (4.7)	85	43.4 (6)		9.33%	-9.34[-10.96,-7.72]
Subtotal * **	**509**		**519**			**100%**	**-8.54[-12.04,-5.05]**
Heterogeneity: Tau²=33.4; Chi²=164.94, df=12(P<0.0001); I²=92.72%							
Test for overall effect: Z=4.79(P<0.0001)							
1.1.2 Sensitivity analysis							
Binns-Turner 2008	15	30.7 (12.3)	15	49.7 (18.9)		5.57%	-19[-30.41,-7.59]
Danhauer 2010	29	30.4 (7.6)	30	31.5 (11.2)		9.27%	-1.1[-5.97,3.77]
Harper 2001	10	-8.6 (10)	10	11.5 (13.2)		6.14%	-20.1[-30.38,-9.82]
Jin 2011	50	42.9 (8.1)	52	51 (6.6)		10.26%	-8.14[-11.02,-5.26]
Li 2012	54	30.9 (2.7)	51	40.4 (4.4)		10.72%	-9.48[-10.9,-8.06]
Lin 2011	34	29.8 (8.8)	34	35.2 (11)		9.36%	-5.39[-10.11,-0.67]
O'Callaghan 2012	48	33 (11.4)	49	31 (9.7)		9.63%	2[-2.22,6.22]
Smith 2001	19	35.7 (11.5)	23	37.3 (12.3)		7.88%	-1.6[-8.81,5.61]
Vachiramon 2013	50	28.8 (7.3)	50	35.3 (9.7)		10.05%	-6.5[-9.86,-3.14]
Wan 2009	65	33.8 (6.5)	71	55.9 (7.7)		10.45%	-22.1[-24.49,-19.71]
Zhou 2015	85	34 (4.7)	85	43.4 (6)		10.68%	-9.34[-10.96,-7.72]
Subtotal * **	**459**		**470**			**100%**	**-8.64[-12.5,-4.79]**
Heterogeneity: Tau²=35.56; Chi²=164.35, df=10(P<0.0001); I²=93.92%							
Test for overall effect: Z=4.39(P<0.0001)							



Analysis 1.2. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 2 Anxiety (non-STAI (full version) measures).

Study or subgroup	Music Intervention N	Mean(SD)	Standard care N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
1.2.1 All studies							
Cai 2001	128	46.3 (8.6)	54	50.3 (7.3)		27.06%	-0.48[-0.8,-0.16]
Ferrer 2005	25	1.1 (1.7)	25	2.7 (2.5)		14.91%	-0.76[-1.34,-0.18]
Li 2004	30	10.7 (5.9)	30	17.9 (8.7)		16.33%	-0.96[-1.49,-0.42]
Nguyen 2010	20	8.1 (2.2)	20	13 (4.2)		11.29%	-1.44[-2.14,-0.73]



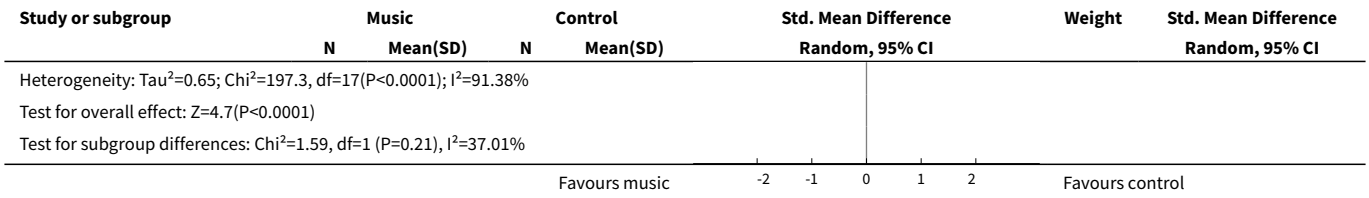
Study or subgroup	Music Intervention N	Mean(SD)	Standard care N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
Yates 2015	11	-6.5 (1.2)	11	-5.5 (1.8)		8.26%	-0.63[-1.49,0.23]
Zhao 2008	49	40 (5.7)	46	42.3 (5.2)		22.14%	-0.43[-0.83,-0.02]
Subtotal ***	**263**		**186**			**100%**	**-0.71[-0.98,-0.43]**
Heterogeneity: Tau²=0.05; Chi²=8.42, df=5(P=0.13); I²=40.61%							
Test for overall effect: Z=5.05(P<0.0001)							
1.2.2 Sensitivity analysis							
Nguyen 2010	20	8.1 (2.2)	20	13 (4.2)		31.46%	-1.44[-2.14,-0.73]
Yates 2015	11	-6.5 (1.2)	11	-5.5 (1.8)		26.44%	-0.63[-1.49,0.23]
Zhao 2008	49	40 (5.7)	46	42.3 (5.2)		42.1%	-0.43[-0.83,-0.02]
Subtotal ***	**80**		**77**			**100%**	**-0.8[-1.44,-0.16]**
Heterogeneity: Tau²=0.21; Chi²=5.95, df=2(P=0.05); I²=66.39%							
Test for overall effect: Z=2.45(P=0.01)							

Favours music -2 -1 0 1 2 Favours control

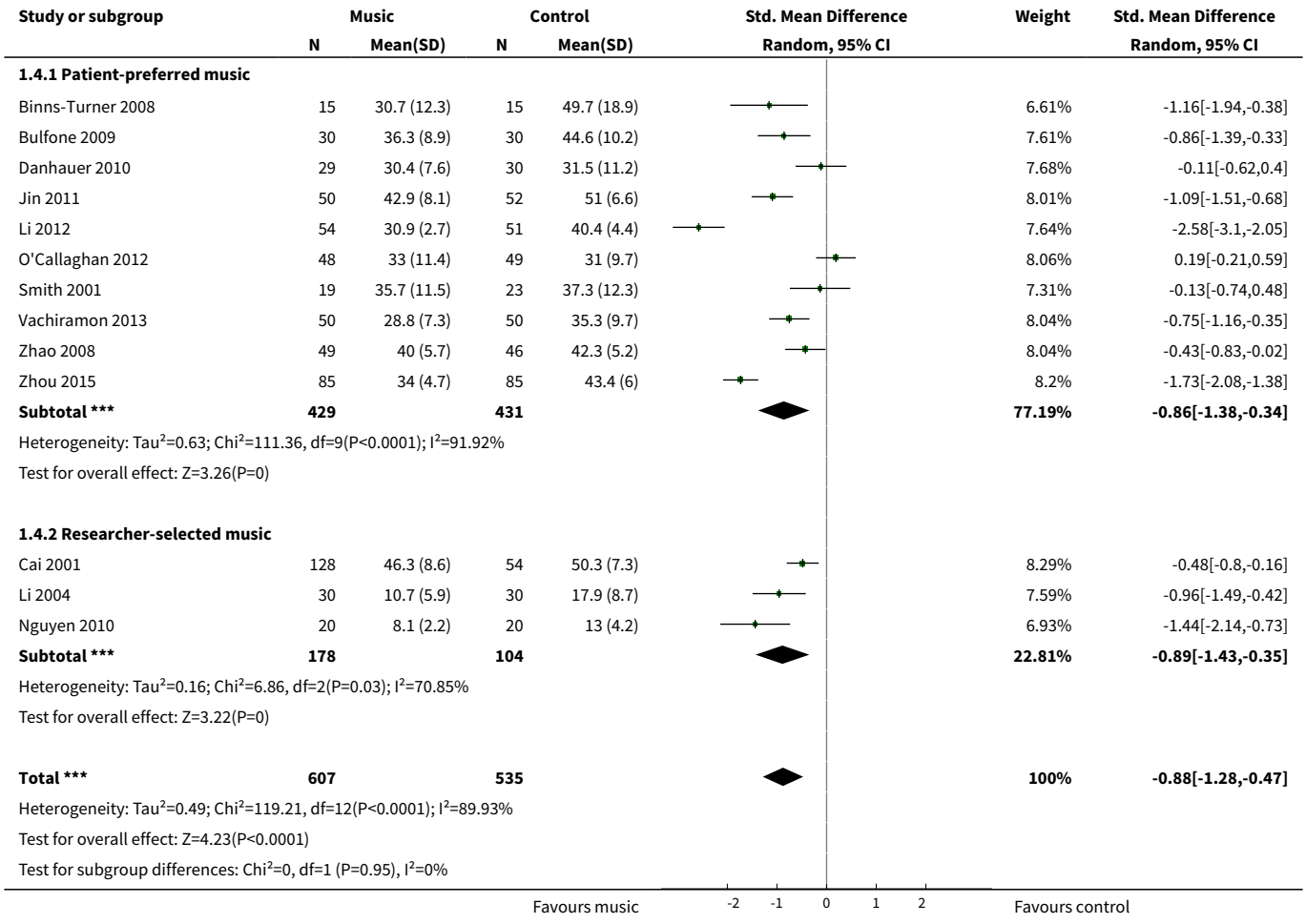
Analysis 1.3. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 3 Anxiety (intervention subgroup).

Study or subgroup	Music N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
1.3.1 Music therapy studies							
Bufalini 2009	20	56.7 (14.1)	19	64.2 (18)		5.34%	-0.46[-1.09,0.18]
Ferrer 2005	25	1.1 (1.7)	25	2.7 (2.5)		5.48%	-0.76[-1.34,-0.18]
Yates 2015	11	-6.5 (1.2)	11	-5.5 (1.8)		4.79%	-0.63[-1.49,0.23]
Subtotal ***	**56**		**55**			**15.6%**	**-0.62[-1.01,-0.24]**
Heterogeneity: Tau²=0; Chi²=0.48, df=2(P=0.79); I²=0%							
Test for overall effect: Z=3.2(P=0)							
1.3.2 Music medicine studies							
Binns-Turner 2008	15	30.7 (12.3)	15	49.7 (18.9)		4.99%	-1.16[-1.94,-0.38]
Bulfone 2009	30	36.3 (8.9)	30	44.6 (10.2)		5.58%	-0.86[-1.39,-0.33]
Cai 2001	128	46.3 (8.6)	54	50.3 (7.3)		5.96%	-0.48[-0.8,-0.16]
Danhauer 2010	29	30.4 (7.6)	30	31.5 (11.2)		5.62%	-0.11[-0.62,0.4]
Jin 2011	50	42.9 (8.1)	52	51 (6.6)		5.8%	-1.09[-1.51,-0.68]
Li 2004	30	10.7 (5.9)	30	17.9 (8.7)		5.57%	-0.96[-1.49,-0.42]
Li 2012	54	30.9 (2.7)	51	40.4 (4.4)		5.6%	-2.58[-3.1,-2.05]
Lin 2011	34	29.8 (8.8)	34	35.2 (11)		5.67%	-0.54[-1.02,-0.05]
Nguyen 2010	20	8.1 (2.2)	20	13 (4.2)		5.18%	-1.44[-2.14,-0.73]
O'Callaghan 2012	48	33 (11.4)	49	31 (9.7)		5.84%	0.19[-0.21,0.59]
Smith 2001	19	35.7 (11.5)	23	37.3 (12.3)		5.41%	-0.13[-0.74,0.48]
Vachiramon 2013	50	28.8 (7.3)	50	35.3 (9.7)		5.82%	-0.75[-1.16,-0.35]
Wan 2009	65	33.8 (6.5)	71	55.9 (7.7)		5.64%	-3.07[-3.57,-2.57]
Zhao 2008	49	40 (5.7)	46	42.3 (5.2)		5.82%	-0.43[-0.83,-0.02]
Zhou 2015	85	34 (4.7)	85	43.4 (6)		5.91%	-1.73[-2.08,-1.38]
Subtotal ***	**706**		**640**			**84.4%**	**-1[-1.45,-0.55]**
Heterogeneity: Tau²=0.72; Chi²=194.43, df=14(P<0.0001); I²=92.8%							
Test for overall effect: Z=4.38(P<0.0001)							
Total ***	**762**		**695**			**100%**	**-0.94[-1.34,-0.55]**

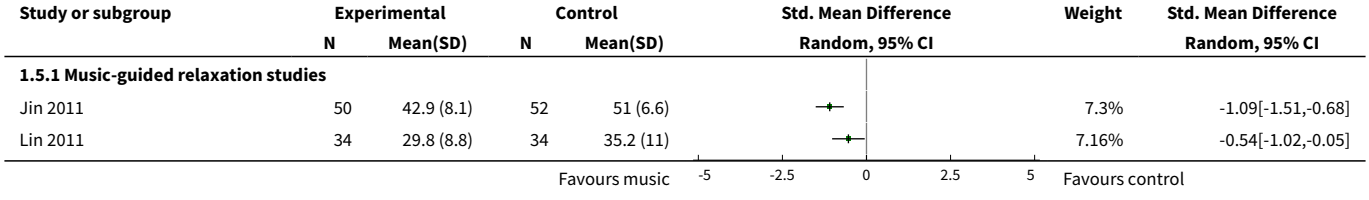
Favours music -2 -1 0 1 2 Favours control



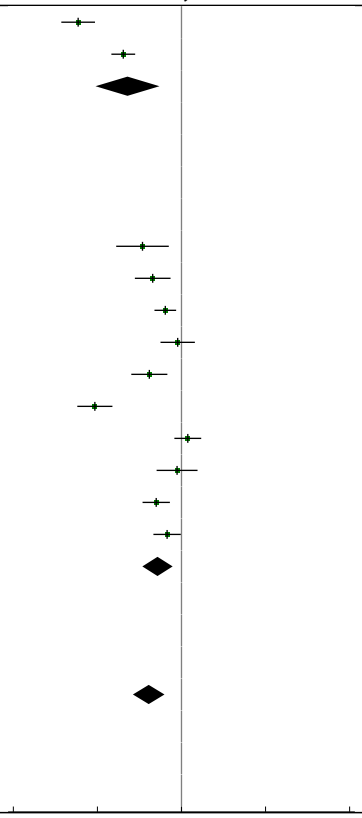
Analysis 1.4. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 4 Anxiety (music preference).



Analysis 1.5. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 5 Anxiety (music-guided relaxation).

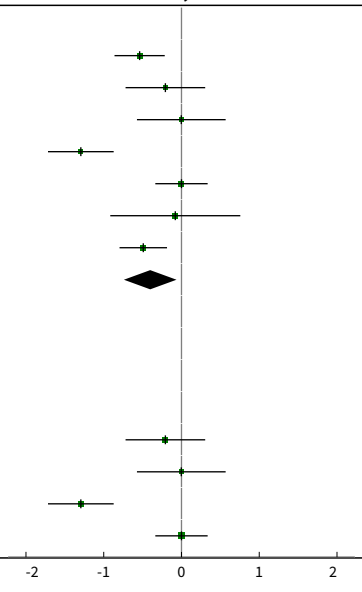


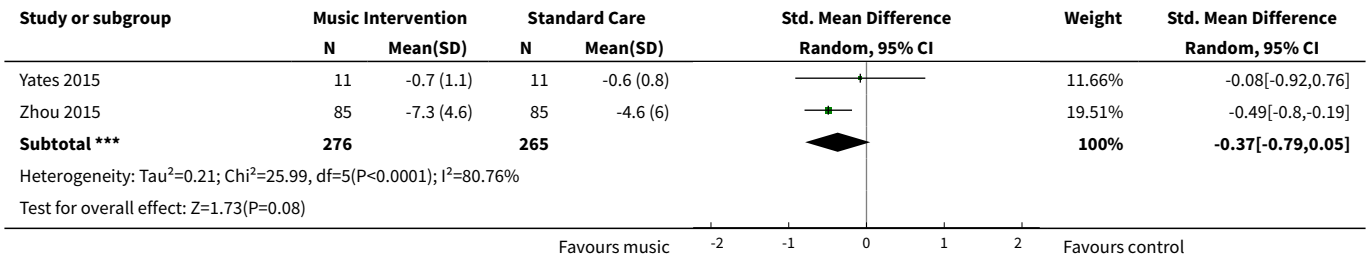
Study or subgroup	Experimental N	Experimental Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
Wan 2009	65	33.8 (6.5)	71	55.9 (7.7)		7.12%	-3.07[-3.57,-2.57]
Zhou 2015	85	34 (4.7)	85	43.4 (6)		7.43%	-1.73[-2.08,-1.38]
Subtotal ***	**234**		**242**			**29.02%**	**-1.61[-2.56,-0.65]**
Heterogeneity: Tau²=0.89; Chi²=57.91, df=3(P<0.0001); I²=94.82%							
Test for overall effect: Z=3.31(P=0)							
1.5.2 Listening to music only							
Binns-Turner 2008	15	30.7 (12.3)	15	49.7 (18.9)		6.38%	-1.16[-1.94,-0.38]
Bulfone 2009	30	36.3 (8.9)	30	44.6 (10.2)		7.05%	-0.86[-1.39,-0.33]
Cai 2001	128	46.3 (8.6)	54	50.3 (7.3)		7.48%	-0.48[-0.8,-0.16]
Danhauer 2010	29	30.4 (7.6)	30	31.5 (11.2)		7.1%	-0.11[-0.62,0.4]
Li 2004	30	10.7 (5.9)	30	17.9 (8.7)		7.04%	-0.96[-1.49,-0.42]
Li 2012	54	30.9 (2.7)	51	40.4 (4.4)		7.07%	-2.58[-3.1,-2.05]
O'Callaghan 2012	48	33 (11.4)	49	31 (9.7)		7.34%	0.19[-0.21,0.59]
Smith 2001	19	35.7 (11.5)	23	37.3 (12.3)		6.86%	-0.13[-0.74,0.48]
Vachiramon 2013	50	28.8 (7.3)	50	35.3 (9.7)		7.33%	-0.75[-1.16,-0.35]
Zhao 2008	49	40 (5.7)	46	42.3 (5.2)		7.33%	-0.43[-0.83,-0.02]
Subtotal ***	**452**		**378**			**70.98%**	**-0.71[-1.16,-0.26]**
Heterogeneity: Tau²=0.46; Chi²=81.99, df=9(P<0.0001); I²=89.02%							
Test for overall effect: Z=3.1(P=0)							
Total ***	**686**		**620**			**100%**	**-0.98[-1.44,-0.51]**
Heterogeneity: Tau²=0.74; Chi²=192.45, df=13(P<0.0001); I²=93.24%							
Test for overall effect: Z=4.07(P<0.0001)							
Test for subgroup differences: Chi²=2.76, df=1 (P=0.1), I²=63.76%							



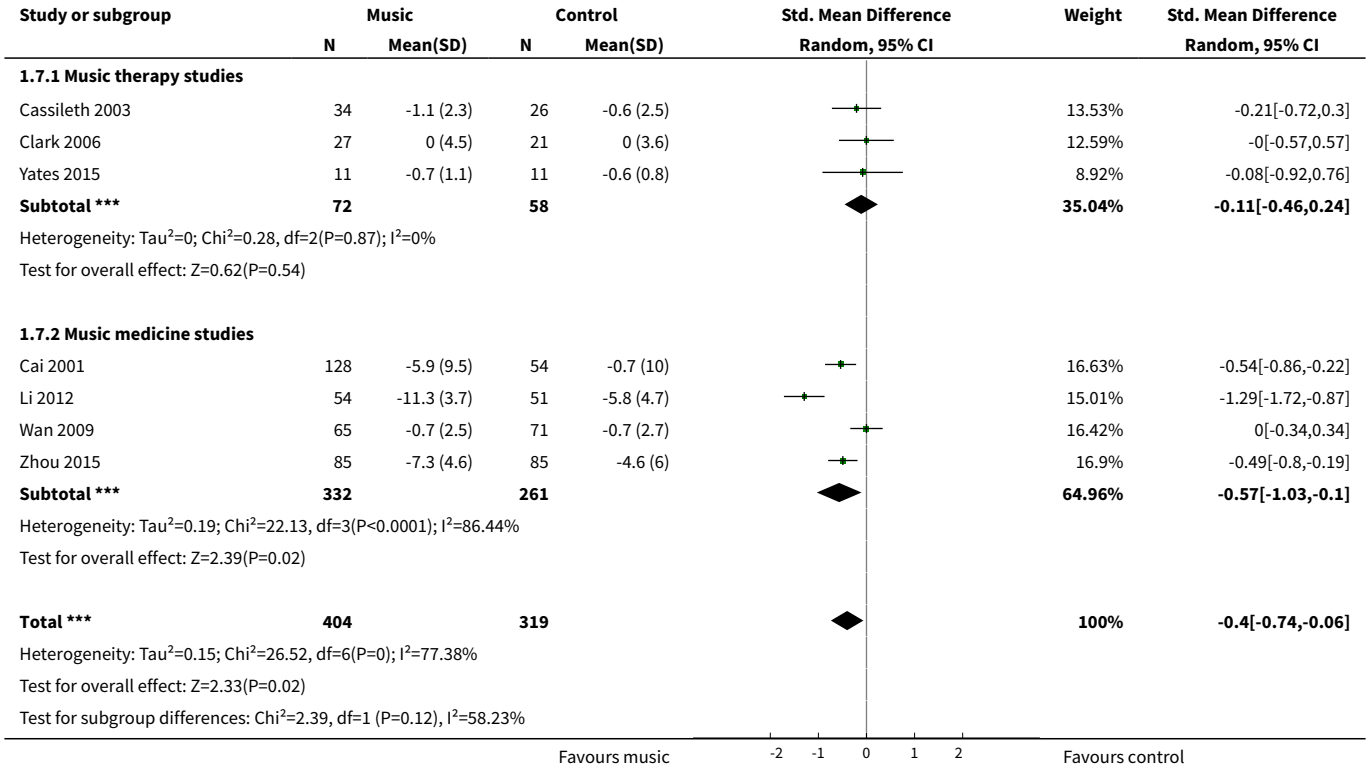
Analysis 1.6. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 6 Depression.

Study or subgroup	Music Intervention N	Music Intervention Mean(SD)	Standard Care N	Standard Care Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
1.6.1 All studies							
Cai 2001	128	-5.9 (9.5)	54	-0.7 (10)		16.63%	-0.54[-0.86,-0.22]
Cassileth 2003	34	-1.1 (2.3)	26	-0.6 (2.5)		13.53%	-0.21[-0.72,0.3]
Clark 2006	27	0 (4.5)	21	0 (3.6)		12.59%	-0[-0.57,0.57]
Li 2012	54	-11.3 (3.7)	51	-5.8 (4.7)		15.01%	-1.29[-1.72,-0.87]
Wan 2009	65	-0.7 (2.5)	71	-0.7 (2.7)		16.42%	0[-0.34,0.34]
Yates 2015	11	-0.7 (1.1)	11	-0.6 (0.8)		8.92%	-0.08[-0.92,0.76]
Zhou 2015	85	-7.3 (4.6)	85	-4.6 (6)		16.9%	-0.49[-0.8,-0.19]
Subtotal ***	**404**		**319**			**100%**	**-0.4[-0.74,-0.06]**
Heterogeneity: Tau²=0.15; Chi²=26.52, df=6(P=0); I²=77.38%							
Test for overall effect: Z=2.33(P=0.02)							
1.6.2 Sensitivity analysis							
Cassileth 2003	34	-1.1 (2.3)	26	-0.6 (2.5)		16.42%	-0.21[-0.72,0.3]
Clark 2006	27	0 (4.5)	21	0 (3.6)		15.51%	-0[-0.57,0.57]
Li 2012	54	-11.3 (3.7)	51	-5.8 (4.7)		17.82%	-1.29[-1.72,-0.87]
Wan 2009	65	-0.7 (2.5)	71	-0.7 (2.7)		19.08%	0[-0.34,0.34]

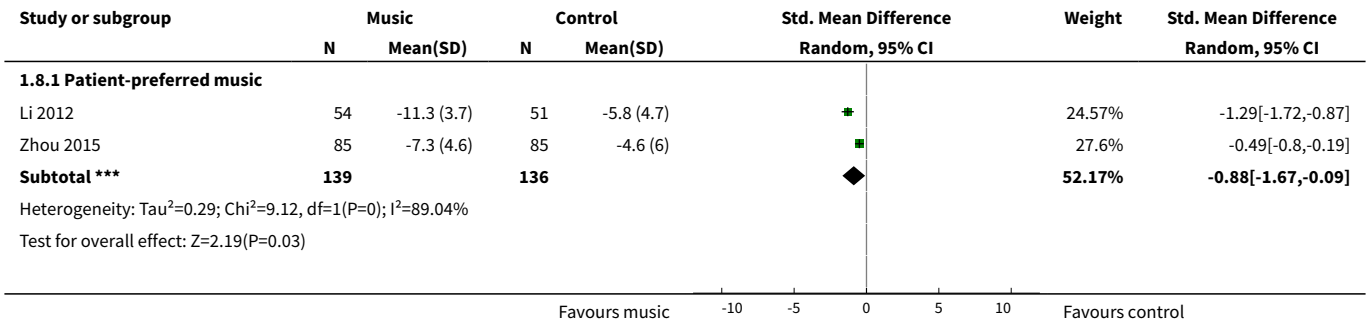


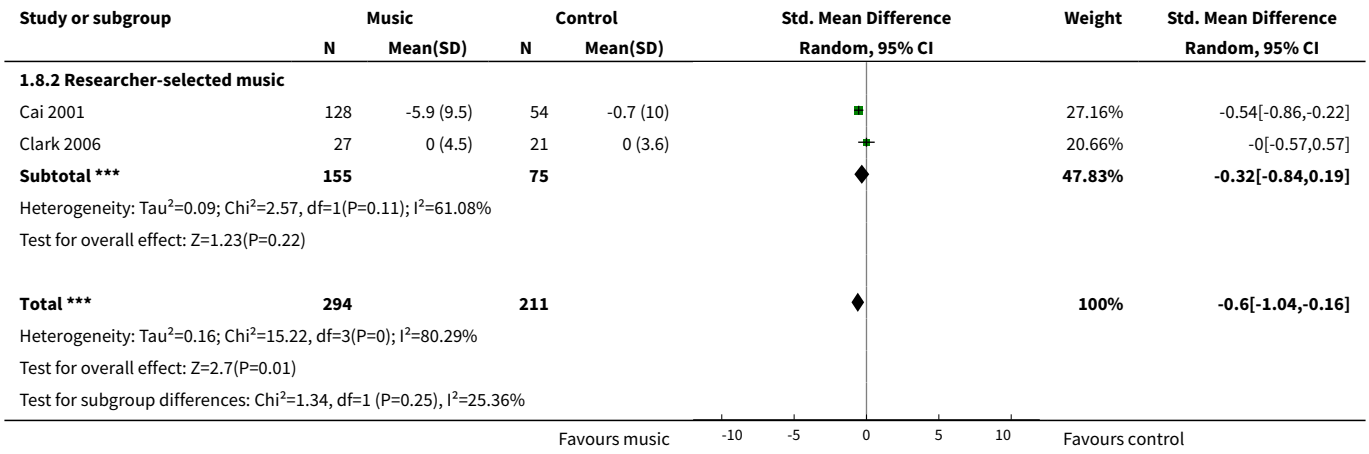


Analysis 1.7. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 7 Depression (intervention subgroup).

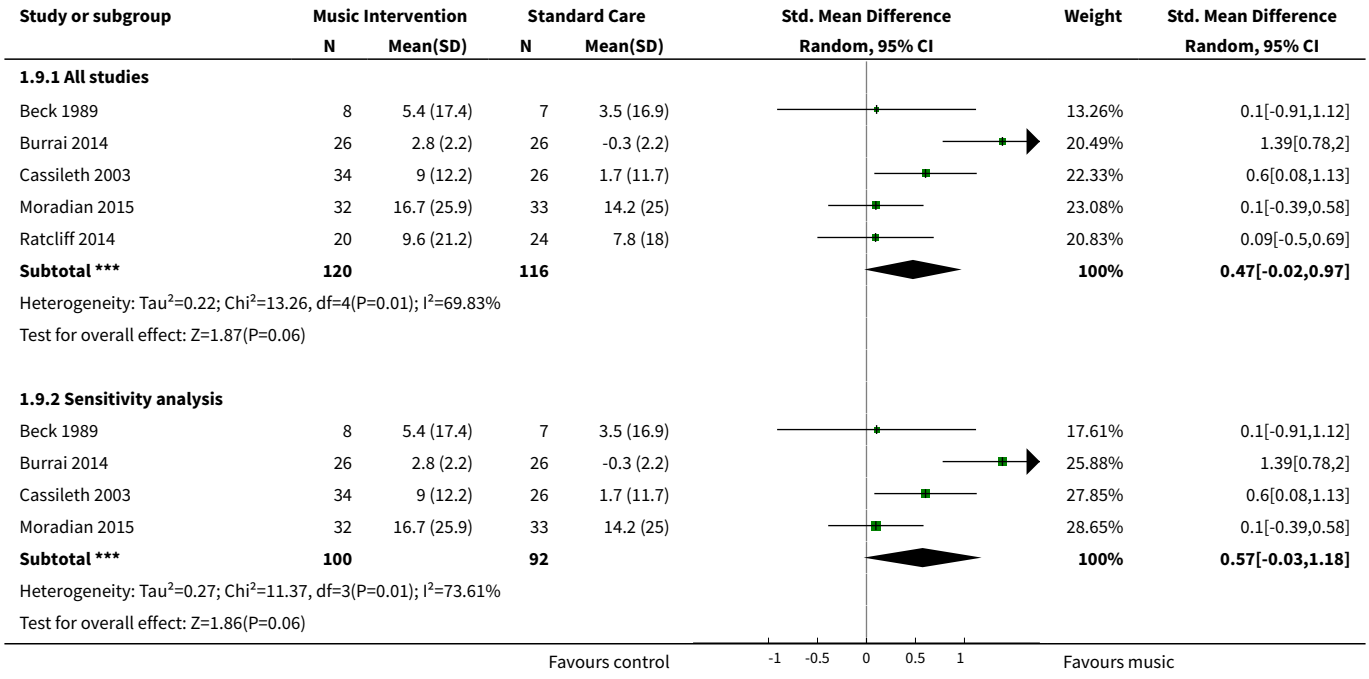


Analysis 1.8. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 8 Depression (music preference).

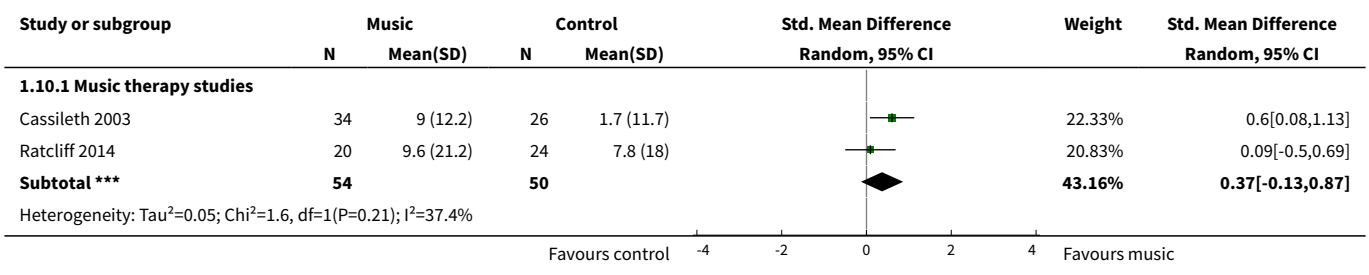


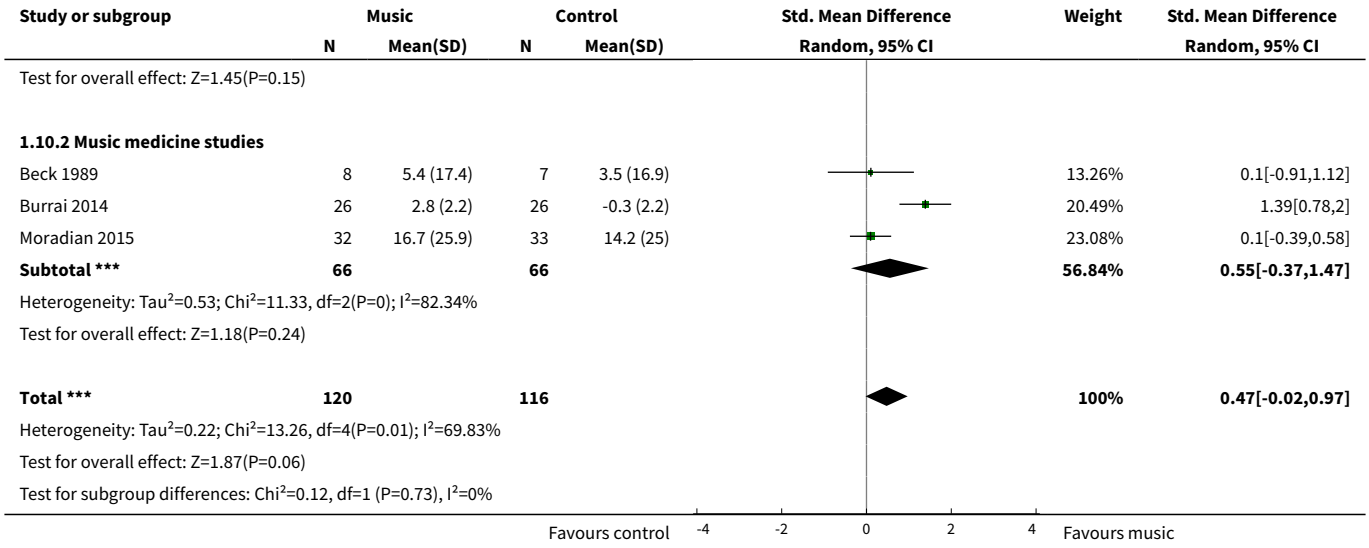


Analysis 1.9. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 9 Mood.

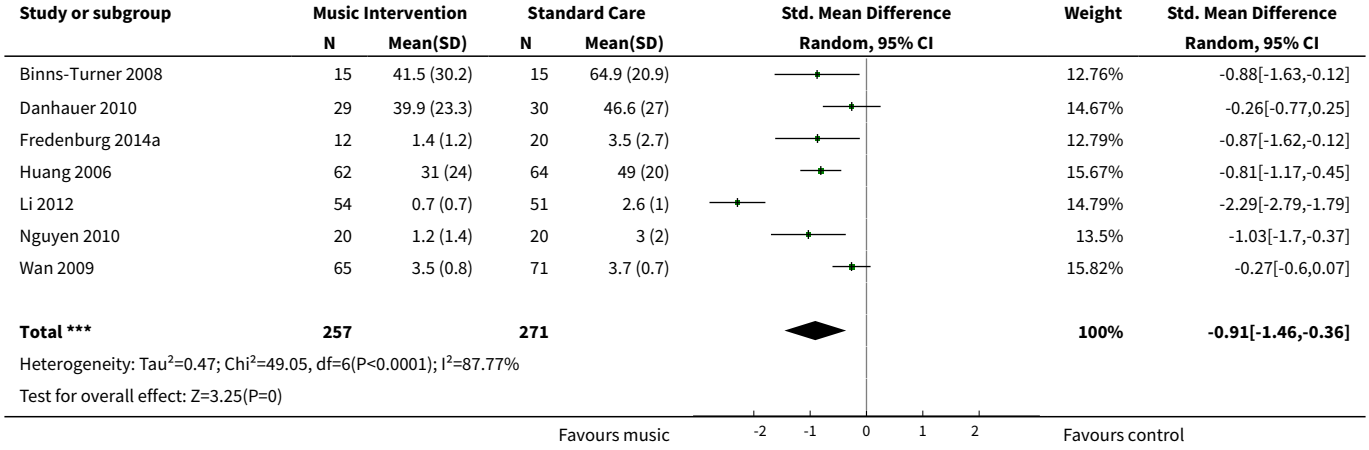


Analysis 1.10. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 10 Mood (intervention subgroup).

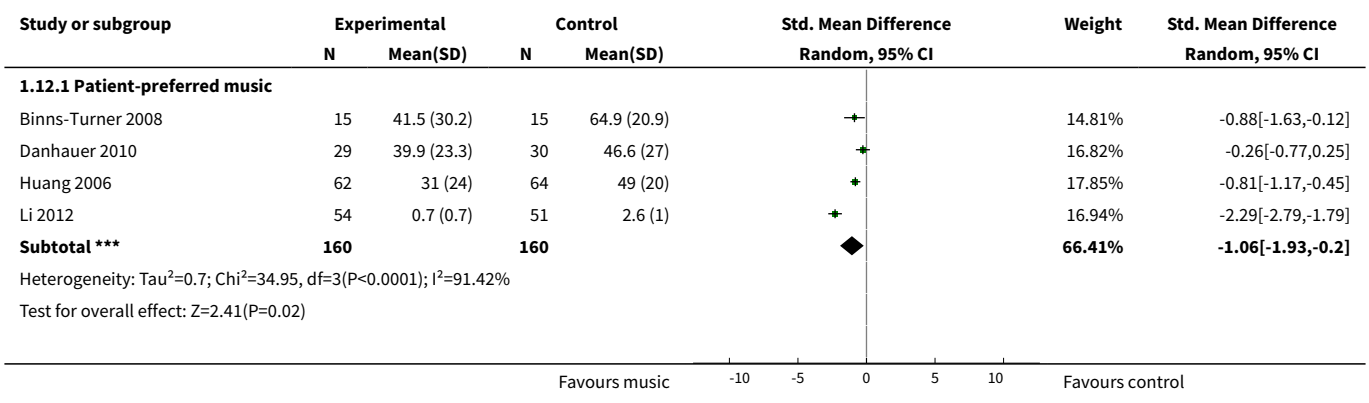




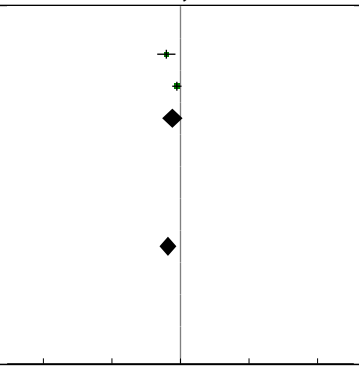
Analysis 1.11. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 11 Pain.



Analysis 1.12. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 12 Pain (music preference).



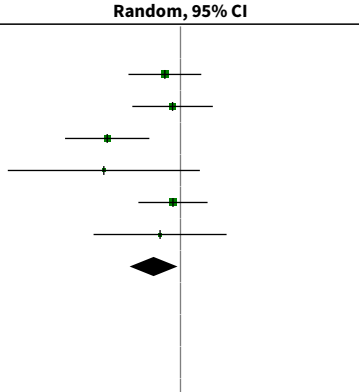
Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
1.12.2 Researcher-selected music							
Nguyen 2010	20	1.2 (1.4)	20	3 (2)		15.59%	-1.03[-1.7,-0.37]
Wan 2009	65	3.5 (0.8)	71	3.7 (0.7)		18%	-0.27[-0.6,0.07]
Subtotal ***	**85**		**91**			**33.59%**	**-0.59[-1.34,0.15]**
Heterogeneity: Tau^2=0.22; Chi^2=4.06, df=1(P=0.04); I^2=75.39%							
Test for overall effect: Z=1.56(P=0.12)							
Total ***	**245**		**251**			**100%**	**-0.92[-1.53,-0.3]**
Heterogeneity: Tau^2=0.52; Chi^2=49.03, df=5(P<0.0001); I^2=89.8%							
Test for overall effect: Z=2.91(P=0)							
Test for subgroup differences: Chi^2=0.65, df=1 (P=0.42), I^2=0%							



Favours music — Favours control

Analysis 1.13. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 13 Fatigue.

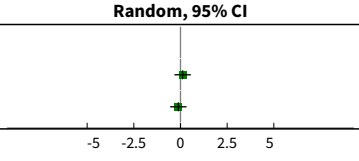
Study or subgroup	Music Intervention N	Mean(SD)	Standard Care N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
1.13.1 All studies							
Cassileth 2003	34	4.3 (4)	26	5.2 (4.1)		22.2%	-0.22[-0.73,0.29]
Clark 2006	28	7.6 (5.3)	21	8.2 (5.3)		19.93%	-0.11[-0.68,0.45]
Ferrer 2005	25	1.9 (1.5)	25	4 (2.4)		18.91%	-1.03[-1.62,-0.44]
Fredenburg 2014b	7	-3 (2.6)	4	1.3 (5)		5.48%	-1.08[-2.43,0.27]
Moradian 2015	32	-23.1 (26.8)	33	-20.6 (20.1)		23.36%	-0.11[-0.59,0.38]
Rosenow 2014	8	-0.6 (2)	10	0.1 (2.4)		10.11%	-0.29[-1.22,0.65]
Subtotal ***	**134**		**119**			**100%**	**-0.38[-0.72,-0.04]**
Heterogeneity: Tau^2=0.07; Chi^2=8.1, df=5(P=0.15); I^2=38.3%							
Test for overall effect: Z=2.2(P=0.03)							
1.13.2 Sensitivity analysis							
Cassileth 2003	34	4.3 (4)	26	5.2 (4.1)		29.68%	-0.22[-0.73,0.29]
Clark 2006	28	7.6 (5.3)	21	8.2 (5.3)		24.28%	-0.11[-0.68,0.45]
Fredenburg 2014b	7	-3 (2.6)	4	1.3 (5)		4.26%	-1.08[-2.43,0.27]
Moradian 2015	32	-23.1 (26.8)	33	-20.6 (20.1)		32.88%	-0.11[-0.59,0.38]
Rosenow 2014	8	-0.6 (2)	10	0.1 (2.4)		8.89%	-0.29[-1.22,0.65]
Subtotal ***	**109**		**94**			**100%**	**-0.2[-0.48,0.08]**
Heterogeneity: Tau^2=0; Chi^2=1.9, df=4(P=0.75); I^2=0%							
Test for overall effect: Z=1.39(P=0.16)							



Favours music — Favours control

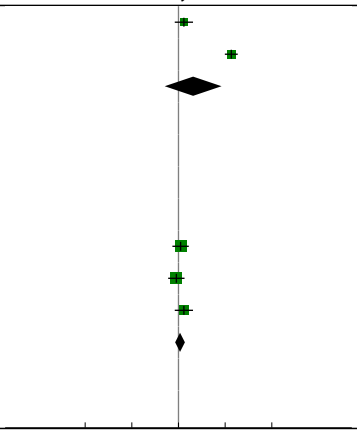
Analysis 1.14. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 14 Physical functioning.

Study or subgroup	Music Intervention N	Mean(SD)	Standard Care N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
1.14.1 All studies							
Hilliard 2003	40	-10.8 (13)	40	-12.5 (16.6)		24.98%	0.11[-0.33,0.55]
Liao 2013	57	2.1 (9)	31	3.1 (8.6)		24.98%	-0.11[-0.55,0.32]



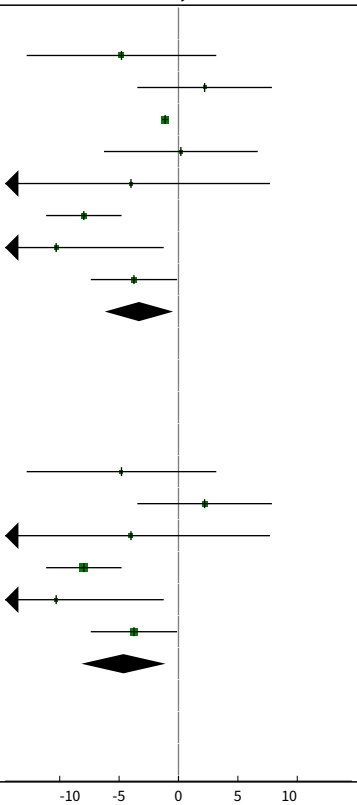
Favours control — Favours music

Study or subgroup	Music Intervention N	Mean(SD)	Standard Care N	Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
Moradian 2015	32	12 (13.7)	33	7.9 (14)		24.86%	0.29[-0.2,0.78]
Xie 2001	124	-5.2 (5.6)	136	-20.8 (5.5)		25.18%	2.83[2.48,3.17]
Subtotal ***	**253**		**240**			**100%**	**0.78[-0.74,2.31]**
Heterogeneity: Tau²=2.37; Chi²=155.86, df=3(P<0.0001); I²=98.08%							
Test for overall effect: Z=1.01(P=0.31)							
1.14.2 Sensitivity analysis							
Hilliard 2003	40	-10.8 (13)	40	-12.5 (16.6)		35.6%	0.11[-0.33,0.55]
Liao 2013	57	2.1 (9)	31	3.1 (8.6)		35.75%	-0.11[-0.55,0.32]
Moradian 2015	32	12 (13.7)	33	7.9 (14)		28.65%	0.29[-0.2,0.78]
Subtotal ***	**129**		**104**			**100%**	**0.08[-0.18,0.34]**
Heterogeneity: Tau²=0; Chi²=1.48, df=2(P=0.48); I²=0%							
Test for overall effect: Z=0.62(P=0.54)							



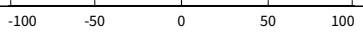
Analysis 1.15. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 15 Heart rate.

Study or subgroup	Music Intervention N	Mean(SD)	Standard Care N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.15.1 All studies							
Binns-Turner 2008	15	2 (11.4)	15	6.8 (10.9)		8.28%	-4.8[-12.78,3.18]
Burrai 2014	26	75.8 (9.1)	26	73.6 (11.6)		12.1%	2.2[-3.47,7.87]
Chen 2013	100	-4.4 (0.8)	100	-3.3 (1.1)		22.71%	-1.12[-1.38,-0.86]
Ferrer 2005	25	79.2 (12.3)	25	79 (11)		10.59%	0.2[-6.27,6.67]
Harper 2001	10	0 (15.9)	10	4 (10.2)		4.79%	-4[-15.7,7.7]
Jin 2011	50	71.8 (7.5)	52	79.8 (8.9)		17.82%	-7.97[-11.15,-4.79]
Nguyen 2010	20	100.8 (11.4)	20	111.1 (17.2)		7.01%	-10.3[-19.35,-1.25]
Zhao 2008	49	76.3 (8.5)	46	80.1 (9.5)		16.71%	-3.75[-7.38,-0.12]
Subtotal ***	**295**		**294**			**100%**	**-3.32[-6.21,-0.44]**
Heterogeneity: Tau²=9.5; Chi²=26.13, df=7(P=0); I²=73.21%							
Test for overall effect: Z=2.26(P=0.02)							
1.15.2 Sensitivity analysis							
Binns-Turner 2008	15	2 (11.4)	15	6.8 (10.9)		12.47%	-4.8[-12.78,3.18]
Burrai 2014	26	75.8 (9.1)	26	73.6 (11.6)		18.16%	2.2[-3.47,7.87]
Harper 2001	10	0 (15.9)	10	4 (10.2)		7.22%	-4[-15.7,7.7]
Jin 2011	50	71.8 (7.5)	52	79.8 (8.9)		26.62%	-7.97[-11.15,-4.79]
Nguyen 2010	20	100.8 (11.4)	20	111.1 (17.2)		10.56%	-10.3[-19.35,-1.25]
Zhao 2008	49	76.3 (8.5)	46	80.1 (9.5)		24.98%	-3.75[-7.38,-0.12]
Subtotal ***	**170**		**169**			**100%**	**-4.63[-8.18,-1.09]**
Heterogeneity: Tau²=9.67; Chi²=11.35, df=5(P=0.04); I²=55.93%							
Test for overall effect: Z=2.56(P=0.01)							
Test for subgroup differences: Chi²=0.32, df=1 (P=0.57), I²=0%							



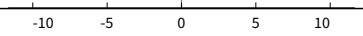
Analysis 1.16. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 16 Heart rate (music preference).

Study or subgroup	Music N	Music Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.16.1 Patient-preferred music							
Binns-Turner 2008	15	2 (11.4)	15	6.8 (10.9)		9.67%	-4.8[-12.78,3.18]
Burrai 2014	26	75.8 (9.1)	26	73.6 (11.6)		13.8%	2.2[-3.47,7.87]
Chen 2013	100	-4.4 (0.8)	100	-3.3 (1.1)		24.37%	-1.12[-1.38,-0.86]
Jin 2011	50	71.8 (7.5)	52	79.8 (8.9)		19.66%	-7.97[-11.15,-4.79]
Zhao 2008	49	76.3 (8.5)	46	80.1 (9.5)		18.55%	-3.75[-7.38,-0.12]
Subtotal ***	**240**		**239**			**86.05%**	**-3.13[-6.54,0.27]**
Heterogeneity: Tau^2=10.58; Chi^2=21.83, df=4(P=0); I^2=81.68%							
Test for overall effect: Z=1.8(P=0.07)							
1.16.2 Researcher-selected music							
Harper 2001	10	0 (15.9)	10	4 (10.2)		5.71%	-4[-15.7,7.7]
Nguyen 2010	20	100.8 (11.4)	20	111.1 (17.2)		8.24%	-10.3[-19.35,-1.25]
Subtotal ***	**30**		**30**			**13.95%**	**-7.94[-15.1,-0.78]**
Heterogeneity: Tau^2=0; Chi^2=0.7, df=1(P=0.4); I^2=0%							
Test for overall effect: Z=2.17(P=0.03)							
Total ***	**270**		**269**			**100%**	**-3.77[-6.97,-0.58]**
Heterogeneity: Tau^2=10.88; Chi^2=25.95, df=6(P=0); I^2=76.88%							
Test for overall effect: Z=2.32(P=0.02)							
Test for subgroup differences: Chi^2=1.41, df=1 (P=0.23), I^2=29.17%							



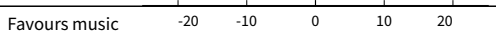
Analysis 1.17. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 17 Respiratory rate.

Study or subgroup	Music Intervention N	Music Intervention Mean(SD)	Standard Care N	Standard Care Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.17.1 All studies							
Chen 2013	100	-0.6 (0.1)	100	-0.5 (0.1)		36.53%	-0.19[-0.23,-0.15]
Jin 2011	50	20.6 (8.6)	52	21.2 (1.8)		16.05%	-0.55[-2.98,1.88]
Nguyen 2010	20	24.5 (3.5)	20	28.2 (3.7)		17.57%	-3.7[-5.94,-1.46]
Zhao 2008	49	16.2 (2.7)	46	17.7 (2.3)		29.85%	-1.44[-2.46,-0.42]
Subtotal ***	**219**		**218**			**100%**	**-1.24[-2.54,0.06]**
Heterogeneity: Tau^2=1.2; Chi^2=15.32, df=3(P=0); I^2=80.42%							
Test for overall effect: Z=1.87(P=0.06)							
1.17.2 Sensitivity analysis							
Jin 2011	50	20.6 (8.6)	52	21.2 (1.8)		24.23%	-0.55[-2.98,1.88]
Nguyen 2010	20	24.5 (3.5)	20	28.2 (3.7)		26.76%	-3.7[-5.94,-1.46]
Zhao 2008	49	16.2 (2.7)	46	17.7 (2.3)		49.01%	-1.44[-2.46,-0.42]
Subtotal ***	**119**		**118**			**100%**	**-1.83[-3.36,-0.3]**
Heterogeneity: Tau^2=0.97; Chi^2=4.18, df=2(P=0.12); I^2=52.14%							
Test for overall effect: Z=2.35(P=0.02)							



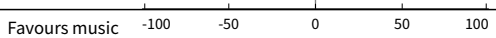
Analysis 1.18. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 18 Systolic blood pressure.

Study or subgroup	Music Intervention N	Mean(SD)	Standard Care N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.18.1 All studies							
Burrai 2014	26	1 (16)	26	3.7 (13.8)		9.35%	-2.7[-10.82,5.42]
Chen 2013	100	-5.7 (0.4)	100	-0.7 (1.3)		34.03%	-5.02[-5.29,-4.75]
Ferrer 2005	25	124.2 (15.6)	25	120.6 (13)		9.59%	3.6[-4.38,11.58]
Harper 2001	10	-2 (21.6)	10	7 (11.5)		3.32%	-9[-24.19,6.19]
Jin 2011	50	122.7 (10.8)	52	132.9 (8.2)		21.9%	-10.22[-13.95,-6.49]
Nguyen 2010	20	98.5 (10.1)	20	102.4 (11.3)		12.32%	-3.9[-10.54,2.74]
Zhao 2008	49	112.9 (18.2)	46	121 (21.5)		9.49%	-8.1[-16.14,-0.06]
Subtotal ***	**280**		**279**			**100%**	**-5.4[-8.32,-2.49]**
Heterogeneity: Tau²=6.48; Chi²=13.19, df=6(P=0.04); I²=54.49%							
Test for overall effect: Z=3.63(P=0)							
1.18.2 Sensitivity analysis							
Burrai 2014	26	1 (16)	26	3.7 (13.8)		13.51%	-2.7[-10.82,5.42]
Harper 2001	10	-2 (21.6)	10	7 (11.5)		4.1%	-9[-24.19,6.19]
Jin 2011	50	122.7 (10.8)	52	132.9 (8.2)		49.17%	-10.22[-13.95,-6.49]
Nguyen 2010	20	98.5 (10.1)	20	102.4 (11.3)		19.45%	-3.9[-10.54,2.74]
Zhao 2008	49	112.9 (18.2)	46	121 (21.5)		13.78%	-8.1[-16.14,-0.06]
Subtotal ***	**155**		**154**			**100%**	**-7.63[-10.75,-4.52]**
Heterogeneity: Tau²=1.52; Chi²=4.48, df=4(P=0.35); I²=10.66%							
Test for overall effect: Z=4.8(P<0.0001)							



Analysis 1.19. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 19 Systolic blood pressure (music preference).

Study or subgroup	Music N	Mean(SD)	Control N	Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.19.1 Patient-preferred music							
Burrai 2014	26	1 (16)	26	3.7 (13.8)		8.22%	-2.7[-10.82,5.42]
Chen 2013	100	-5.7 (0.4)	100	-0.7 (1.3)		45.97%	-5.02[-5.29,-4.75]
Jin 2011	50	122.7 (10.8)	52	132.9 (8.2)		23.42%	-10.22[-13.95,-6.49]
Zhao 2008	49	112.9 (18.2)	46	121 (21.5)		8.37%	-8.1[-16.14,-0.06]
Subtotal ***	**225**		**224**			**85.99%**	**-6.65[-10.07,-3.23]**
Heterogeneity: Tau²=6.77; Chi²=8.31, df=3(P=0.04); I²=63.89%							
Test for overall effect: Z=3.81(P=0)							
1.19.2 Researcher-selected music							
Harper 2001	10	-2 (21.6)	10	7 (11.5)		2.7%	-9[-24.19,6.19]
Nguyen 2010	20	98.5 (10.1)	20	102.4 (11.3)		11.32%	-3.9[-10.54,2.74]
Subtotal ***	**30**		**30**			**14.01%**	**-4.72[-10.8,1.37]**
Heterogeneity: Tau²=0; Chi²=0.36, df=1(P=0.55); I²=0%							
Test for overall effect: Z=1.52(P=0.13)							
Total ***	**255**		**254**			**100%**	**-6.29[-8.86,-3.72]**
Heterogeneity: Tau²=3.72; Chi²=8.68, df=5(P=0.12); I²=42.41%							
Test for overall effect: Z=4.79(P<0.0001)							



Study or subgroup	Music N	Music Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Test for subgroup differences: Chi²=0.29, df=1 (P=0.59), I²=0%							

Favours music -100 -50 0 50 100 Favours control

Analysis 1.20. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 20 Diastolic blood pressure.

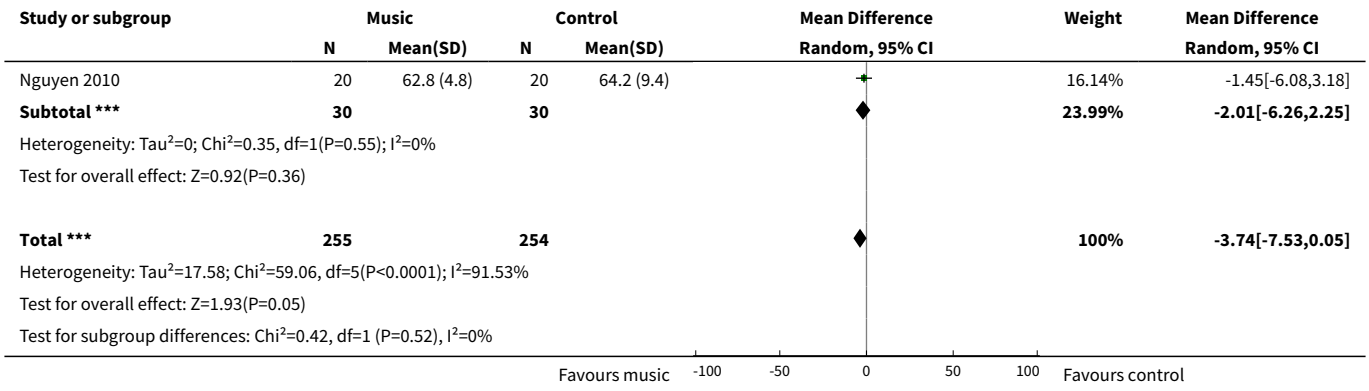
Study or subgroup	Music Intervention N	Music Intervention Mean(SD)	Standard Care N	Standard Care Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.20.1 All studies							
Burrai 2014	26	-0.4 (9.4)	26	1.9 (6.7)		14.19%	-2.3[-6.72,2.12]
Chen 2013	100	-1.7 (0.9)	100	-1.4 (0.9)		18.24%	-0.3[-0.54,-0.06]
Ferrer 2005	25	77.4 (8.7)	25	71.2 (7.7)		13.99%	6.16[1.6,10.72]
Harper 2001	10	-2 (12.5)	10	3 (12)		6.79%	-5[-15.74,5.74]
Jin 2011	50	72.5 (6.1)	52	80.6 (5.3)		17.02%	-8.1[-10.32,-5.88]
Nguyen 2010	20	62.8 (4.8)	20	64.2 (9.4)		13.89%	-1.45[-6.08,3.18]
Zhao 2008	49	65.9 (7)	46	71.6 (8.7)		15.88%	-5.75[-8.95,-2.55]
Subtotal ***	**280**		**279**			**100%**	**-2.35[-5.88,1.18]**
Heterogeneity: Tau²=17.78; Chi²=67.07, df=6(P<0.0001); I²=91.05%							
Test for overall effect: Z=1.31(P=0.19)							
1.20.2 Sensitivity analysis							
Burrai 2014	26	-0.4 (9.4)	26	1.9 (6.7)		19.61%	-2.3[-6.72,2.12]
Harper 2001	10	-2 (12.5)	10	3 (12)		5.91%	-5[-15.74,5.74]
Jin 2011	50	72.5 (6.1)	52	80.6 (5.3)		30.37%	-8.1[-10.32,-5.88]
Nguyen 2010	20	62.8 (4.8)	20	64.2 (9.4)		18.77%	-1.45[-6.08,3.18]
Zhao 2008	49	65.9 (7)	46	71.6 (8.7)		25.34%	-5.75[-8.95,-2.55]
Subtotal ***	**155**		**154**			**100%**	**-4.94[-7.78,-2.09]**
Heterogeneity: Tau²=5.67; Chi²=9.88, df=4(P=0.04); I²=59.53%							
Test for overall effect: Z=3.4(P=0)							

Favours music -10 -5 0 5 10 Favours control

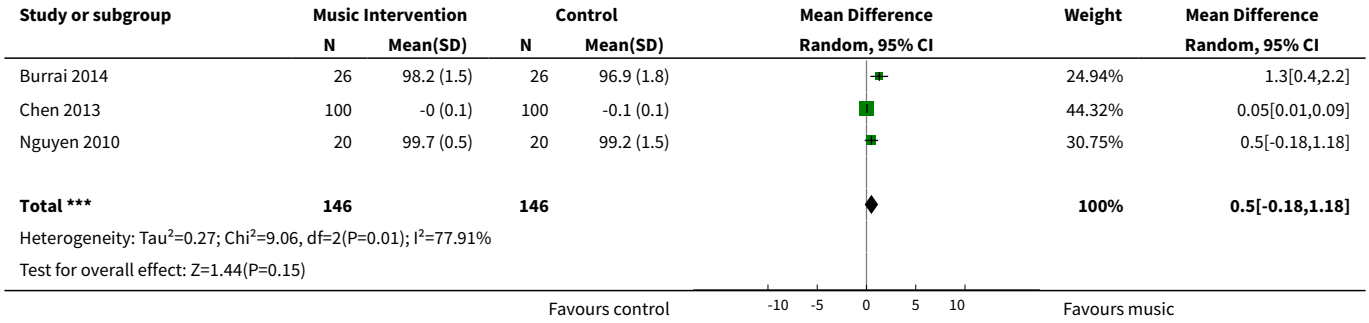
Analysis 1.21. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 21 Diastolic blood pressure (music preference).

Study or subgroup	Music N	Music Mean(SD)	Control N	Control Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.21.1 Patient-preferred music							
Burrai 2014	26	-0.4 (9.4)	26	1.9 (6.7)		16.49%	-2.3[-6.72,2.12]
Chen 2013	100	-1.7 (0.9)	100	-1.4 (0.9)		21.25%	-0.3[-0.54,-0.06]
Jin 2011	50	72.5 (6.1)	52	80.6 (5.3)		19.82%	-8.1[-10.32,-5.88]
Zhao 2008	49	65.9 (7)	46	71.6 (8.7)		18.46%	-5.75[-8.95,-2.55]
Subtotal ***	**225**		**224**			**76.01%**	**-4.1[-8.78,0.59]**
Heterogeneity: Tau²=20.75; Chi²=58.18, df=3(P<0.0001); I²=94.84%							
Test for overall effect: Z=1.71(P=0.09)							
1.21.2 Researcher-selected music							
Harper 2001	10	-2 (12.5)	10	3 (12)		7.85%	-5[-15.74,5.74]

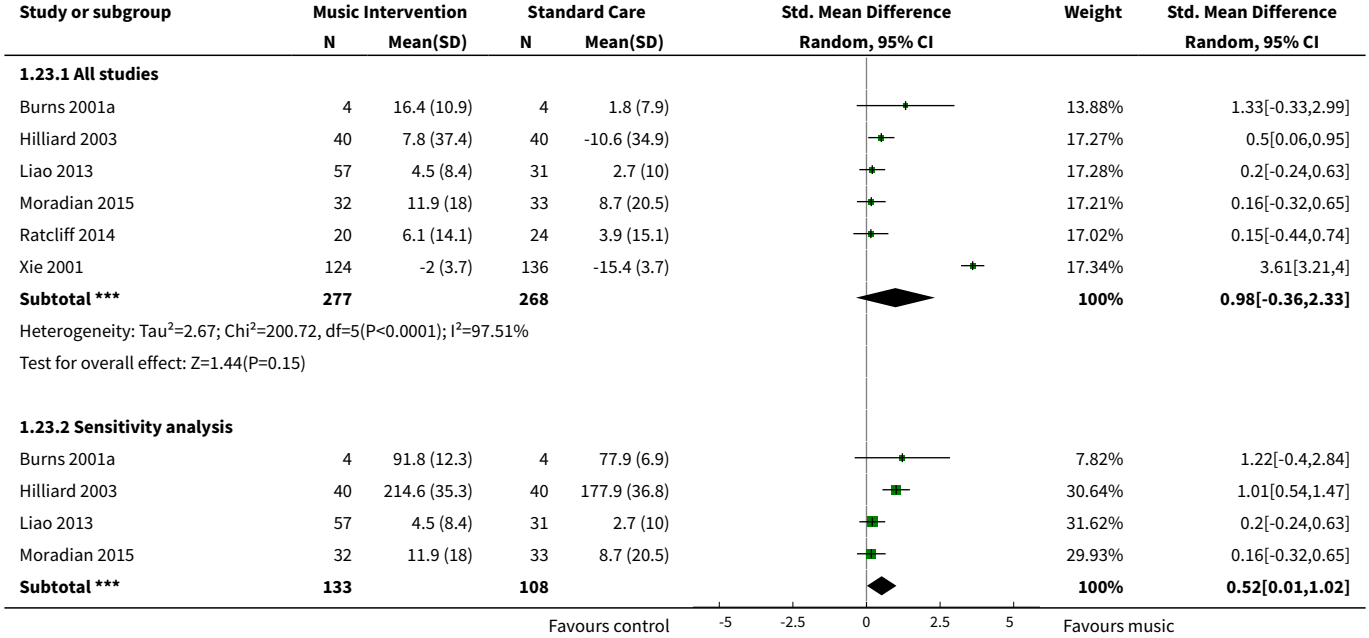
Favours music -100 -50 0 50 100 Favours control

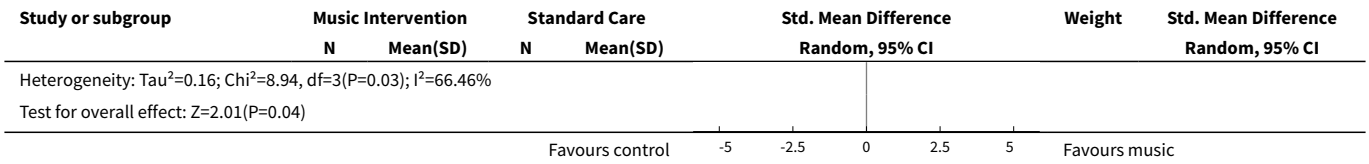


Analysis 1.22. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 22 Oxygen Saturation.

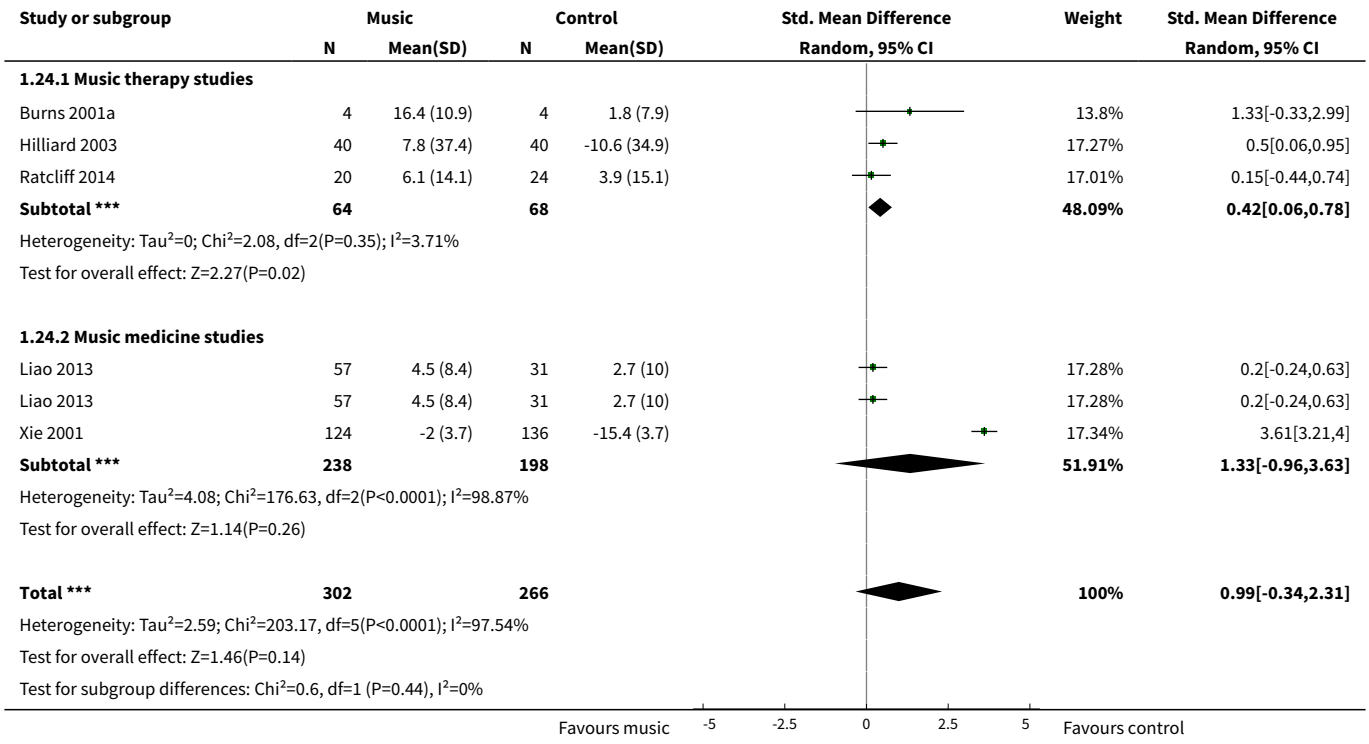


Analysis 1.23. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 23 Quality of Life.





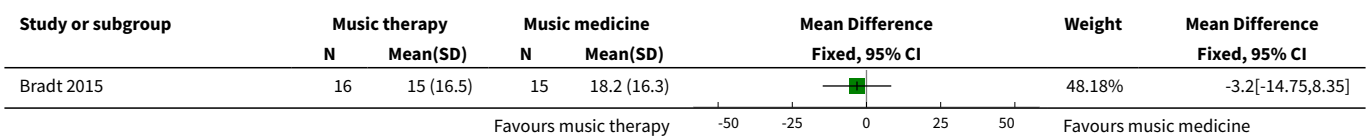
Analysis 1.24. Comparison 1 Music intervention plus standard care versus standard care alone, Outcome 24 Quality of life (intervention subgroup).

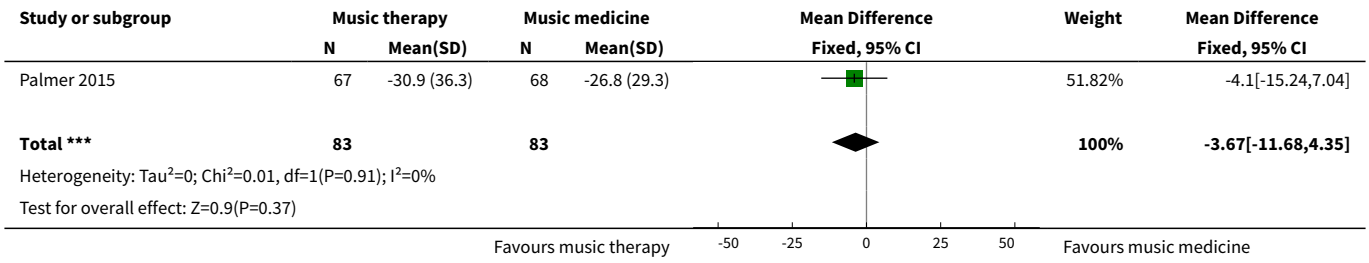


Comparison 2. Music therapy plus standard care versus music medicine plus standard care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety	2	166	Mean Difference (IV, Fixed, 95% CI)	-3.67 [-11.68, 4.35]

Analysis 2.1. Comparison 2 Music therapy plus standard care versus music medicine plus standard care, Outcome 1 Anxiety.

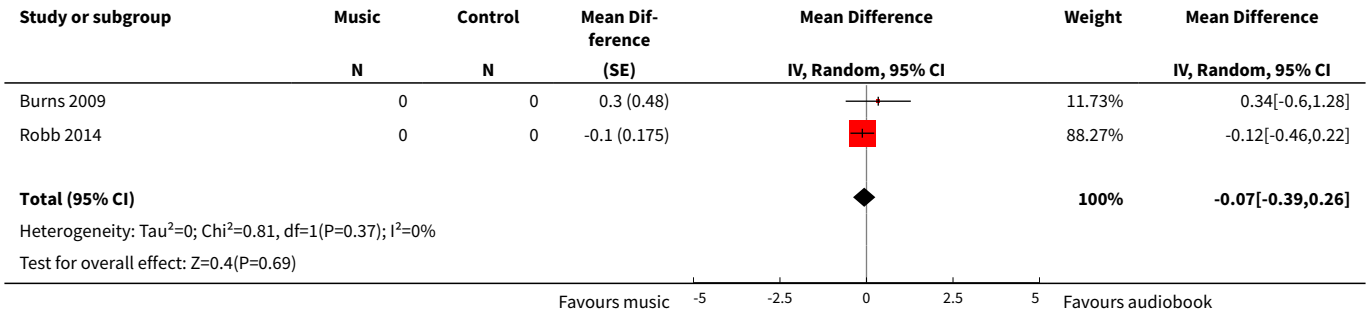




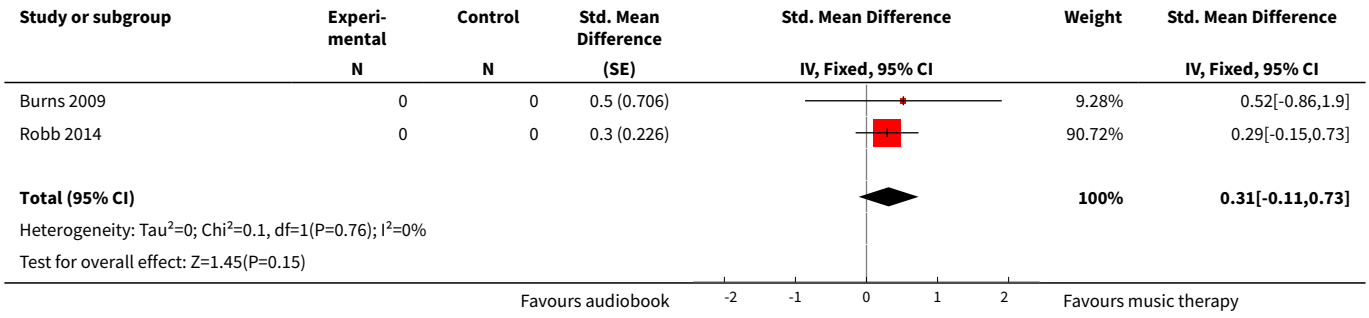
Comparison 3. Music interventions plus standard care versus standard care plus placebo control

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Distress	2		Mean Difference (Random, 95% CI)	-0.07 [-0.39, 0.26]
2 Spiritual well-being	2		Std. Mean Difference (Fixed, 95% CI)	0.31 [-0.11, 0.73]

Analysis 3.1. Comparison 3 Music interventions plus standard care versus standard care plus placebo control, Outcome 1 Distress.



Analysis 3.2. Comparison 3 Music interventions plus standard care versus standard care plus placebo control, Outcome 2 Spiritual well-being.



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 neoplas* or cancer* or carcinoma* or tumo*).mp.
3 1 or 2
4 music/ or music therapy/
5 (sing or sings or singing or song* or improvis*).mp.
6 (music* or melod*).mp.
7 4 or 5 or 6
8 3 and 7
9 randomized controlled trial.pt.
10 controlled clinical trial.pt.
11 randomized.ab.
12 placebo.ab.
13 clinical trials as topic.sh.
14 randomly.ab.
15 trial.ti.
16 9 or 10 or 11 or 12 or 13 or 14 or 15
17 8 and 16

key: mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier; pt=publication type; ab=abstract; ti=title

Appendix 3. Embase search strategy (OvidSp)

1 exp neoplasm/
2 (malignan* or neoplasm* or cancer* or carcinom* or tumo*).mp.
3 1 or 2
4 music therapy/ or music/
5 (sing or sings or singing or song* or improvis*).mp.
6 (music* or melod*).mp.
7 4 or 5 or 6
8 3 and 7
9 crossover procedure/
10 double-blind procedure/
11 randomized controlled trial/
12 single-blind procedure/
13 random*.mp.
14 factorial*.mp.
15 (crossover* or cross over* or cross-over*).mp.
16 placebo*.mp.
17 (double* adj blind*).mp.
18 (singl* adj blind*).mp.
19 assign*.mp.
20 allocat*.mp.
21 volunteer*.mp.
22 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23 8 and 22

key: [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]

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 trebl$ 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 tumo$)) 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 tumo*)
#7 #5 OR #6
#8 Topic=(random allocation)
#9 Topic=(controlled clinical trial*)
#10 Topic=(randomized controlled trial*)
#11Topic=(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. RILM Abstracts of Music Literature search strategy (EbscoHost)

Cancer or tumor or malignant or neoplasm

Appendix 15. Study Selection, Quality Assessment & Data Extraction Form

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

Name Coder:

Date:

Paper Code:

First author	Title	Journal/Conference Proceedings etc	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:

(Continued)

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
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	
• 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	Low risk Unclear risk High risk
Number of withdrawals:	
Were withdrawals described? **Yes** **No ?** **Not clear ?**	

(Continued)

Please add reasons for withdrawal + N or % here:

Selective reporting	
• 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 of means from within group - description of results in text
			N	Mean (SD)	N	Mean (SD)	
	Depression						
	Anxiety						
	Anger						
	Hopelessness						
	Helplessness						
	Other psychological:						
	Other psychological:						
	Quality of life						
	Fatigue						
	Nausea						
	Pain						
	Heart rate						
	Respiratory rate						

(Continued)

	Arterial pressure
	Systolic blood pressure
	Diastolic blood pressure
	Cortisol levels
	IgA levels
	Other hormone levels: _________
	Other hormone levels: _________
	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: 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):	

(Continued)

Appendix 1

Trial characteristics	
	Further details
Single centre / multicentre	
Country / countries	
How was participant eligibility defined?	
How many people were randomizedrandomized?	
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 analyzed	Exp.group 1: Exp group 2: Control:
Time-points when measurements were taken during the study	
Time-points reported in the study	
Time-points you are using in RevMan	
Other	

Appendix 16. Original search strategies

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

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

CancerLit Search Strategy (CancerLit was searched in the original review but is no longer available)

music OR (music therapy)

Musictherapyworld.de (was searched in the original review but is no longer functional)

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

WHAT'S NEW

Date	Event	Description
29 April 2016	New search has been performed	In the previous version of this review, we searched the databases until September 2010 (Bradt 2011). In this updated version we reran the searches until January 2016. We also extended our handsearching to include two additional journals, namely *Music Medicine* and *Approaches*. In this updated review we have re-

Date	Event	Description
		vised the 'Risk of bias' tables for all studies according to the new Cochrane 'Risk of bias' tool.
29 April 2016	New citation required and conclusions have changed	This review is an update of the previous Cochrane review that included 30 studies (Bradt 2011). This updated review includes 22 new trials. One of the previous authors, Dr Denise Grocke, decided not to participate in the update of this review, and we added a new co-author, Aaron Teague. Our conclusions about the impact of music interventions on state anxiety in people with cancer remain similar to those in Bradt 2011. Although the pooled effect of the studies that used the Spielberger State Anxiety Inventory (STAI) was slightly lower than in the previous review, the addition of trials examining this outcome resulted in a more precise estimate. The pooled effect of studies that used measurement tools other than the STAI was higher than in the previous review. The conclusions for the effect of music interventions on depression changed. Whereas the previous review did not find support for an effect, this review update found a moderate effect for depression. We also found a similar effect size (moderate) as the previous review for mood, but the pooled effect was no longer statistically significant in this update. The conclusions for the effect of music interventions on pain changed. Whereas the previous review reported a moderate effect, this review update found a large effect for pain. The conclusions for the effect of music interventions on fatigue also changed. Whereas the previous review did not find evidence of an effect, this review update found a small to moderate effect for music interventions on fatigue. The conclusions for physical functioning remained the same. The conclusion for the effect of music interventions on quality of life remained similar, that is, there was a large pooled effect size that was not statistically significant. However, a subgroup analysis revealed that music therapy interventions resulted in a moderate and statistically significant effect that was consistent across trials, whereas music medicine studies resulted in a large but heterogeneous effect size that was not statistically significant. The conclusions for the effects of music interventions on vital signs remained similar to those of the previous review. This review update included additional outcomes such as resilience, coping, and anesthetic and analgesic intake, but no meta-analysis was possible because we only identified one study per outcome. Because of the addition of many trials in this update, we were able to conduct a priori determined sub-analyses comparing music therapy with music medicine studies and comparing patient-preferred music with researcher-selected music for several of the outcomes.

HISTORY

Protocol first published: Issue 1, 2008
Review first published: Issue 8, 2011

Date	Event	Description
15 July 2011	Amended	Label revision in forest plot of 'distress' outcome.
24 June 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

Background, objectives, criteria for considering studies: Bradt, Dileo, Grocke and Magill
Search strategies, methods: Bradt (reviewed and approved by Dileo, Grocke and Magill)
Database searches and handsearches: Bradt, Dileo, Grocke, Magill and Teague
Screening search results: Bradt, Teague and graduate assistants
Organising retrieval of papers: Bradt
Screening retrieved papers against inclusion criteria: Bradt and Teague
Appraising quality of papers: Bradt, Dileo and Magill
Abstracting data from papers: Bradt,Teague and graduate assistants
Writing to authors of papers for additional information: Bradt, Teague 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 (Review Manager 2014): Bradt, Teague and research assistant
RevMan statistical data: Bradt
Other statistical analysis not using RevMan: Bradt
Interpretation of data: Bradt, Dileo, Grocke and Magill
Statistical inferences: Bradt
Writing the review: Bradt (reviewed and approved by Dileo, Grocke and Magill)
Securing funding for the review: Dileo (for original review)
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

- Drexel University, USA.

  Drexel University provided financial support for a research assistant to assist with the update of this review

External sources

- State of Pennsylvania Formula Fund, USA.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

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

We slightly altered the MEDLINE search strategy, removing the words 'compose' and 'composing' as text words because they resulted in hundreds of irrelevant returns.

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

INDEX TERMS

Medical Subject Headings (MeSH)

Affect; Anxiety [*therapy]; Body Image; Depression [therapy]; Fatigue [therapy]; Music [psychology]; Music Therapy [*methods]; Neoplasms [physiopathology] [*psychology]; Pain Management; Quality of Life; Standard of Care; Stress, Psychological [therapy]; Treatment Outcome

MeSH check words

Humans