Patient Preference and Adherence

Dovepress
open access to scientific and medical research

Open Access Full Text Article

REVIEW

Effectiveness of music therapy: a summary of systematic reviews based on randomized controlled trials of music interventions

Patient Preference and Adherence downloaded from https://www.dovepress.com/
For personal use only.

This article was published in the following Dove Press journal:
Patient Preference and Adherence
16 May 2014
Number of times this article has been viewed

Hiroharu Kamioka[1]
Kiichiro Tsutani[2]
Minoru Yamada[3]
Hyuntae Park[4]
Hiroyasu Okuizumi[5]
Koki Tsuruoka[6]
Takuya Honda[7]
Shinpei Okada[8]
Sang-Jun Park[8]
Jun Kitayuguchi[9]
Takafumi Abe[9]
Shuichi Handa[5]
Takuya Oshio[10]
Yoshiteru Mutoh[11]

[1]Faculty of Regional Environment Science, Tokyo University of Agriculture, Tokyo, Japan; [2]Department of Drug Policy and Management, Graduate School of Pharmaceutical Sciences, The University of Tokyo, Tokyo, Japan; [3]Kyoto University Graduate School Research, Kyoto, Japan; [4]Department of Functioning Activation, National Center for Geriatrics and Gerontology, Aichi, Japan; [5]Mimaki Onsen (Spa) Clinic, Tomi, Nagano, Japan; [6]Graduate School of Social Services, Japan College of Social Work, Tokyo, Japan; [7]Japanese Society for the Promotion of Science, Tokyo, Japan; [8]Physical Education and Medicine Research Foundation, Tomi, Nagano, Japan; [9]Physical Education and Medicine Research Center Unnan, Shimane, Japan; [10]Social Welfare Service Corporation CARE-PORT MIMAKI, Tomi, Nagano, Japan; [11]The Research Institute of Nippon Sport Science University, Tokyo, Japan

Correspondence: Hiroharu Kamioka
Faculty of Regional Environment Science, Tokyo University of Agriculture, 1-1-1 Sakuragaoka, Setagaya-ku, Tokyo 156-8502, Japan
Tel/fax +81 3 5477 2587
Email h1kamiok@nodai.ac.jp

Objective: The objective of this review was to summarize evidence for the effectiveness of music therapy (MT) and to assess the quality of systematic reviews (SRs) based on randomized controlled trials (RCTs).

Study design: An SR of SRs based on RCTs.

Methods: Studies were eligible if they were RCTs. Studies included were those with at least one treatment group in which MT was applied. We searched the following databases from 1995 to October 1, 2012: MEDLINE via PubMed, CINAHL (Cumulative Index of Nursing and Allied Health Literature), Web of Science, Global Health Library, and Ichushi-Web. We also searched all Cochrane Database and Campbell Systematic Reviews up to October 1, 2012. Based on the *International Classification of Diseases*, 10th revision, we identified a disease targeted for each article.

Results: Twenty-one studies met all inclusion criteria. This study included 16 Cochrane reviews. As a whole, the quality of the articles was very good. Eight studies were about "Mental and behavioural disorders (F00-99)"; there were two studies on "Diseases of the nervous system (G00-99)" and "Diseases of the respiratory system (J00-99)"; and there was one study each for "Endocrine, nutritional and metabolic diseases (E00-90)", "Diseases of the circulatory system (I00-99)", and "Pregnancy, childbirth and the puerperium (O60)". MT treatment improved the following: global and social functioning in schizophrenia and/or serious mental disorders, gait and related activities in Parkinson's disease, depressive symptoms, and sleep quality.

Conclusion: This comprehensive summary of SRs demonstrated that MT treatment improved the following: global and social functioning in schizophrenia and/or serious mental disorders, gait and related activities in Parkinson's disease, depressive symptoms, and sleep quality. MT may have the potential for improving other diseases, but there is not enough evidence at present. Most importantly, no specific adverse effect or harmful phenomenon occurred in any of the studies, and MT was well tolerated by almost all patients.

Keywords: ICD-10, schizophrenia, mental disorders, Parkinson's disease, depression, sleep

Article focus

Although many studies have reported the effects of music therapy (MT), there is no review of systematic reviews (SRs) based on randomized controlled trials (RCTs).

Key messages

The key messages of this paper are as follows.

1. This is the first SR of SRs of the effectiveness of cure based on music interventions in studies with RCT designs.

© 2014 Kamioka et al. This work is published by Dove Medical Press Limited, and licensed under Creative Commons Attribution – Non Commercial (unported, v3.0) License. The full terms of the License are available at http://creativecommons.org/licenses/by-nc/3.0/. Non-commercial uses of the work are permitted without any further permission from Dove Medical Press Limited, provided the work is properly attributed. Permissions beyond the scope of the License are administered by Dove Medical Press Limited. Information on how to request permission may be found at: http://www.dovepress.com/permissions.php

2. Our study is unique because it summarizes the evidence for each target disease according to the *International Classification of Diseases*, revision 10 (ICD-10).
3. We propose the future research agenda for studies on the treatment effect of MT.

Strength and limitation of this study

The strengths of this study are as follows: 1) the methods and implementation registered high on the PROSPERO database; 2) it was a comprehensive search strategy across multiple databases with no data restrictions; and 3) there were high agreement levels for quality assessment of articles.

This study has three limitations. Firstly, some selection criteria were common across studies; however, the bias remained due to differences in eligibility for participation in each original RCT. Secondly, publication bias was a limitation. Lastly, since this review focused on summarizing the effects of MT for each disease, we did not describe all details on quality and quantity, such as type of MT, frequency of MT, and time on MT.

Introduction

MT is widely utilized for treatment of and assistance in various diseases. In one literature review, the authors found seven case reports/series and seven studies on MT for multiple sclerosis patients. The results of these studies as well as the case reports demonstrated patients' improvements in the domains of self-acceptance, anxiety, and depression.[1] Another review examined the overall efficacy of MT in children and adolescents with psychopathology, and examined how the size of the effect of MT is influenced by the type of pathology, the subject's age, the MT approach, and the type of outcome.[2] The analysis revealed that MT had a medium to large positive effect (effect size =0.61) on clinically relevant outcomes that was statistically highly significant ($P<0.001$) and statistically homogeneous. A more recent SR assessed the effects of musical elements in the treatment of individuals with acquired neurological disorder.[3] The results showed that mechanisms of recovery remained unclear: two of the three studies that examined mechanisms of recovery via neuro-imaging techniques supported the role of the right hemisphere, but reports were contradictory, and exact mechanisms of recovery remained indefinable. An interesting meta-analysis described results that justified strong consideration for the inclusion of neonatal intensive care unit (NICU) MT protocols in best practice standards for NICU treatment of preterm infants: examples of these therapies were listening to music for pacification, music reinforcement of sucking/feeding ability, and music as a basis for pacification during multilayered, multimodal stimulation.[4]

Examining the curative effects of MT has unique challenges. A review article by Nilsson[5] described how nurses face many challenges as they care for the needs of hospitalized patients, and that they often have to prioritize physical care over the patient's emotional, spiritual, and psychological needs. In clinical practice, music intervention can be a tool to support these needs by creating an environment that stimulates and maintains relaxation, wellbeing, and comfort. Furthermore, the Nilsson article[5] presented a concrete recommendation for music interventions in clinical practice, such as "slow and flowing music, approximately 60 to 80 beats per minute", "nonlyrical", "maximum volume level at 60 dB", "patient's own choice, with guidance", "suitable equipment chosen for the specific situation", "a minimum duration of 30 minutes in length", and "measurement, follow up, and documentation of the effects". In addition, MT has been variably applied as both a primary and accessory treatment for persons with addictions to alcohol, tobacco, and other drugs of abuse. However, an SR[6] described that no consensus exists regarding the efficacy of MT as treatment for patients with addictions.

On the other hand, music may be considered an adjunctive therapy in clinical situations. Music is effective in reducing anxiety and pain in children undergoing medical and dental procedures.[7] A meta-analysis confirmed that patients listening to music during colonoscopy, which is now the recommended method for screening colon cancer, was an effective method for reducing procedure time, anxiety, and the amount of sedation. More importantly, no harmful effects were observed for all the target studies.[8] The usual practice following a cervical cancer abnormal cervical smear is to perform a colposcopy. However, women experience high levels of anxiety and negative emotional responses at all stages of cervical screening. An SR of RCTs evaluated interventions designed to reduce anxiety levels during colposcopic examination. Psychosexual dysfunction (ie, anxiety) was reduced by playing music during colposcopy.[9]

The definition of musical intervention is complex, but the literature describes two broad categories of music interventions: music medicine and MT.[10] Music medicine is the use of passive listening (usually involving prerecorded music) as implemented by medical personnel. In music medicine studies, the subject's preference for the music used may be considered by having him or her select from a variety of tapes. Alternately, some studies use predefined

music stimuli that do not take the subject's preferences into account. Furthermore, there is generally no attempt by the researcher to form a therapeutic relationship with the subject, and there is no process involved in the music treatment. In essence, music medicine studies usually allow one to assess the effects of music alone as a therapeutic intervention. In contrast, MT interventions most often involve a relationship between the therapist and the subject, the use of live music (performed or created by the therapist and/or patient), and a process that includes assessment, treatment, and evaluation. Patient preference for the music is usually a consideration in MT studies.

We were interested in evaluating the curative effect of MT according to diseases because many of the primary studies and review articles of much MT have reported results in this way. In particular, we wanted to focus on all cure and rehabilitation effects using the ICD-10. It is well known in research design that evidence grading is highest for an SR with meta-analysis of RCTs. Although many studies have reported the effects of MT, there is no review of SRs based on RCTs. The objective of this review was to summarize evidence for the effectiveness of MT and to assess the quality of SRs based on RCTs of these therapies.

Methods

Criteria for considering studies included in this review

Types of studies

Studies were eligible if they were SRs (with or without a meta-analysis) based on RCTs.

Types of participants

There was no restriction on patients.

Types of intervention and language

Studies included were those with at least one treatment group in which MT was applied. The definition of MT is complex, but in this study, any kind of MT (not only music appreciation but also musical instrument performance and singing, for example) was permitted and defined as an intervention. Studies had to include information on the use of medication, alternative therapies, and lifestyle changes, and these had to be comparable among groups. There was no restriction on the basis of language.

Types of outcome measures

We focused on all cure and rehabilitation effects using the ICD-10.

Search methods for studies identification

Bibliographic database

We searched the following databases from 1995 to October 1, 2012: MEDLINE via PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Web of Science, Ichushi Web (in Japanese), the Global Health Library (GHL), and the Western Pacific Region Index Medicus (WPRIM). The International Committee of Medical Journal Editors (ICMJE) recommended uniform requirements for manuscripts submitted to biomedical journals in 1993. We selected articles published (that included a protocol) since 1995, because it appeared that the ICMJE recommendation had been adopted by the relevant researchers and had strengthened the quality of the reports.

We also searched the Cochrane Database of Systematic Reviews (Cochrane Reviews), the Database of Abstracts of Reviews of Effects (Other Reviews), the Cochrane Central Register of Controlled Trials (Clinical Trials or CENTRAL), the Cochrane Methodology Register (Methods Studies), the Health Technology Assessment Database (Technology Assessments), the NHS Economic Evaluation Database (Economic Evaluations), About The Cochrane Collaboration databases (Cochrane Groups), the Campbell Systematic Reviews (the Campbell Collaboration), and the All Cochrane, up to October 1, 2012.

All searches were performed by two specific searchers (hospital librarians) who were qualified in medical information handling, and who were experienced in searches of clinical trials.

Search strategies

The special search strategies contained the elements and terms for MEDLINE, CINAHL, Web of Science, Ichushi Web, GHL, WPRIM, and All Cochrane databases (Figure 1 and Table 1). Only keywords about intervention were used for the searches. First, titles and abstracts of identified published articles were reviewed in order to determine the relevance of the articles. Next, references in relevant studies and identified SRs were screened.

Registry checking

We searched the International Clinical Trials Registry Platform (ICTRP), Clinical Trials.gov, and the University Hospital Medical Information Network – Clinical Trials Registry (UMIN-CTR), up to October 1, 2012.

ICTRP in the WHO Registry Network meet specific criteria for content, quality and validity, accessibility, unique

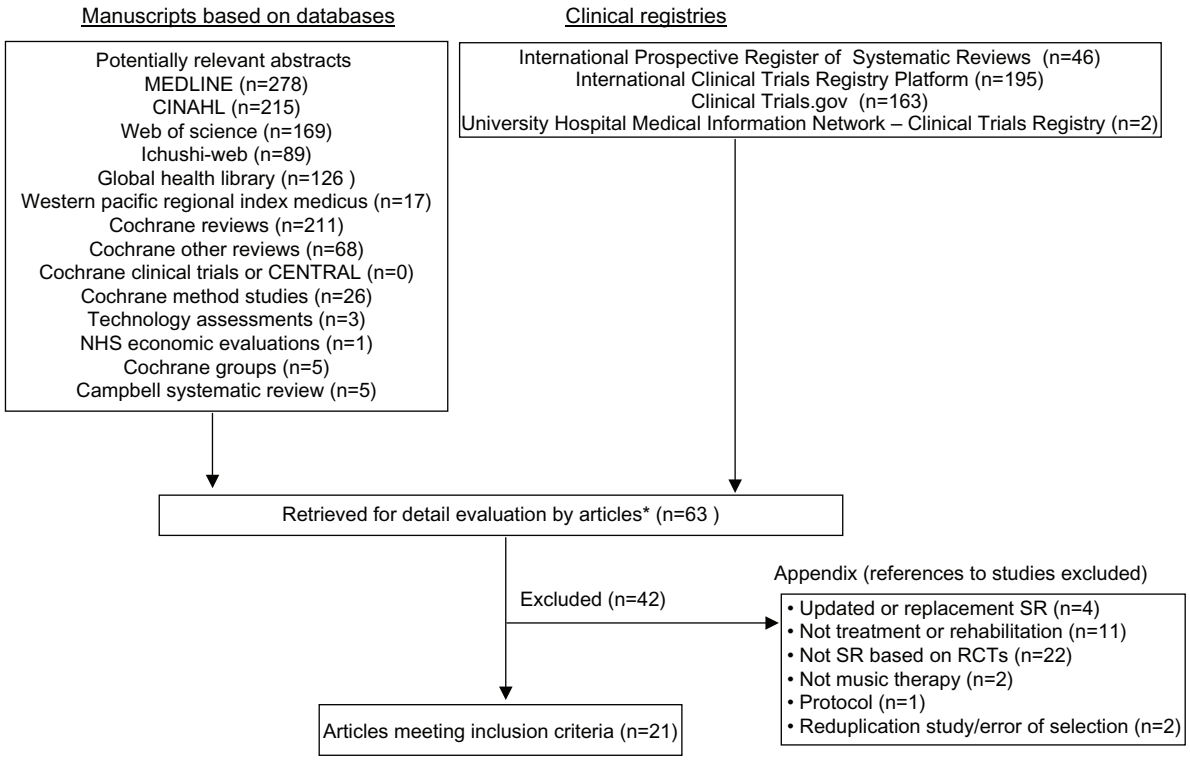

Figure 1 Flowchart of trial process.
Note: *Reduplication.
Abbreviations: CINAHL, Cumulative Index of Nursing and Allied Health Literature; CENTRAL, Cochrane Central Register of Controlled Trials; RCT, randomized controlled trial; SR, systematic review.

identification, technical capacity, and administration. Primary registries meet the requirements of the ICMJE. Clinical Trials.gov is a registry of federally and privately supported clinical trials conducted in the US and around the world. UMIN-CTR is a registry of clinical trials conducted in Japan and around the world.

Handsearching and reference checking

We handsearched abstracts published on MT in relevant journals in Japan. We checked the references of included studies for further relevant literature.

Review methods

Selection of trials

To make the final selection of studies for the review, all criteria were applied independently by four authors (ie, TH, JK, SJP, and TA) to the full text of articles that had passed the first eligibility screening (Figure 1). Disagreements and uncertainties were resolved by discussion with other authors (ie, HK, KT, and YM).

Studies were selected when 1) the design was an SR based on RCTs and 2) one of the interventions was a form of MT. Protocols without results were excluded, and we included only completed studies. Cure and rehabilitation effects were used as a primary outcome measure. Trials that were excluded are presented with reasons for exclusion (Table S1).

Quality assessment of included studies

To ensure that variation was not caused by systematic errors in the study design or execution, eleven review authors (HP, MY, HO, SO, SJP, TO, KT, TH, SH, JK, and HK) independently assessed the quality of the articles. A full quality appraisal of these papers was made using the combined tool based on the AMSTAR checklist[11] developed to assess the methodological quality of SRs.

Each item was scored as "present" (Yes), "absent" (No), "unclear or inadequately described" (Can not answer), or "not applicable" (n/a). Depending on the study design, some items were not applicable. The "n/a" was excluded from calculation for quality assessment. We displayed the percentage of descriptions that were present on all items for the quality assessment of articles. Then, based on the percentage of risk of poor methodology and/or bias, each item was assigned to one of the following categories: good description (80%–100%), poor description (50%–79%), or very poor description (0%–49%).

Table 1 The special search strategies

1. MEDLINE
#1 Search music[all]
#2 Search musical[all]
#3 Search music[MeSH]
#4 Search "Music Therapy"[Mesh]
#5 Search song[Text Word]
#6 Search songs[Text Word]
#7 Search singing[Text Word]
#8 Search ((((((#1) OR #2) OR #3) OR #4) OR #5) OR #6) OR #7
#9 Search systematic[sb]
#10 Search Meta-Analysis[Publication type]
#11 Search "Meta-Analysis as Topic"[MeSH Terms]
#12 Search Meta-analysis*[all]
#13 Search Metaanalysis*[all]
#14 Search systematic review*[all]
#15 Search (((((#9) OR #10) OR #11) OR #12) OR #13) OR #14
#16 Search (#8) AND #15
#17 Search (#8) AND #15 Filters: Publication date from 1995/01/01
2. CINHAL
#1 (TI music OR AB music) OR (TI musical OR AB musical) OR TX "music therap*" OR MH music OR MH "music therapy"
#2 (TI "song" OR AB "song") OR (TI "songs" OR AB "songs") OR (TI "singing" OR AB "singing") OR MH "singing"
#3 MH "meta analysis" OR PT "meta analysis" OR TI "meta analy*" OR AB "meta analysis*"
#4 MH "systematic review" OR PT "systematic review" OR TI "systematic review*" OR AB "systematic review*"
#5 #1 or #2
#6 #3 or #4
#7 #5 and #6
3. Web of Science
#1 (music*) OR (music therap*)
#2 (song*) OR (singing) NOT (song*)
#3 (meta analys*) OR (systematic review*)
#4 #2 OR #1
#5 #4 AND #3
#6 #5 Article time span=1995-2012
4. Ichushi Web
#1 (音楽療法/TH or 音楽療法/AL) or (音楽療法士/TH or 音楽療法士/AL) or 音楽/TH or 音楽/AL or ミュージック/AL or 歌唱/AL or (楽器/TH or 楽器/AL) or 演奏/AL
#2 メタアナリシス/TH or メタアナリシス/AL or メタ分析/AL or (RD=メタアナリシス)
#3 システマティックレビュー/TH or システマティックレビュー/AL or "systematic review"/AL
#4 総説文献/TH or (文献研究/TH or 文献/AL) or レビュー/AL or (EBM/TH or EBM/AL)
#5 #2 or #3 or #4
#6 #1 and #5
#7 (#6) and (DT=1995:2012 PT=会議録除く)
5. GHL
(music or musical or singing) AND ("meta analysis" or meta-analysis or #systematic and review*#)
6. WPRIM
#1 All:music or music% or "music therap%"
#2 Mesh Heading:Music/All Categories/All Subheadings
#3 Mesh Heading:Music Therapy/All Categories/All Subheadings
#4 Abstract:song? or singing
(*Continued*)

Table 1 (*Continued*)

#5 Keywords:song? or singing
#6 #5 or #4 or #3 or #2 or #1
#7 MeSH Heading:Meta-Analysis/All Categories/All Subheadings
#8 MeSH Heading:Meta-Analysis as Topic/All Categories/All Subheadings
#9 All:meta-analy% or "meta analy%" or metaanaly%
#10 All:"sistematic review" or "systematic review%"
#11All:review%
#12 #11 or # 10 or #9 or #8 or #7
#13 #12 and #6
#14 #12 and #6 -Limits:1995-2012
7. All Cochrane
#1 MeSH descriptor: [Music] explode all trees
#2 MeSH descriptor: [Music Therapy] explode all trees
#3 music* (Word variations have been searched)
#4 song* or singing:ti,ab,kw (Word variations have been searched)
#5 #1 or #2 or #3 or #4
#6 MeSH descriptor: [Meta-Analysis] explode all trees
#7 MeSH descriptor: [Meta-Analysis as Topic] explode all trees
#8 "meta-analysis":pt (Word variations have been searched)
#9 meta next analy* (Word variations have been searched)
#10 systematic next review* (Word variations have been searched)
#11 #6 or #7 or #8 or #9 or #10
#12 #5 and #11 from 1995 (Word variations have been searched)
8. Campbell Collaboration
music* in "ALL text"
9. ICTRP
music therapy* OR music* OR singing
10. Internationl Prospective Register of Systematic Review
music
11. Clinical Trials. Gov
#1music OR musical
12. UMIN-CTR
音楽 in 「自由記載語」

Disagreements and uncertainties were resolved by discussion with other authors (ie, KT and HK). Inter-rater reliability was calculated on a dichotomous scale using percentage agreement and Cohen's kappa coefficient (κ).

Summary of studies and data extraction

Eleven review authors (HP, MY, HO, SO, SJP, TH, TO, SH, JK, KT, and HK) described the summary from each article based on the structured abstracts.[12,13]

Benefit and harm

The GRADE Working Group[14] reported that the balance between benefit and harm, quality of evidence, applicability, and the certainty of the baseline risk were all considered in judgments about the strength of recommendations. Adverse events for intervention were especially important information for researchers and users of clinical practice guidelines, and we presented this information with the description of each article.

Table 2 A structured abstract of 21 systematic reviews

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
Sinha et al[17]	Auditory integration training and other sound therapies for autism spectrum disorders (ASD)	To determine the effectiveness of auditory integration therapy or other methods of sound therapy in individuals with autism spectrum disorders.	For this update, we searched the following databases in September 2010: CENTRAL (2010, Issue 2), MEDLINE (1950 to September week 2, 2010), EMBASE (1980 to week 38, 2010), CINAHL (1937 to current), PsycINFO (1887 to current), ERIC (1966 to current), LILACS (September 2010) and the reference lists of published papers. One new study was found for inclusion.	Randomized controlled trials involving adults or children with autism spectrum disorders. Treatment was auditory integration therapy or other sound therapies involving listening to music modified by filtering and modulation. Control groups could involve no treatment, a waiting list, usual therapy, or a placebo equivalent. The outcomes were changes in core and associated features of autism spectrum disorders, auditory processing, QoL, and adverse events.
Mossler et al[18]	Music therapy for people with schizophrenia and schizophrenia-like disorders	To review the effects of music therapy, or music therapy added to standard care, compared with "placebo" therapy, standard care or no treatment for people with serious mental disorders such as schizophrenia.	We searched the Cochrane Schizophrenia Group Trials Register (December 2010) and supplemented this by contacting relevant study authors, handsearching of music therapy journals, and manual searches of reference lists.	All RCTs that compared music therapy with standard care, placebo therapy, or no treatment.

Table 2 (*Continued*)

Data extraction/data collection and analysis	Main results	The authors' conclusions
Two independent review authors performed data extraction. All outcome data in the included papers were continuous. We calculated point estimates and standard errors from paired *t*-test scores and post-intervention means. Meta-analysis was inappropriate for the available data.	We identified six RCTs of auditory integration therapy and one of Tomatis therapy, involving a total of 182 individuals aged 3–39 years. Two were cross-over trials. Five trials had fewer than 20 participants. Allocation concealment was inadequate for all studies. Twenty different outcome measures were used, and only two outcomes were used by three or more studies. Meta-analysis was not possible due to very high heterogeneity or the presentation of data in unusable forms. Three studies did not demonstrate any benefit of auditory integration therapy over control conditions. Three studies reported improvements at 3 months for the auditory integration therapy group based on the Aberrant Behavior Checklist, but they used a total score rather than subgroup scores, which is of questionable validity, and Veale's results did not reach statistical significance. Rimland 1995 also reported improvements at 3 months in the auditory integration therapy group for the Aberrant Behavior Checklist subgroup scores. The study addressing Tomatis therapy described an improvement in language with no difference between treatment and control conditions and did not report on the behavioral outcomes that were used in the auditory integration therapy trials.	There is no evidence that auditory integration therapy or other sound therapies are effective as treatments for autism spectrum disorders. As synthesis of existing data has been limited by the disparate outcome measures used between studies, there is not sufficient evidence to prove that this treatment is not effective. However, of the seven studies including 182 participants that have been reported to date, only two (with an author in common), involving a total of 35 participants, report statistically significant improvements in the auditory integration therapy group and for only two outcome measures (Aberrant Behavior Checklist and Fisher's Auditory Problems Checklist). As such, there is no evidence to support the use of auditory integration therapy at this time.
Studies were reliably selected, quality assessed, and data extracted. We excluded data where more than 30% of participants in any group were lost to follow-up. We synthesized non-skewed continuous endpoint data from valid scales using an SMD. If statistical heterogeneity was found, we examined treatment "dosage" and treatment approach as possible sources of heterogeneity.	We included eight studies (total 483 participants). These examined effects of music therapy over the short- to medium-term (1–4 months), with treatment "dosage" varying from seven to 78 sessions. Music therapy added to standard care was superior to standard care for global state (medium-term, one RCT, n=72, RR 0.10, 95% CI 0.03–0.31; NNT 2, 95% CI 1.2–2.2). Continuous data identified good effects on negative symptoms (four RCTs, n=240, SMD average endpoint SANS –0.74, 95% CI –1.00 to –0.47); general mental state (one RCT, n=69, SMD average endpoint PANSS –0.36, 95% CI –0.85 to 0.12; two RCTs, n=100, SMD average endpoint. BPRS –0.73, 95% CI –1.16 to –0.31); depression (two RCTs, n=90, SMD average endpoint. SDS –0.63, 95% CI –1.06 to –0.21; one RCT, n=30, SMD average endpoint Ham-D –0.52, 95% CI –1.25 to –0.12); and anxiety (one RCT, n=60, SMD average endpoint SAS –0.61, 95% CI –1.13 to –0.09). Positive effects were also found for social functioning (one RCT, n=70, SMD average endpoint. SDSI score –0.78, 95% CI –1.27 to –0.28). Furthermore, some aspects of cognitive functioning and behavior seem to develop positively through music therapy. Effects, however, were inconsistent across studies and depended on the number of music therapy sessions as well as the quality of music therapy provided.	Music therapy as an addition to standard care helps people with schizophrenia to improve their global state, mental state (including negative symptoms), and social functioning if a sufficient number of music therapy sessions are provided by qualified music therapists. Further research should especially address the long-term effects of music therapy, dose–response relationships, as well as the relevance of outcomes measures in relation to music therapy.

(*Continued*)

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
Bradt et al[19]	Music interventions for improving psychological and physical outcomes in cancer patients	To compare the effects of music therapy or music medicine interventions and standard care with standard care alone, or standard care and other interventions in patients with cancer.	We searched CENTRAL (The Cochrane Library 2010, Issue 10), MEDLINE, EMBASE, CINAHL, PsycINFO, LILACS, Science Citation Index, CancerLit, http://www.musictherapyworld.net, CAIRSS, Pro Quest Digital Dissertations, ClinicalTrials.gov, Current Controlled Trials, and the National Research Register. All databases were searched from their start date to September 2010. We handsearched music therapy journals and reference lists and contacted experts. There was no language restriction.	We included all RCTs and quasi-RCTs of music interventions for improving psychological and physical outcomes in patients with cancer. Participants undergoing biopsy and aspiration for diagnostic purposes were excluded.
Bradt and Dileo[20]	Music therapy for end-of-life care	To examine effects of music therapy with standard care versus standard care alone or standard care combined with other therapies on psychological, physiological, and social responses in end-of-life care.	We searched CENTRAL, MEDLINE, CINAHL, EMBASE, PsycINFO, LILACS, CancerLit, Science Citation Index, http://www.musictherapyworld.de, CAIRSS for Music, Pro Quest Digital Dissertations, ClinicalTrials.gov, Current Controlled Trials, and the National Research Register to September 2009. We handsearched music therapy journals and reference lists, and contacted experts to identify unpublished manuscripts. There was no language restriction.	We included all RCTs and quasi-RCTs that compared music interventions and standard care with standard care alone or combined with other therapies in any care setting with a diagnosis of advanced life-limiting illness being treated with palliative intent and with a life expectancy of less than 2 years.
Vink et al[21]	Music therapy for people with dementia	To assess the effects of music therapy in the treatment of behavioral, social, cognitive and emotional problems of older people with dementia, in relation to the type of music therapy intervention.	ALOIS, the specialized Register of the CDCIG was searched on April 14, 2010 using the terms: music therapy, music singing, sing, and auditory stimulation. Additional searches were also carried out on April 14, 2010 in the major health care databases MEDLINE, EMBASE, PsycINFO, CINAHL, and LILACS, trial registers and grey literature sources to ensure the search was as up-to-date and as comprehensive as possible.	Randomized controlled trials that reported clinically relevant outcomes associated with music therapy in treatment of behavioral, social, cognitive, and emotional problems of older people with dementia.

Data extraction/data collection and analysis	Main results	The authors' conclusions
Two review authors independently extracted the data and assessed the risk of bias. Where possible, results were presented in meta-analyses using MDs and SMDs. Post-test scores were used. In cases of significant baseline difference, we used change scores.	We included 30 trials with a total of 1,891 participants. We included music therapy interventions offered by trained music therapists, as well as listening to prerecorded music offered by medical staff. The results suggest that music interventions may have a beneficial effect on anxiety in people with cancer, with a reported average anxiety reduction of 11.20 units (95% CI −19.59 to −2.82, *P*=0.009) on the STAI-S scale and −0.61 standardized units, (95% CI −0.97 to −0.26, *P*=0.0007) on other anxiety scales. Results also suggested a positive impact on mood (SMD =0.42, 95% CI 0.03–0.81, *P*=0.03), but no support was found for depression. Music interventions may lead to small reductions in heart rate, respiratory rate, and blood pressure. A moderate pain-reducing effect was found (SMD =−0.59, 95% CI −0.92 to −0.27, *P*=0.0003), but no strong evidence was found for enhancement of fatigue or physical status. The pooled estimate of two trials suggested a beneficial effect of music therapy on patients' QoL (SMD =1.02, 95% CI 0.58–1.47, *P*=0.00001). No conclusions could be drawn regarding the effect of music interventions on distress, body image, oxygen saturation level, immunologic functioning, spirituality, and communication outcomes. Seventeen trials used listening to prerecorded music, and 13 trials used music therapy interventions that actively engaged the patients. Not all studies included the same outcomes, and due to the small number of studies per outcome, we could not compare the effectiveness of music medicine interventions with that of music therapy interventions.	This systematic review indicates that music interventions may have beneficial effects on anxiety, pain, mood, and QoL in people with cancer. Furthermore, music may have a small effect on heart rate, respiratory rate, and blood pressure. Most trials were at high risk of bias, and therefore, these results need to be interpreted with caution.
Data were extracted, and methodological quality was assessed, independently by review authors. Additional information was sought from study authors when necessary. Results are presented using weighted MDs for outcomes measured by the same scale and SMDs for outcomes measured by different scales. Post-test scores were used. In cases of statistically significant baseline difference, we used change scores.	Five studies (175 participants) were included. There is insufficient evidence of high quality to support the effect of music therapy on QoL of people in end-of-life care. Given the limited number of studies and small sample sizes, more research is needed. No strong evidence was found for the effect of music therapy on pain or anxiety. These results were based on two small studies. There were insufficient data to examine the effect of music therapy on other physical, psychological, or social outcomes.	A limited number of studies suggest there may be a benefit of music therapy on the QoL of people in end-of-life care. However, the results stem from studies with a high risk of bias. More research is needed.
Two reviewers screened the retrieved studies independently for methodological quality. Data from accepted studies were independently extracted by the reviewers.	Ten studies were included. The methodological quality of the studies was generally poor, and the study results could not be validated or pooled for further analyses.	The methodological quality and the reporting of the included studies were too poor to draw any useful conclusions.

(*Continued*)

Table 2 (*Continued*)

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
Bradt et al[22]	Music interventions for mechanically ventilated patients	To examine the effects of music interventions with standard care versus standard care alone on anxiety and physiological responses in mechanically ventilated patients.	We searched CENTRAL (The Cochrane Library 2010, Issue 1) MEDLINE, CINAHL, AMED, EMBASE, PsycINFO, LILACS, Science Citation Index, http://www.musictherapyworld.net, CAIRSS for Music, Pro Quest Digital Dissertations, ClinicalTrials.gov, Current Controlled Trials, the National Research Register, and NIH RePORTer (formerly CRISP) (all to January 2010). We handsearched music therapy journals and reference lists and contacted relevant experts to identify unpublished manuscripts. There was no language restriction.	We included all RCTs and quasi-RCTs that compared music interventions and standard care with standard care alone for mechanically ventilated patients.
Cepeda et al[23]	Music for pain relief	To evaluate the effects of music on acute, chronic, or cancer pain intensity, pain relief, and analgesic requirements.	We searched the Cochrane Library, MEDLINE, EMBASE, PsycINFO, LILACS, and the references in retrieved manuscripts. There was no language restriction.	We included RCTs that evaluated the effect of music on any type of pain in children or adults. We excluded trials that reported results of concurrent non-pharmacological therapies.
Bradt et al[24]	Music therapy for acquired brain injury	To examine the effects of music therapy with standard care versus standard care alone or standard care combined with other therapies on gait, upper extremity function, communication, mood and emotions, social skills, pain, behavioral outcomes, activities of daily living, and adverse events.	We searched the Cochrane Stroke Group Trials Register (February 2010), the Cochrane Central Register of Controlled Trials (the Cochrane Library Issue 2, 2009), MEDLINE (July 2009), EMBASE (August 2009), CINAHL (July 2010) PsycINFO (July 2009), LILACS (August 2009), AMED (August 2009), and Science Citation Index (August 2009). We handsearched music therapy journals and conference proceedings, searched dissertation and specialist music databases, trials and research reference lists, and contacted experts and music therapy associations. There was no language restriction.	RCTs and quasi-RCTs that compared music therapy interventions and standard care with standard care alone or combined with other therapies for people older than 16 years of age who had acquired brain damage of a non-degenerative nature and were participating in treatment programs offered in hospital, outpatient, or community settings.

Data extraction/data collection and analysis	Main results	The authors' conclusions
Two authors independently extracted the data and assessed the methodological quality. Additional information was sought from the trial researchers, when necessary. Results were presented using MDs for outcomes measured by the same scale and SMDs for outcomes measured by different scales. Post-test scores were used. In cases of significant baseline difference, we used change scores.	We included eight trials (213 participants). Listening to music was the main intervention used, and seven of the studies did not include a trained music therapist. Results indicated that listening to music may be beneficial for anxiety reduction in mechanically ventilated patients; however, these results need to be interpreted with caution due to the small sample size. Findings indicated that listening to music consistently reduced heart rate and respiratory rate, suggesting a relaxation response. No strong evidence was found for blood pressure reduction. Listening to music did not improve oxygen saturation level. No studies could be found that examined the effects of music interventions on QoL, patient satisfaction, post-discharge outcomes, mortality, or cost-effectiveness.	Listening to music may have a beneficial effect on heart rate, respiratory rate, and anxiety in mechanically ventilated patients. However, the quality of the evidence is not strong. Most studies examined the effects of listening to prerecorded music. More research is needed on the effects of music offered by a trained music therapist.
Data was extracted by two independent review authors. We calculated the MD in pain intensity levels, percentage of patients with at least 50% pain relief, and opioid requirements. We converted opioid consumption to morphine equivalents. To explore heterogeneity, studies that evaluated adults, children, acute, chronic, malignant, labor, procedural, or experimental pain were evaluated separately, as well as those studies in which patients chose the type of music.	Fifty-one studies involving 1,867 subjects exposed to music and 1,796 controls met inclusion criteria. In the 31 studies evaluating mean pain intensity there was a considerable variation in the effect of music, indicating statistical heterogeneity (I^2 =85.3%). After grouping the studies according to the pain model, this heterogeneity remained, with the exception of the studies that evaluated acute postoperative pain. In this last group, patients exposed to music had pain intensity that was 0.5 units lower on a 0–10 scale than unexposed subjects (95% CI –0.9 to –0.2). Studies that permitted patients to select the music did not reveal a benefit from music; the decline in pain intensity was 0.2 units, 95% CI (–0.7 to 0.2). Four studies reported the proportion of subjects with at least 50% pain relief; subjects exposed to music had a 70% higher likelihood of having pain relief than unexposed subjects (95% CI 1.21–2.37). NNT =5 (95% CI 4–13). Three studies evaluated opioid requirements two hours after surgery: subjects exposed to music required 1.0 mg (18.4%) less morphine (95% CI –2.0 to –0.2) than unexposed subjects. Five studies assessed requirements 24 hours after surgery: the music group required 5.7 mg (15.4%) less morphine than the unexposed group (95% CI -–8.8 to –2.6). Five studies evaluated requirements during painful procedures: the difference in requirements showed a trend towards favoring the music group (–0.7 mg, 95% CI –1.8 to 0.4).	Listening to music reduces pain intensity levels and opioid requirements, but the magnitude of these benefits is small and, therefore, its clinical importance unclear.
Two review authors independently assessed methodological quality and extracted data. We present results using MDs (using post-test scores), as all outcomes were measured with the same scale.	We included seven studies (184 participants). The results suggest that RAS may be beneficial for improving gait parameters in stroke patients, including gait velocity, cadence, stride length, and gait symmetry. These results were based on two studies that received a low risk of bias score. There were insufficient data to examine the effect of music therapy on other outcomes.	RAS may be beneficial for gait improvement in people with stroke. These results are encouraging, but more RCTs are needed before recommendations can be made for clinical practice. More research is needed to examine the effects of music therapy on other outcomes in people with acquired brain injury.

(*Continued*)

Table 2 (*Continued*)

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
Gold et al[25]	Music therapy for autistic spectrum disorder	To review the effects of music therapy for individuals with autistic spectrum disorders.	The following databases were searched: CENTRAL, 2005 (issue 3); MEDLINE (1966 to July 2004); EMBASE (1980 to July 2004); LILACS (1982 to July 2004); PsycINFO (1872 to July 2004); CINAHL, (1872 to July 2004); ERIC (1966 to July 2004); ASSIA (1987 to July 2004); Sociofile (1963 to July 2004); Dissertation Abstracts International (late 1960s to July 2004). These searches were supplemented by searching specific sources for music therapy literature and manual searches of reference lists. Personal contacts to some investigators were made.	All RCTs or controlled clinical trials comparing music therapy added to standard care to "placebo" therapy, no treatment, or standard care.
Laopaiboon et al[26]	Music during caesarean section under regional anesthesia for improving maternal and infant outcomes	To evaluate the effectiveness of music during cesarean section under regional anesthesia for improving clinical and psychological outcomes for mothers and infants.	We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (30 September 2008).	We included randomized controlled trials comparing music added to standard care during cesarean section under regional anesthesia to standard care alone.
Bradt and Dileo[27]	Music for stress and anxiety reduction in coronary heart disease patients	To examine the effects of music interventions with standard care versus standard care alone on psychological and physiological responses in persons with CHD.	We searched CENTRAL, MEDLINE, CINAHL, EMBASE, PsycINFO, LILACS, Science Citation Index, http://www.musictherapyworld.net, CAIRSS for Music, Pro Quest Digital Dissertations, ClinicalTrials.gov, Current Controlled Trials, and the National Research Register (all to May 2008). We handsearched music therapy journals and reference lists, and contacted relevant experts to identify unpublished manuscripts. There was no language restriction.	We included all RCTs that compared music interventions and standard care with standard care alone for persons with CHD.
Maratos et al[28]	Music therapy for depression	To examine the efficacy of music therapy with standard care compared with standard care alone among people with depression and to compare the effects of music therapy for people with depression against other psychological or pharmacological therapies.	CCDANCTR studies and CCDANCTR references were searched on November 7, 2007, and MEDLINE, PsycINFO, EMBASE, PsycLIT, PSYindex, and other relevant sites were searched in November 2006. Reference lists of retrieved articles were handsearched, as well as specialist music and arts therapies journals.	All RCTs comparing music therapy with standard care or other interventions for depression.

Data extraction/data collection and analysis	Main results	The authors' conclusions
Studies were independently selected, quality assessed, and data extracted by two authors. Continuous outcomes were synthesized using an SMD to enable a meta-analysis combining different scales, and to facilitate the interpretation of effect sizes. Heterogeneity was assessed using the I^2 statistic.	Three small studies were included (total n=24). These examined the short-term effect of brief music therapy interventions (daily sessions over 1 week) for autistic children. Music therapy was superior to "placebo" therapy with respect to verbal and gestural communicative skills (verbal, two RCTs, n=20, SMD 0.36, 95% CI 0.15–0.57; gestyrak, 2 RCTs, n=20, SMD 0.50, 95% CI 0.22–0.79). Effects on behavioral problems were not significant.	The included studies were of limited applicability to clinical practice. However, the findings indicate that music therapy may help children with autistic spectrum disorder to improve their communicative skills. More research is needed to examine whether the effects of music therapy are enduring, and to investigate the effects of music therapy in typical clinical practice.
Two review authors, Malinee Laopaiboon and Ruth Martis, independently assessed eligibility, risk of bias in included trials and extracted data. We analyzed continuous outcomes using an MD with a 95% CI.	One trial involving 76 women who planned to have their babies delivered by cesarean section met the inclusion criteria, but data were available for only 64 women. This trial was of low quality with unclear allocation concealment, and only a few main clinical outcomes reported for the women. The trial did not report any infant outcomes. It appears that music added to standard care during cesarean section under regional anesthesia had some impact on pulse rate at the end of maternal contact with the neonate in the intra-operative period (MD –7.50 fewer beats per minute, 95% CI 14.08 to –0.92) and after completion of skin suture for the cesarean section (MD –7.37 fewer beats per minute, 95% CI 13.37–1.37). There was also an improvement in the birth satisfaction score (maximum possible score of 35) (MD of 3.38, 95% CI 1.59–5.17). Effects on other outcomes were either not significant or not reported in the one included trial.	The findings indicate that music during planned cesarean section under regional anesthesia may improve pulse rate and birth satisfaction score. However, the magnitude of these benefits is small and the methodological quality of the one included trial is questionable. Therefore, the clinical significance of music is unclear. More research is needed to investigate the effects of music during cesarean section under regional anesthesia on both maternal and infant outcomes, in various ethnic pregnant women, and with adequate sample sizes.
Data were extracted and methodological quality was assessed, independently by the two reviewers. Additional information was sought from the trial researchers when necessary. Results are presented using weighted MDs for outcomes measured by the same scale and SMDs for outcomes measured by different scales. Post-test scores were used. In cases of significant baseline difference, we used change scores.	Twenty-three trials (1,461 participants) were included. Listening to music was the main intervention used, and 21 of the studies did not include a trained music therapist. Results indicated that listening to music has a moderate effect on anxiety in patients with CHD; however, results were inconsistent across studies. This review did not find strong evidence for reduction of psychological distress. Findings indicated that listening to music reduces heart rate, respiratory rate, and blood pressure. Studies that included two or more music sessions led to a small and consistent pain-reducing effect. No strong evidence was found for peripheral skin temperature. None of the studies considered hormone levels, and only one study considered QoL as an outcome variable.	Listening to music may have a beneficial effect on blood pressure, heart rate, respiratory rate, anxiety, and pain in persons with CHD. However, the quality of the evidence is not strong and the clinical significance unclear. Most studies examined the effects of listening to prerecorded music. More research is needed on the effect of music offered by a trained music therapist.
Data on participants, interventions, and outcomes were extracted and entered into a database independently by two review authors. The methodological quality of each study was also assessed independently by two review authors. The primary outcome was reduction in symptoms of depression, based on a continuous scale.	Five studies met the inclusion criteria of the review. Marked variations in the interventions offered and the populations studied meant that meta-analysis was not appropriate. Four of the five studies individually reported greater reduction in symptoms of depression among those randomized to music therapy than to those in standard care conditions. The fifth study, in which music therapy was used as an active control treatment, reported no significant change in mental state for music therapy compared with standard care. Dropout rates from music therapy conditions appeared to be low in all studies.	Findings from individual randomized trials suggest that music therapy is accepted by people with depression and is associated with improvements in mood. However, the small number and low methodological quality of studies mean that it is not possible to be confident about its effectiveness. High quality trials evaluating the effects of music therapy on depression are required.

(*Continued*)

Table 2 (*Continued*)

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
de Dreu et al[29]	Rehabilitation, exercise therapy and music in patients with Parkinson's disease: a meta-analysis of the effects of music-based movement therapy on walking ability, balance and quality of life	To study that people with PD benefit from MbM therapy when compared with conventional therapy or no therapy in terms of standing balance, transfers, gait performance, severity of freezing, and QoL.	We searched PubMed, EMBASE, Cochrane, CINAHL, and SPORTDiscus for articles published until 1st August, 2011.	The following selection criteria were applied: 1) people with PD were targeted, 2) the study was an RCT of high quality (PEDro score of >4), 3) the intervention contained MbM, and 4) the rhythmic cues were embedded in music.
Cogo-Moreira et al[30]	Music education for improving reading skills in children and adolescents with dyslexia	To study the effectiveness of music education on reading skills (ie, oral reading skills, reading comprehension, reading fluency, phonological awareness, and spelling) in children and adolescents with dyslexia.	We searched the following electronic databases in June 2012: CENTRAL (2012, Issue 5), MEDLINE (1948 to May week 4 2012), EMBASE (1980 to 2012 week 22), CINAHL (searched June 7, 2012), LILACS (searched June 7, 2012), PsycINFO (1887 to May week 5 2012), ERIC (searched June 7, 2012), Arts and Humanities Citation Index (1970 to 6 June 2012), Conference Proceedings Citation Index – Social Sciences and Humanities (1990 to June 2012), and WorldCat (searched June 7, 2012). We also searched the WHO ICTRP and reference lists of studies. We did not apply any date or language limits.	We planned to include RCTs. We looked for studies that included at least one of our primary outcomes. The primary outcomes were related to the main domain of reading: oral reading skills, reading comprehension, reading fluency, phonological awareness, and spelling measured through validated instruments. The secondary outcomes were self-esteem and academic achievement.
Drahota et al[31]	Sensory environment on health-related outcomes of hospital patients	To assess the effect of hospital environments on adult patient health-related outcomes.	We searched: CENTRAL (last searched January 2006); MEDLINE (1902 to December 2006); EMBASE (January 1980 to February 2006); 14 other databases covering health, psychology, and the built environment; reference lists; and organization websites. This review is currently ongoing (MEDLINE last search October 2010), see Studies awaiting classification.	RCTs and non-randomized controlled trials, before-and-after studies, and interrupted times series of environmental interventions in adult hospital patients reporting health-related outcomes.

Data extraction/data collection and analysis	Main results	The authors' conclusions
Two reviewers extracted relevant data from the included studies. A meta-analysis of RCTs on the efficacy of MbM therapy, including individual rhythmic music training and partnered dance classes, was performed. Identified studies (N=6) were evaluated on methodological quality, and SESs were calculated.	Studies were generally small (total N=168). Significant homogeneous SESs were found for the Berg Balance Scale, Timed Up and Go test, and stride length (SESs, 4.1, 2.2, and 0.11; *P*-values <0.01; I^2, 0%, 0%, and 7%, respectively). A sensitivity analysis on type of MbM therapy (dance- or gait-related interventions) revealed a significant improvement in walking velocity for gait-related MbM therapy but not for dance-related MbM therapy. No significant effects were found for UPDRS-motor score, freezing of gait, and QoL.	MbM therapy appears promising for the improvement of gait and gait-related activities in PD. Future studies should incorporate larger groups and focus on long-term compliance and follow-up.
Two authors (HCM and RBA) independently screened all titles and abstracts identified through the search strategy to determine their eligibility. For our analysis we had planned to use MD for continuous data, with 95% CIs, and to use the random-effects statistical model when the effect estimates of two or more studies could be combined in a meta-analysis.	We retrieved 851 references via the search strategy. No RCTs testing music education for the improvement of reading skills in children with dyslexia could be included in this review.	There is no evidence available from RCTs on which to base a judgment about the effectiveness of music education for the improvement of reading skills in children and adolescents with dyslexia. This uncertainty warrants further research via RCTs, involving an interdisciplinary team: musicians, hearing and speech therapists, psychologists, and physicians.
Two review authors independently undertook data extraction and "risk of bias" assessment. We contacted authors to obtain missing information. For continuous variables, we calculated an MD or SMD, and 95% CIs for each study. For dichotomous variables, we calculated RR with 95% CI. When appropriate, we used a random-effects model of meta-analysis. Heterogeneity was explored qualitatively and quantitatively based on risk of bias, case mix, hospital visit characteristics, and country of study.	Overall, 102 studies were included in this review. Interventions explored were: "positive distracters", to include aromas (two studies), audiovisual distractions (five studies), decoration (one study), and music (85 studies); interventions to reduce environmental stressors through physical changes, to include air quality (three studies), bedroom type (one study), flooring (two studies), furniture and furnishings (one study), lighting (one study), and temperature (one study); and multifaceted interventions (two studies). We did not find any studies meeting the inclusion criteria to evaluate: art, access to nature for example through hospital gardens, atriums, flowers, and plants, ceilings, interventions to reduce hospital noise, patient controls, technologies, way-finding aids, or the provision of windows. Overall, it appears that music may improve patient-reported outcomes such as anxiety; however, the benefit for physiological outcomes, and medication consumption has less support. There are few studies to support or refute the implementation of physical changes, and except for air quality, the included studies demonstrated that physical changes in the hospital environment at least did no harm.	Music may improve patient-reported outcomes in certain circumstances, so support for this relatively inexpensive intervention may be justified. For some environmental interventions, well designed research studies have yet to take place.

(*Continued*)

Table 2 (*Continued*)

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
Chan et al[32]	The effectiveness of music listening in reducing depressive symptoms in adults: a systematic review	To review trials of the effectiveness of listening to music in reducing depressive symptoms in adults, and identify areas requiring further study.	A comprehensive search strategy was employed to identify all published papers in English language between January 1989 and March 2010. We searched nine databases with initial search terms including "music", "depression", or "depressive symptoms".	We searched the published literature for RCTs and quasi-experimental trials that included an intervention with music listening designed to reduce the depression level, compared with a control group. The intervention was music listening, it is defined as listening to music via any form of music device or live music, without the active involvement of a music therapist.
Naylor et al[33]	The effectiveness of music in pediatric healthcare: a systematic review of randomized controlled trials	To systematically review the effectiveness of music on pediatric health-related outcomes.	The following international electronic databases were searched on March 4, 2009: Ovid Medline (Medical Literature Analysis and Retrieval System Online), 1950 to February, week 3, 2009; EMBASE, 1980–2009 week 9; PsycINFO, 1967 to February, week 4, 2009; AMED (Allied and Complementary Medicine), 1985–February 2009; and CINAHL, 1983–2008.	Studies were included if they met the following six criteria: 1) examined the effectiveness of a music intervention; 2) involved a clinical population in a health care, research, or education setting; 3) involved children and adolescents between 1 and 18 years of age (or reported a mean age within this range); 4) used an RCT design (parallel or crossover); 5) reported at least one quantifiable outcome measure; and 6) was published between 1984 and 2009.
Irons et al[34]	Singing for children and adults with cystic fibrosis	To evaluate the effects of a singing intervention in addition to usual therapy on the QoL, morbidity, respiratory muscle strength, and pulmonary function of children and adults with cystic fibrosis.	We searched the Group's Cystic Fibrosis Trials Register, the CENTRAL, major allied complementary databases, and clinical trial registers. Handsearching for relevant conference proceedings and journals was also carried out. Date of search of trials register: September 2, 2009. Date of additional searches: September 17, 2009.	RCTs in which singing (as an adjunctive intervention) is compared with either a sham intervention or no singing in people with cystic fibrosis.
Irons et al[35]	Singing for children and adults with bronchiectasis	To evaluate the effects of a singing intervention as a therapy on the QoL, morbidity, respiratory muscle strength, and pulmonary function of children and adults with bronchiectasis.	We searched the CAG trial register, CENTRAL, major allied complementary databases, and clinical trials registers. Professional organizations and individuals were also contacted. CAG performed searches in February 2011, and additional searches were carried out in February 2011.	RCTs in which singing (as an intervention) is compared with either a sham intervention or no singing in patients with bronchiectasis.
de Niet et al[36]	Music-assisted relaxation to improve sleep quality: meta-analysis	To evaluate the efficacy of music-assisted relaxation for sleep quality in adults and elders with sleep complaints with or without a comorbid medical condition.	We conducted searches in EMBASE (1997–July 2008), Medline (1950–July 2008), Cochrane (2000–July 2008), PsycINFO (1987–July 2008) and CINAHL (1982–July 2008) for studies published in English, German, French, or Dutch.	We included published RCTs performed in an adult (18–60 years) or elderly (60 years or older) population with primary sleep complaints or sleep complaints comorbid with a medical condition. Studies involving active use of music, such as playing instruments, were excluded.

Data extraction/data collection and analysis	Main results	The authors' conclusions
The data extracted included specific details about the interventions, populations, study methods, and outcomes of significance to the review question and specific objectives. Two studies were pooled together for meta-analysis due to similarity in outcome measures and intervention time points.	Listening to music over a period of time helps to reduce depressive symptoms in the adult population. Daily intervention does not seem to be superior over weekly intervention, and it is recommended that music listening sessions be conducted repeatedly over a time span of more than 3 weeks to allow an accumulative effect to occur.	All types of music can be used as listening material, depending on the preferences of the listener. It is recommended that the listeners are given choices over the kind of music they listen to. There is a need to conduct more studies, which replicate the designs used in the existing studies that met the inclusion criteria, on the level of efficacy of music listening and on the reduction of depressive symptoms for a more accurate meta-analysis of the findings and which would reflect with greater accuracy the significant effects that music has on the level of depressive symptoms.
Data extraction includes information about each study (authorship, year of publication, country, recruitment setting, and experimental design), participants (sample size, sex, population, and age), intervention (treatment, delivery, participant involvement, and dosage), and quality rating. Because of heterogeneity in the study populations, interventions used, and outcome measures applied, it was neither feasible nor appropriate to conduct a meta-analysis.	Qualitative synthesis revealed significant improvements in one or more health outcomes within four of seven trials involving children with learning and developmental disorders; two of three trials involving children experiencing stressful life events; and four of five trials involving children with acute and/or chronic physical illness. No significant effects were found for two trials involving children with mood disorders and related psychopathology.	These findings offer limited qualitative evidence to support the effectiveness of music on health-related outcomes for children and adolescents with clinical diagnoses. Recommendations for establishing a consensus on research priorities and addressing methodological limitations are put forth to support the continued advancement of this popular intervention.
No trials were found that met the selection criteria.	No meta-analysis could be performed.	As no studies that met the criteria were found, this review is unable to support or refute the benefits of singing as a therapy for people with cystic fibrosis. Future RCTs are required to evaluate singing therapy for people with cystic fibrosis.
Two authors independently reviewed the titles, abstracts, and citations to assess potential relevance for full review. No eligible trials were identified and thus no data were available for analysis.	No meta-analysis could be performed.	In the absence of data, we cannot draw any conclusion to support or refute the adoption of singing as an intervention for people with bronchiectasis. Given the simplicity of the potentially beneficial intervention, future RCTs are required to evaluate singing therapy for people with bronchiectasis.
Pre and post-test means and standard deviations, demographic data, and condition properties were extracted from each included study. Review Manager 5.0.12 (The Cochrane Collaboration, Oxford, UK) was used to calculate the effect sizes of the individual studies and for calculation of the pooled MD.	Five RCTs with six treatment conditions and a total of 170 participants in intervention groups and 138 controls met our inclusion criteria. Music-assisted relaxation had a moderate effect on the sleep quality of patients with sleep complaints (SMD –0.74; 95% CI –0.96 to –0.46). Subgroup analysis revealed no statistically significant contribution of accompanying measures.	Music-assisted relaxation can be used without intensive investment in training and materials and is therefore cheap, easily available, and can be used by nurses to promote music-assisted relaxation to improve sleep quality.

(*Continued*)

Table 2 (*Continued*)

Study	Title	Aim/objective	Data source/search strategy	Study selection/ selection criteria
Gold et al[37]	Dose–response relationship in music therapy for people with serious mental disorders: systematic review and meta-analysis	To examine the benefits of music therapy for people with serious mental disorders.	A comprehensive search strategy was applied to identify all relevant studies. The trial database PsiTri, which contains structured information on published and unpublished clinical trials in mental health, based on multiple database searches as well as handsearches by several Cochrane groups, was searched for entries containing the word "music" in any field. PubMed was searched using its "Clinical Queries" search strategy designed to identify scientifically strong studies of therapy outcome, which was expanded with the MeSH term "Evaluation Studies", and crossed with the MeSH terms "Music Therapy" and "Mentally Ill Persons" or "Mental Disorders".	Study participants eligible for this review were adults with serious mental disorders diagnosed by an international classification system. This included psychotic disorders as well as some non-psychotic disorders such as borderline personality disorder, depression, bipolar disorder, and suicidality connected to a mental disorder. Studies were included only if participants were offered music therapy, according to the definition above. Most importantly, this excluded interventions of the "music medicine" type, where music alone is provided as a treatment, rather than using music as a medium within a psychotherapeutic process and relationship. Secondly, it had to be possible to disentangle music therapy from other therapies.

Abbreviations: ASSIA, Applied Social Sciences Index and Abstracts; BPRS, Brief Psychiatric Rating Scale; CAG, Cochrane Airways Group; CAIRSS, Computer-Assisted Information Retrieval System; CCDANCTR, Cochrane Collaboration Depression, Anxiety and Neurosis Controlled Trials Register; CDCIG, Cochrane Dementia and Cognitive Improvement Group; CENTRAL, Cochrane Central Register of Controlled Trials; CHD, coronary heart disease; CI, confidence interval; CINAHL, Cumulative Index of Nursing and Allied Health Literature; ERIC, Education Resource Information Centre; Ham-D, Hamilton Depression Scale; ICTRP, International Clinical Trials Registry Platform; LILACS, Latin American and Caribbean Health Sciences Literature; MbM, music-based movement; MD, mean difference; MeSH, Medical Subject Headings; NIH, National Institutes of Health; NNT, number needed to treat; PANSS, Positive and Negative Symptoms Scale; PD, Parkinson's disease; PEDro, Physiotherapy Evidence Database; QoL, quality of life; RAS, rhythmic auditory stimulation; RCT, randomized controlled trial; RR, risk ratio; SANS, Scale for the Assessment of Negative Symptoms; SDS, Self-rating Depression Scale; SDSI, Social Disability Schedule for Inpatients; SES, summary effect size; SMD, standardized mean difference; STAI-S, State-Trait Anxiety Inventory – State; UPDRS, Unified Parkinson's Disease Rating Scale; WHO, World Health Organization.

Research protocol registration

We submitted and registered our research protocol to the PROSPERO (no 42012002950). PROSPERO is an international database of prospectively registered SRs in health and social care.[15] Key features from the review protocol are recorded and maintained as a permanent record in PROSPERO. This provides a comprehensive listing of SRs registered at inception, and enables comparison of reported review findings with what was planned in the protocol. PROSPERO is managed by UK Centre for Reviews and Dissemination (CRD) and funded by the UK National Institute for Health Research. Registration was recommended because it encourage full publication of the review's findings and transparency in changes to methods that could bias findings.[16]

Results

Study selection

The literature searches included potentially relevant articles (Figure 1). Abstracts from those articles were assessed, and 63 papers were retrieved for further evaluation (checks for relevant literature). Forty-two publications were excluded because they did not meet the eligibility criteria (Table S1). A total of 21 studies[17–37] met all inclusion criteria (Table 1). The language of all eligible publications was English.

Study characteristics

The contents of all articles were summarized as structured abstracts (Table 2). Sinha et al[17] reported that there was no evidence that auditory integration therapy or other sound therapies are effective as treatments for autism spectrum disorders. Mossler et al[18] concluded that MT as an addition to standard care helps people with schizophrenia to improve their global state, mental state (including negative symptoms), and social functioning if a sufficient number of MT sessions are provided by qualified music therapists. Bradt et al[19] indicated that music interventions may have beneficial effects on anxiety, pain, mood, and quality of life (QoL) in people with cancer. Bradt and Dileo[20] reported that there may be a benefit of MT on QoL

Data extraction/data collection and analysis	Main results	The authors' conclusions
Results for the same type of outcome were combined across studies in a meta-analysis. Results of different outcomes were not combined. If the same outcome was measured with different scales in the same study, both using equally valid methods (in terms of rater blinding and standardization and validity of instrument), the average effect size of these measures was used.	Results showed that music therapy, when added to standard care, has strong and significant effects on global state, general symptoms, negative symptoms, depression, anxiety, functioning, and musical engagement. Significant dose–effect relationships were identified for general, negative, and depressive symptoms, as well as functioning, with explained variance ranging from 73% to 78%. Small effect sizes for these outcomes are achieved after 3–10, large effects after 16–51 sessions.	The findings suggest that music therapy is an effective treatment which helps people with psychotic and non-psychotic severe mental disorders to improve global state, symptoms, and functioning. Slight improvements can be seen with a few therapy sessions, but longer courses or more frequent sessions are needed to achieve more substantial benefits.

of people in end-of-life care. Vink et al[21] reported that the methodological quality and the reporting of the included studies on dementia were too poor to draw any useful conclusions. Bradt et al[22] indicated that listening to music may have a beneficial effect on heart rate, respiratory rate, and anxiety in mechanically ventilated patients. Cepeda et al[23] reported that listening to music reduces pain intensity levels and opioid requirements on patients with chronic, acute, neuropathic, and cancer pain or experimental pain, but the magnitude of these benefits is small and therefore its clinical importance unclear. Bradt et al[24] reported that rhythmic auditory stimulation might be beneficial for gait improvement in people with stroke. Gold et al[25] indicated that MT may help children with autistic spectrum disorder to improve their communicative skills. Laopaiboon et al[26] indicated that music during planned cesarean section under regional anesthesia may improve pulse rate and birth satisfaction score. Bradt and Dileo[27] reported that listening to music may have a beneficial effect on blood pressure, heart rate, respiratory rate, anxiety, and pain in persons with coronary heart disease. Maratos et al[28] suggested that MT is accepted by people with depression and is associated with improvements in mood, but the small number and low methodological quality of studies meant that it is not possible to be confident about its effectiveness. de Dreu et al[29] reported that music-based movement therapy appeared promising for the improvement of gait and gait-related activities in Parkinson's disease. Cogo-Moreira et al[30] concluded that there is no evidence available on which to base a judgment about the effectiveness of music education for the improvement of reading skills in children and adolescents with dyslexia. Drahota et al[31] reported that music may improve patient-reported outcomes in certain circumstances such as anxiety for hospital patients. Chan et al[32] concluded that listening to music over a period of time helps to reduce depressive symptoms in the adult population. Naylor et al[33] reported that there is limited qualitative evidence to support the effectiveness of music on health-related outcomes for children and adolescents with clinical diagnoses. Irons et al[34] concluded that because no studies that met the criteria were found, their

review was unable to support or refute the benefits of singing as a therapy for people with cystic fibrosis. Irons et al[35] reported that they could not draw any conclusion to support or refute the adoption of singing as an intervention for people with bronchiectasis because of the absence of data. de Niet et al[36] concluded that music-assisted relaxation could be without intensive investment in training and materials and is therefore cheap, easily available and can be used by nurses to promote music-assisted relaxation to improve sleep quality. Gold et al[37] reported that MT is an effective treatment which helps people with psychotic and nonpsychotic severe mental disorders to improve global state, symptoms, and functioning.

Based on ICD-10, we identified a disease targeted in each article (Table 3). Among 21 studies, eight studies were about "Mental and behavioural disorders (F00-99)". There were two studies in "Diseases of the nervous system (G00-99)" and "Diseases of the respiratory system (J00-99)", and one study in "Endocrine, nutritional and metabolic diseases (E00-90)", "Diseases of the circulatory system (I00-99)", and "Pregnancy, childbirth and the puerperium (O60)". Because there were a variety of target diseases, there were six articles in which we could not identify a single disease.

Evidence of effectiveness

Table 4 presents a brief summary of 21 SRs. Five studies (ie, schizophrenia for global and mental state and social functioning,[18] Parkinson's disease for gait and related activities,[29] depressive symptoms,[32] sleep quality,[36] and serious mental disorders for global and social functioning[37]) concluded that there are effects of the intervention.

Ten studies with a meta-analysis (ie, cancer for anxiety, pain, mood, and QoL,[19] advanced life-limiting illness for QoL,[20] mechanically ventilated patients for heart rate, respiratory rate, and anxiety,[22] multiple pain for intensity level and opioid requirement,[23] acquired brain injury for gait parameters,[24] autistic spectrum disorders for communicative skills,[25] cesarean section for heart rate and birth satisfaction,[26] coronary heart disease for blood pressure,

Table 3 International classification of target diseases in each article

Chapter	ICD code	Classification	Study (detail ICD code)
1	A00–B99	Certain infectious and parasitic diseases	
2	C00–D48	Neoplasms	Bradt et al[19] (unidentification about neoplasm type)
3	D50–D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	
4	E00–E90	Endocrine, nutritional and metabolic diseases	Irons et al[34] (E84.9)
5	F00–F99	Mental and behavioral disorders	Sinha et al[17] and Gold et al[25] (F84.0); Mossler et al[18] (F21, F22); Vink et al[21] (F00–03); Maratos et al[28] (F30–33); Cogo-Moreira et al[30] (F81.0); Chan et al[32] (F30–33); and de Niet et al[36] (G47)
6	G00–G99	Diseases of the nervous system	Bradt et al[24] (G46) and de Dreu et al[29] (G20–21)
7	H00–H59	Diseases of the eye and adnexa	
8	H60–H95	Diseases of the ear and mastoid process	
9	I00–I99	Diseases of the circulatory system	Bradt and Dileo[27] (I20–25)
10	J00–J99	Diseases of the respiratory system	Bradt et al[22] (J44) and Irons et al[35] (J47)
11	K00–K93	Diseases of the digestive system	
12	L00–L99	Diseases of the skin and subcutaneous tissue	
13	M00–M99	Diseases of the musculoskeletal system and connective tissue	
14	N00–N99	Diseases of the genitourinary system	
15	O00–O99	Pregnancy, childbirth and the puerperium	Laopaiboon et al[26] (O60)
16	P00–P96	Certain conditions originating in the perinatal period	
17	Q00–Q99	Congenital malformations, deformations and chromosomal abnormalities	
18	R00–R99	Symptoms, signs and abnormal clinical and laboratory finding not elsewhere classified	
19	S00–T98	Injury, positioning and certain other consequences of external causes	
20	V00–Y98	External causes of morbidity and mortality	
21	Z00–Z99	Factors influencing health status and contact with health services	
22	U00–U99	Code for special purpose	
–	Unidentification	Because many illnesses were mixed, we could not identify it	Bradt and Dileo,[20] Cepeda et al,[23] Drahota et al,[31] Naylor et al,[33] and Gold et al[37]

Abbreviation: ICD, International Classification of Diseases.

Table 4 Brief summary of 21 systematic reviews

Study	Published year	Intervention type	Meta-analysis	Object disease or symptom	Having effect or not	Adverse events
Sinha et al[17]	2011	Auditory integration therapy and other sound therapies that involved listening to music modified by filtering (attenuating sounds at selected frequencies) and modulating (random alternating high and low sound)	Not performed	Autism spectrum disorders	Unclear	No study reported specific deterioration.
Mossler et al[18]	2011	Music therapy (a systematic process of intervention wherein the therapist helps the client to promote health, using music experiences and the relationships that develop through them as dynamic forces of change)	Performed	Schizophrenia and schizophrenia-like disorders	Effective; improving their global state, mental state (including negative symptoms), and social functioning	No study reported specific deterioration.
Bradt et al[19]	2011	All types of music therapy or music medicine	Performed	Cancer	May be effective; improving anxiety, pain, mood, and QoL	No study reported specific deterioration.
Bradt and Dileo[20]	2010	All types of music therapy or music medicine	Performed	Advanced life-limiting illness	May be effective; improving QoL	No study reported specific deterioration.
Vink et al[21]	2003	All types of music therapy or music medicine	Performed	Dementia	Unclear	No study reported specific deterioration.
Bradt et al[22]	2010	All types of music therapy or music medicine	Performed	Mechanically ventilated patients	May be effective; improving heart rate, respiratory rate, and anxiety	No study reported specific deterioration.
Cepeda et al[23]	2006	Listening to music (as defined by the investigator)	Performed	Acute, chronic, neuropathic, cancer, or experimental pain	May be effective; reducing pain intensity levels and opioid requirements	No study reported specific deterioration.
Bradt et al[24]	2010	All types of music therapy or music medicine	Performed	Acquired brain injury	May be effective; improving gait parameters	No study reported specific deterioration.
Gold et al[25]	2006	Music therapy delivered by a professional	Performed	Autistic spectrum disorders in children	May be effective; improving communicative skills	No study reported specific deterioration.
Laopaiboon et al[26]	2009	All types of music therapy or music medicine	Performed	Cesarean section	May be effective; improving heart rate and birth satisfaction score	No study reported specific deterioration.
Bradt and Dileo[27]	2009	Any form of participation in music (eg, listening to music, singing, and playing music)	Performed	Coronary heart disease	May be effective; improving blood pressure, heart rate, respiratory rate, anxiety, and pain	No study reported specific deterioration.
Maratos et al[28]	2008	Music therapy provided by a certificated professional	Not performed	Depression	May be effective; accepted by people with depression and improving mood	No study reported specific deterioration.
de Dreu et al[29]	2012	Music-based movement therapy (the form of individual gait training or in a group, partnered dance)	Performed	Parkinson's disease	Effective; improving gait and gait-related activities	No study reported specific deterioration.
Cogo-Moreira et al[30]	2012	Music education (individual or group music lessons or musical training)	No studies	Dyslexia	No evidence	Non-information due to no studies included in the review
Drahota et al[31]	2012	Music listening	Performed	Hospital patients	May be effective; improving patient-reported outcomes such as anxiety	No study reported specific deterioration.

(*Continued*)

Table 4 (*Continued*)

Study	Published year	Intervention type	Meta-analysis	Object disease or symptom	Having effect or not	Adverse events
Chan et al[32]	2011	Listening to music via any form of music device or live music, without the active involvement of a music therapist	Performed	Depressive symptoms	Effective; reducing depressive symptoms	No study reported specific deterioration.
Naylor et al[33]	2011	Music as an intervention or therapy, regardless of delivery mode (ie, by a trained music therapist)	Performed	Various clinical condition	May be effective; improving health outcomes in children with learning and developmental disorder	No study reported specific deterioration.
Irons et al[34]	2010	All types of music therapy or music medicine	No studies	Cystic fibrosis	No evidence	Non information due to no studies included in the review
Irons et al[35]	2010	All types of singing programs	No studies	Bronchiectasis	No evidence	Non information due to no studies included in the review
de Niet et al[36]	2009	Listening to music (CD/DVD)	Performed	Sleep complaints	Effective; improving sleep quality	No study reported specific deterioration.
Gold et al[37]	2009	Music therapy (a systematic process of intervention wherein the therapist helps the client to promote health, using music experiences and the relationships that develop through them as dynamic forces of change)	Performed	Serious mental disorders	Effective; improve global state, symptoms, and functioning	No study reported specific deterioration.

Abbreviation: QoL, quality of life

heart rate, respiratory rate, anxiety, and pain,[27] hospital patients for self-reported outcomes such as anxiety,[31] and various clinical conditions for health outcomes in children with learning and developmental disorder[33]) concluded that there might be an effect of the intervention. An SR without a meta-analysis of depression reported that there might be an effect of the intervention.[28]

Two studies (ie, autism spectrum[17] and dementia[21]) described that the effect of intervention is unclear. There was no evidence for three studies (ie, dyslexia,[30] cystic fibrosis,[34] and bronchiectasis[35]) because they were not RCTs.

Adverse events

There were no specific adverse events in any of the studies.

Quality assessment

We evaluated eleven items from the AMSTAR checklist in more detail (Table 5). Inter-rater reliability metrics for the quality assessment indicated substantial agreement for all 231 items (percentage agreement 95.3% and κ=0.825). As a whole, the quality of the articles was very good.

Discussion

This is the first SR of SRs of the effectiveness of cure based on music interventions in studies with RCT designs. Our study is unique because it summarized the evidence for each target disease according to ICD-10 classification. We assume that this study will be helpful to researchers who want to grasp an effect of MT comprehensively and could provide information that is indispensable for the organization that is going to make the guidelines according to each disease.

Twenty-one SRs based on RCTs were identified, and music intervention was clearly effective for five diseases (ie, schizophrenia for global and mental state and social functioning, Parkinson's disease for gait and related activities, depressive symptoms, sleep quality, and serious mental disorders for global and social functioning).

A review of all SRs showed that there was no special adverse effect or harm associated with MT.

Tendency of target disease and outcome

The most commonly reported target diseases were "Mental and behavioural disorders (F00-99)",[17,18,21,25,28,30,32,36] and the effect of MT on these diseases was improved mental health (eg, anxiety and mood), pain, QoL, and communication skills. The main reason given in these articles for improved mental health was that the beauty and rhythm of the music tone allowed the

Table 5 AMSTAR is a measurement tool created to assess the methodological quality of systematic reviews

	Total evaluation	N (%)
1. Was an "a priori" design provided? The research question and inclusion criteria should be established before the conduct of the review.	☐ Yes	20 (95%)
	☐ No	0 (0%)
	☐ Can't answer	1 (5%)
	☐ Not applicable	0 (0%)
2. Was there duplicate study selection and data extraction? There should be at least two independent data extractors and a consensus procedure for disagreements should be in place.	☐ Yes	21 (100%)
	☐ No	0 (0%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	0 (0%)
3. Was a comprehensive literature search performed? At least two electronic sources should be searched. The report must include years and databases used (eg, CENTRAL, EMBASE, and MEDLINE). Keywords and/or MeSH terms must be stated and where feasible the search strategy should be provided. All searches should be supplemented by consulting current contents, reviews, textbooks, specialized registers, or experts in the particular field of study, and by reviewing the references in the studies found.	☐ Yes	21 (100%)
	☐ No	0 (0%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	0 (0%)
4. Was the status of publication (ie, grey literature) used as an inclusion criterion? The authors should state that they searched for reports regardless of their publication type. The authors should state whether or not they excluded any reports (from the systematic review), based on their publication status, language etc.	☐ Yes	14 (67%)
	☐ No	6 (28%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	1 (5%)
5. Was a list of studies (included and excluded) provided? A list of included and excluded studies should be provided.	☐ Yes	17 (81%)
	☐ No	4 (19%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	0 (0%)
6. Were the characteristics of the included studies provided? In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all the studies analyzed, eg, age, race, sex, relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.	☐ Yes	18 (85%)
	☐ No	1 (5%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	2 (10%)
7. Was the scientific quality of the included studies assessed and documented? "A priori" methods of assessment should be provided (eg, for effectiveness studies if the author(s) chose to include only randomized, double-blind, placebo controlled studies, or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant.	☐ Yes	19 (90%)
	☐ No	0 (0%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	2 (10%)
8. Was the scientific quality of the included studies used appropriately in formulating conclusions? The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.	☐ Yes	18 (85%)
	☐ No	2 (10%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	1 (5%)
9. Were the methods used to combine the findings of studies appropriate? For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (ie, chi-squared test for homogeneity, I^2). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (ie, is it sensible to combine?).	☐ Yes	16 (76%)
	☐ No	0 (0%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	5 (24%)
10. Was the likelihood of publication bias assessed? An assessment of publication bias should include a combination of graphical aids (eg, funnel plot, other available tests) and/or statistical tests (eg, Egger regression test).	☐ Yes	15 (71%)
	☐ No	0 (0%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	6 (29%)
11. Was the conflict of interest stated? Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.	☐ Yes	20 (95%)
	☐ No	0 (0%)
	☐ Can't answer	0 (0%)
	☐ Not applicable	1 (5%)

Abbreviations: CENTRAL, Cochrane Central Register of Controlled Trials; MeSH, Medical Subject Headings; Can't, can not.

patient to be comfortable. In studies about the effects of MT on anxiety, discomfort, fear, and pain, MT has been variably applied as an accessory treatment for persons with addictions,[6] and as evasion of direct discomfort for undergoing medical device procedures such as colonoscopy,[8] colposcopy[9] and dental procedures.[7]

The second most frequently reported target diseases were "Diseases of the nervous system (G00-99)",[24,29] and the effects of MT on these diseases showed commonly gait parameters. MT is expected to improve gait and related activities such as rehabilitation in diseases of the central nervous system. There were also several

studies that identified "Diseases of the respiratory system (J00-99)."[22,35] Improvements seen in these studies were mainly due to effects of singing on breathing function, such as respiratory rate, and on the circulation function, such as heart rate.

Validity of overall evidence based on quality assessment

We performed an evaluation of all SRs by the AMSTAR checklist developed to assess the methodological quality of SRs. There were no serious problems with the conduct and reporting of all target studies. This study included 16 Cochrane Reviews.[17–28,30,31,34,35] In the Cochrane Reviews, the eligibility criteria for a meta-analysis are strict, and for each article, heterogeneity and low quality of reporting are to first be excluded. Therefore, we assumed that the conclusion of each SR had enough validity.

Overall evidence

Most importantly, a specific adverse effect or harmful phenomenon did not occur in any study, and MT was well tolerated by almost all patients. MT treatment has positive effects for the following: schizophrenia and/or serious mental disorders for global and social functioning, Parkinson's disease for gait and related activities, depressive symptoms, and sleep quality. We assume that the direct effects of MT are generally improvement of mental health and sense of rhythm, and reduction of pain. In addition, we assume that communication with other people improves through music, the sense of isolation disappears, and QoL rises.

Although further accumulation of RCT data is necessary, MT may be effective treatment for the following diseases and symptoms: cancer and/or advanced life-limiting illnesses affecting mental state and QoL, mechanically ventilated patients with impaired respiratory function and mental state, chronic pain requiring opioid treatment, acquired brain injury affecting gait parameters, autistic spectrum disorders involving communicative skills, cesarean section effects on heart rate and birth satisfaction, coronary heart disease effects on circulatory, respiratory function, and mental state, and self-reported outcomes for hospitalized patients and other patients with various clinical conditions. These SRs describe the need for additional high quality RCTs to assess the effect of MT.

Future research agenda to build evidence

Table 6 shows the future research agenda for studies on the treatment effect of MT. Because only SRs of RCTs were included in this study, their characteristic study designs limited our results to the assessment of short-term effects. Even if a study is not an RCT design, it is necessary to evaluate the long-term effects.

Table 6 Future research agenda to build evidence of music therapy

Item
1. Long-term effect
2. Consensus of the intervention framework such as type, frequency, time for each disease*
3. Dose–response relationship
4. Description of cost
5. Development of the original checklist for music therapy**

Notes: *Reporting guidelines for intervention on each disease; **reporting guideline for research methodology on study plan, implementation, and description.

Because studies of intervention using music vary in design, a consensus of the framework is necessary.[10] In this study, examination according to a detailed intervention method was not possible, but it would be important for future studies to define MT. Furthermore, studies to assess dose–response relationships according to each disease are clearly necessary.[18]

Bowen et al[38] suggested that public health is moving toward the goal of implementing evidence-based intervention. However, the feasibility of possible interventions and whether comprehensive and multilevel evaluations are needed to justify them must be determined. It is at least necessary to show the cost of such interventions. We must introduce an interventional method based on its cost-benefit, cost-effectiveness, and cost-utility.

In addition, MT as an intervention is unique and completely different than pharmacological or traditional rehabilitation methods. Therefore, it may be necessary to add some original items like herbal intervention,[39] aquatic exercise,[40] and balneotherapy[41] to the CONSORT 2010 checklist as alternative or complementary medicines.

Strength and limitations

This review has several strengths: 1) the methods and implementation registered high on the PROSPERO database; 2) it was a comprehensive search strategy across multiple databases with no data restrictions; 3) there were high agreement levels for quality assessment of articles; and 4) it involved detailed data extraction to allow for collecting all articles' content into a recommended structured abstract.

This review also had several limitations that should be acknowledged. Firstly, some selection criteria were common across studies, as described above; however, bias

remained due to differences in eligibility for participation in each original RCT. Secondly, publication bias was a limitation. Although there was no linguistic restriction in the eligibility criteria, we searched studies with only English and Japanese keywords. Thirdly, in order to be specific to SRs based on RCTs, it ignores some excellent results of primary research by other research designs. Fourthly, as a point of terminology for MT, because we applied a broad definition to the use of music in medicine, it may be more confusing or a bit misleading in the cultural context of Western health care.

In addition, since this review focused on summaries of effects of MT for each disease, we did not describe all details on quality and quantity such as type of MT, frequency of MT, and time on MT. Moreover, we could not follow standard procedures as estimates of the effects of moderating variables. Finally, because we broadly defined MT as music appreciation, musical instrument performance, and singing, we could not assess a specific intervention.

Conclusion

This comprehensive summary of SRs demonstrates that MT treatment improved the following: global and social functioning in schizophrenia and/or serious mental disorders, gait and related activities in Parkinson's disease, depressive symptoms, and sleep quality. MT may have the potential for improving other diseases, but there is not enough evidence at present. Most importantly, a specific adverse effect or harmful phenomenon did not occur in any of the studies, and MT was well tolerated by almost all patients.

To most effectively assess the potential benefits of MT, it will be important for future research to explore 1) long-term effects, 2) a consensus of the framework of music intervention, 3) dose–response relationships, 4) the cost of the intervention, and 5) development of the original check item in MT.

Acknowledgments

We would like to express our appreciation to Ms Aya Maruyama (methodology of MT), Ms Rie Higashino, Ms Yoko Ikezaki, Ms Rinako Kai (paperwork), and Ms Satoko Sayama and Ms Mari Makishi (all searches of studies) for their assistance in this study.

Author contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. All authors took part in drafting the article or revising it critically for important intellectual content.

Ethical approval

No ethical approval was required.

Data sharing

No additional data are available.

Funding

This study was supported by the Health and Labour Sciences Research Grants (Research on Health Security Control ID No H24-021; representative Dr K Tsutani) from the Japanese Ministry of Health, Labour and Welfare of Japan in 2012.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Ostermann T, Schmid W. Music therapy in the treatment of multiple sclerosis: a comprehensive literature review. *Expert Rev Neurother*. 2006;6:469–477.
2. Gold C, Voracek M, Wigram T. Effects of music therapy for children and adolescents with psychopathology: a meta-analysis. *J Child Psychol Psychiatry*. 2004;45:1054–1063.
3. Hurkmans J, de Bruijn M, Boonstra AM, et al. Music in the treatment of neurological language and speech disorder: a systematic review. *Aphasiology*. 2012;26:1–19.
4. Standley J. Music therapy research in the NICU: an updated meta-analysis. *Neonatal Network*. 2012;31:311–316.
5. Nilsson U. The anxiety- and pain-reducing effects of music interventions: a systematic review. *AORN J*. 2008;87:780–807.
6. Mays KL, Clark DL, Gordon AJ. Treating addiction with tunes: a systematic review of music therapy for the treatment of patients with addictions. *Substance Abuse*. 2008;29:51–59.
7. Klassen JA, Liang Y, Tjosvold L, Klassen TP, Hartling L. Music for pain and anxiety in children undergoing medical procedures: a systematic review of randomized controlled trials. *Ambul Pediatr*. 2008;8:117–128.
8. Tam WWS, Wong ELY, Twinn SF. Effect of music on procedure time and sedation during colonoscopy: a meta-analysis. *World J Gastroenterol*. 2008;14:5336–5343.
9. Galaal K, Bryant A, Deane KH, Al-Khaduri M, Lopes AD. Interventions for reducing anxiety in women undergoing colposcopy. *Cochrane Database Syst Rev*. 2011;(12):CD006013.
10. Dileo C. Effects of music and music therapy on medical patients: a meta-analysis of the research and implications for the future. *J Soc Integr Oncol*. 2006;4:67–70.
11. Shea BJ, Grimshaw JM, Wells GA, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC Med Res Methodol*. 2007;7:10.
12. Hopewell S, Clarke M, Moher D, et al. CONSORT for reporting randomized trials in journal and conference abstracts. *Lancet*. 2008;371:281–283.
13. Hopewell S, Ravaud P, Baron G, et al. Effect of editors' implementation of CONSORT guidelines on the reporting of abstracts in high impact medical journals: interrupted time series analysis. *BMJ*. 2012;344:e4178.

14. Atkins D, Best D, Briss PA, et al. Grading quality of evidence and strength of recommendations. *BMJ*. 2004;328:1490–1497.
15. International Prospective Register of Systematic Reviews [database on the Internet]. York, UK: University of York. Available from: http://www.crd.york.ac.uk/prospero. Accessed June 20, 2012.
16. Booth A, Clarke M, Ghersi D, et al. An international registry of systematic review protocols. *Lancet*. 2011;377:108–109.
17. Sinha Y, Silove N, Hayen A, Williams K. Auditory integration training and other sound therapies for autism spectrum disorders (ASD). *Cochrane Database Syst Rev*. 2011;12:CD003681.
18. Mossler K, Chen X, Heldal TO, et al. Music therapy for people with schizophrenia and schizophrenia-like disorders. *Cochrane Database Syst Rev*. 2011;12:CD004025.
19. Bradt J, Dileo C, Grocke D, et al. Music interventions for autistic spectrum disorder. *Cochrane Database Syst Rev*. 2011;8:CD006911.
20. Bradt J, Dileo C. Music therapy for end-of-life care. *Cochrane Database Syst Rev*. 2010;1:CD007169.
21. Vink AC, Birks JS, Bruinsma MS, Scholten RJ. Music therapy for people with dementia. *Cochrane Database Syst Rev*. 2003;4:CD003477.
22. Bradt J, Dileo C, Grocke D. Music interventions for mechanically ventilated patients. *Cochrane Database Syst Rev*. 2010;12:CD006902.
23. Cepeda MS, Carr DB, Lau J, et al. Music for pain relief. *Cochrane Database Syst Rev*. 2006;2:CD004843.
24. Bradt J, Magee WL, Dileo C, et al. Music interventions for acquired brain injury. *Cochrane Database Syst Rev*. 2010;7:CD006787.
25. Gold C, Wigram T, Elefant C. Music therapy for autistic spectrum disorder. *Cochrane Database Syst Rev*. 2006;2:CD004381.
26. Laopaiboon M, Lumbiganon P, Martis R, et al. Music during caesarean section under regional anaesthesia for improving maternal and infant outcomes. *Cochrane Database Syst Rev*. 2009;2:CD006914.
27. Bradt J, Dileo C. Music for stress and anxiety reduction in coronary heart disease patients. *Cochrane Database Syst Rev*. 2009;2:CD006577.
28. Maratos A, Gold C, Wang X, et al. Music therapy for depression. *Cochrane Database Syst Rev*. 2008;1:CD004517.
29. de Dreu MJ, van der Wilk AS, Poppe E, Kwakkel G, van Wegen EE. Rehabilitation, exercise therapy and music in patients with Parkinson's diseases: a meta-analysis of the effects of music-based movement therapy on walking ability, balance and quality of life. *Parkinsonism Relat Disord*. 2012;18 Suppl 1:S114–S119.
30. Cogo-Moreira H, Andriolo RB, Yazigi L, et al. Music education for improving reading skills in children and adolescents with dyslexia. *Cochrane Database Syst Rev*. 2012;8:CD009133.
31. Drahota A, Ward D, Mackenzie H, et al. Sensory environment on health-related outcomes of hospital patients. *Cochrane Database Syst Rev*. 2012;3:CD005315.
32. Chan MF, Wong ZY, Thayala NV. The effectiveness of music listening in reducing depressive symptoms in adults: a systematic review. *Complement Ther Med*. 2011;19:332–348.
33. Naylor KT, Kingsnorth S, Lamont A, et al. The effectiveness of music in pediatric healthcare: a systematic review of randomized controlled trials. *Evid Based Complement Alternat Med*. 2011;2011:464759.
34. Irons JY, Kenny DT, Chang AB. Singing for children and adults with cystic fibrosis. *Cochrane Database Syst Rev*. 2010;5:CD008036.
35. Irons JY, Kenny DT, Chang AB. Singing for children and adults with bronchiectasis. *Cochrane Database Syst Rev*. 2010;2:CD007729.
36. de Niet G, Tiemens B, Lendemeijer B, Hutschemaekers G. Music-assisted relaxation to improve sleep quality: meta-analysis. *J Adv Nurs*. 2009;65:1356–1364.
37. Gold C, Solli HP, Kruger V, et al. Dose-response relationship in music therapy for people with serious mental disorders: systematic review and meta-analysis. *Clin Psychol Rev*. 2009;29:193–207.
38. Bowen DJ, Kreuter M, Spring B, et al. How we design feasibility studies. *Am J Prev Med*. 2009;36:452–457.
39. Gragnier JJ, Boon H, Rochon P, et al. Reporting randomized, controlled trials of herbal interventions: an elaborated CONSORT statement. *Ann Intern Med*. 2006;144:364–367.
40. Kamioka H, Tsutani K, Okuizumi H, et al. Effectiveness of aquatic exercise and balneotherapy: a summary of systematic reviews based on randomized controlled trials of water immersion therapies. *J Epidemiol*. 2010;20:2–12.
41. Kamioka K, Kawamura Y, Tsutani K et al. A checklist to assess the quality of reports on spa therapy and balneotherapy trials was developed using the Delphi consensus method: the SPAC checklist. *Complement Ther Med*. 2013;21(4):324–332.

Supplementary material

Table S1 References to studies excluded in this review

First author. Journal (Year)	Title	Reason for exclusion
Standley J. *Neonatal Netw* (2012)	Music therapy research in the NICU: an updated meta-analysis	Not SR based on RCTs
Wittwer JE. *Disabil Rehabil* (2012)	Rhythmic auditory cueing to improve walking in patients with neurological conditions other than Parkinson's disease – what is the evidence?	Not SR based on RCTs
Hurkmans J. *Aphasiology* (2012)	Music in the treatment of neurological language and speech disorders: a systematic review	Not SR based on RCTs
Burns DS. *J Music Ther* (2012)	Theoretical rationale for music selection in oncology intervention research: an integrative review	Not SR based on RCTs
Fredericks S. *Clin Nurs Res* (2012)	Anxiety, depression, and self-management: a systematic review	Not SR based on RCTs
Galaal K. *Cochrane Database Syst Rev* (2011)	Interventions for reducing anxiety in women undergoing colposcopy	Not treatment or rehabilitation
Pittman S. *Int Nurs Rev* (2011)	Music intervention and preoperative anxiety: an integrative review	Not SR based on RCTs
Cogo-Moreia H. *Cochrane Database Syst Rev* (2011)	Music education for improving reading skills in children and adolescents with dyslexia	Updated or replacement SR
Schmid W. *BMC Health Serv Res* (2010)	Home-based music therapy – a systematic overview of settings and conditions for an innovative service in healthcare	Not SR based on RCTs
Renner RM. *Contraception* (2010)	Pain control in first-trimester surgical abortion: a systematic review of randomized controlled trials	Not music therapy
de Niet GJ. *Int J Evid Based Healthc* (2009)	Review of systematic reviews about the efficacy of non-pharmacological interventions to improve sleep quality in insomnia	Not music therapy
Engwall M. *J Perianesth Nurs* (2009)	Music as a nursing intervention for postoperative pain: a systematic review	Not treatment or rehabilitation
Harting L. *Arch Dis Child Fetal Neonatal Ed* (2009)	Music for medical indications in the neonatal period: a systematic review of randomised controlled trials	Not treatment or rehabilitation
Bechtold ML. *Dig Dis Sci* (2009)	Effect of music on patients undergoing colonoscopy: a meta-analysis of randomized controlled trials	Not treatment or rehabilitation
Klassen JA. *Ambul Pediatr* (2008)	Music for pain and anxiety in children undergoing medical procedures: a systematic review of randomized controlled trials	Not treatment or rehabilitation
Tam WW. *World J Gastroenterol* (2008)	Effect of music on procedure time and sedation during colonoscopy: a meta-analysis	Not treatment or rehabilitation
Gillen E. *Int J Evid Based Healthc* (2008)	Effects of music listening on adult patients' pre-procedural state anxiety in hospital	Not treatment or rehabilitation
Dileo C. *Cochrane Database Syst Rev* (2008)	Music for preoperative anxiety	Protocol
Mays KL. *Subst Abus* (2008)	Treating addiction with tunes: a systematic review of music therapy for the treatment of patients with addictions	Not SR based on RCTs
Klassen JA. *Ambul Pediatr* (2008)	Music for pain and anxiety in children undergoing medical procedures: a systematic review of randomized controlled trials	Not treatment or rehabilitation
Galaal K. *Cochrane Database Syst Rev* (2007)	Interventions for reducing anxiety in women undergoing colposcopy	Not treatment or rehabilitation
Rudin D. *Endoscopy* (2007)	Music in the endoscopy suite: a meta-analysis of randomized controlled studies	Not treatment or rehabilitation
Richards T. *Medsurg Nurs* (2007)	The effect of music therapy on patients' perception and manifestation of pain, anxiety, and patient satisfaction	Not SR based on RCTs
Vanderboom T. *J Radiol Nurs* (2007)	Does music reduce anxiety during invasive procedures with procedural sedation? An integrative research review	Not SR based on RCTs
Lim PH. *Int Nurs Rev* (2006)	Music as nursing intervention for pain in five Asian countries	Not SR based on RCTs
Ostermann T. *Expert Rev Neurother* (2006)	Music therapy in the treatment of multiple sclerosis: a comprehensive literature review	Not SR based on RCTs
Dileo C. *J Soc Integr Oncol* (2006)	Effects of music and music therapy on medical patients: a meta-analysis of the research and implications for the future	Not SR based on RCTs
Sung HC. *J Clin Nurs* (2005)	Use of preferred music to decrease agitated behaviors in older people with dementia: a review of the literature	Not SR based on RCTs

(*Continued*)

Table S1 (*Continued*)

First author. Journal (Year)	Title	Reason for exclusion
Pelletier CL. *J Music Ther* (2004)	The effect of music on decreasing arousal due to stress: a meta-analysis	Not SR based on RCTs
Whipple J. *J Music Ther* (2004)	Music in intervention for children and adolescents with autism: a meta-analysis	Not SR based on RCTs
Wilkins MK. *Evid Based Nurs* (2004)	Music intervention in the intensive care unit: a complementary therapy to improve patient outcomes	Not SR based on RCTs
Gold C. *J Child Psychol Psychiatry* (2004)	Effects of music therapy for children and adolescents with psychopathology: a meta-analysis	Not SR based on RCTs
Silverman MJ. *J Music Ther* (2003)	The influence of music on the symptoms of psychosis: a meta-analysis	Not treatment or rehabilitation
Standley JM. *J Pediatr Nurs* (2002)	A meta-analysis of the efficacy of music therapy for premature infants	Not SR based on RCTs
Evans D. *J Adv Nurs* (2002)	The effectiveness of music as an intervention for hospital patients: a systematic review	Not SR based on RCTs
You ZY. *Acta Academiae Med Sinicae* (2002)	Meta-analysis of assisted music therapy for chronic schizophrenia	Reduplication study/ error of selection
You ZY. *Zhongguo Yi Xue Ke Xue Yuan Xue Bao* (2002)	Meta-analysis of assisted music therapy for chronic schizophrenia	Updated or replacement SR
Evans D. *Joanna Briggs Institute Evidence Based Nurs Midwifery* (2001)	Music as an intervention for hospital patients: a systematic review	Not SR based on RCTs
Koger SM. *Cochrane Database Syst Rev* (2000)*	Music therapy for dementia symptoms	Updated or replacement SR
Koger SM. *Cochrane Database Syst Rev* (2000)*	Music therapy for dementia symptoms	Updated or replacement SR
Koger SM. *J Music Ther* (1999)	Is music therapy an effective intervention for dementia? A meta-analytic review of literature	Not SR based on RCTs

Note: *Published and reformed in the same year.
Abbreviations: NICU, neonatal intensive care unit; RCT, randomized controlled trial; SR, systematic review.

Patient Preference and Adherence

Dovepress

Publish your work in this journal

Patient Preference and Adherence is an international, peer-reviewed, open access journal focusing on the growing importance of patient preference and adherence throughout the therapeutic continuum. Patient satisfaction, acceptability, quality of life, compliance, persistence and their role in developing new therapeutic modalities and compounds to optimize clinical outcomes for existing disease states are major areas of interest. This journal has been accepted for indexing on PubMed Central. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit http://www.dovepress.com/testimonials.php to read real quotes from published authors.

Submit your manuscript here: http://www.dovepress.com/patient-preference-and-adherence-journal