

## RESEARCH ARTICLE

## Effects of music therapy on depression: A meta-analysis of randomized controlled trials

Qishou Tang<sup>1</sup>, Zhaohui Huang<sup>2</sup>, Huan Zhou<sup>1,3</sup>, Peijie Ye<sup>1\*</sup>

**1** Bengbu Medical University, Bengbu, Anhui, China, **2** Anhui Provincial Center for Women and Child Health, Hefei, Anhui, China, **3** National Drug Clinical Trial Institution, The First Affiliated Hospital of Bengbu Medical University, Bengbu, Anhui, China

\* [459695783@qq.com](mailto:459695783@qq.com)

## Abstract

## Background

We aimed to determine and compare the effects of music therapy and music medicine on depression, and explore the potential factors associated with the effect.

## Methods

PubMed (MEDLINE), Ovid-Embase, the Cochrane Central Register of Controlled Trials, EMBASE, Web of Science, and Clinical Evidence were searched to identify studies evaluating the effectiveness of music-based intervention on depression from inception to May 2020. Standardized mean differences (SMDs) were estimated with random-effect model and fixed-effect model.

## Results

A total of 55 RCTs were included in our meta-analysis. Music therapy exhibited a significant reduction in depressive symptom (SMD = -0.66; 95% CI = -0.86 to -0.46;  $P < 0.001$ ) compared with the control group; while, music medicine exhibited a stronger effect in reducing depressive symptom (SMD = -1.33; 95% CI = -1.96 to -0.70;  $P < 0.001$ ). Among the specific music therapy methods, recreative music therapy (SMD = -1.41; 95% CI = -2.63 to -0.20;  $P < 0.001$ ), guided imagery and music (SMD = -1.08; 95% CI = -1.72 to -0.43;  $P < 0.001$ ), music-assisted relaxation (SMD = -0.81; 95% CI = -1.24 to -0.38;  $P < 0.001$ ), music and imagery (SMD = -0.38; 95% CI = -0.81 to 0.06;  $P = 0.312$ ), improvisational music therapy (SMD = -0.27; 95% CI = -0.49 to -0.05;  $P = 0.001$ ), music and discuss (SMD = -0.26; 95% CI = -1.12 to 0.60;  $P = 0.225$ ) exhibited a different effect respectively. Music therapy and music medicine both exhibited a stronger effects of short and medium length compared with long intervention periods.

## Conclusions

A different effect of music therapy and music medicine on depression was observed in our present meta-analysis, and the effect might be affected by the therapy process.

## OPEN ACCESS

**Citation:** Tang Q, Huang Z, Zhou H, Ye P (2020) Effects of music therapy on depression: A meta-analysis of randomized controlled trials. PLoS ONE 15(11): e0240862. <https://doi.org/10.1371/journal.pone.0240862>

**Editor:** Sukru Torun, Anadolu University, TURKEY

**Received:** June 10, 2020

**Accepted:** October 4, 2020

**Published:** November 18, 2020

**Peer Review History:** PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: <https://doi.org/10.1371/journal.pone.0240862>

**Copyright:** © 2020 Tang et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Data Availability Statement:** All relevant data are within the manuscript and its [Supporting Information](#) files.

**Funding:** The Key Project of University Humanities and Social Science Research in Anhui Province (SK2017A0191) was granted by Education

Department of Anhui Province; the Research Project of Anhui Province Social Science Innovation Development (2018XF155) was granted by Anhui Provincial Federation of Social Sciences; the Ministry of Education Humanities and Social Sciences Research Youth fund Project (17YJC840033) was granted by Ministry of Education of the People's Republic of China. These funders had a role in study design, text editing, interpretation of results, decision to publish and preparation of the manuscript.

**Competing interests:** The authors have declared that no competing interests exist.

## Introduction

Depression was reported to be a common mental disorders and affected more than 300 million people worldwide, and long-lasting depression with moderate or severe intensity may result in serious health problems [1]. Depression has become the leading causes of disability worldwide according to the recent World Health Organization (WHO) report. Even worse, depression was closely associated with suicide and became the second leading cause of death, and nearly 800 000 die of depression every year worldwide [1, 2]. Although it is known that treatments for depression, more than 3/4 of people in low and middle-income countries receive no treatment due to a lack of medical resources and the social stigma of mental disorders [3]. Considering the continuously increased disease burden of depression, a convenient effective therapeutic measures was needed at community level.

Music-based interventions is an important nonpharmacological intervention used in the treatment of psychiatric and behavioral disorders, and the obvious curative effect on depression has been observed. Prior meta-analyses have reported an obvious effect of music therapy on improving depression [4, 5]. Today, it is widely accepted that the music-based interventions are divided into two major categories, namely music therapy and music medicine. According to the American Music Therapy Association (AMTA), “music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program” [6]. Therefore, music therapy is an established health profession in which music is used within a therapeutic relationship to address physical, emotional, cognitive, and social needs of individuals, and includes the triad of music, clients and qualified music therapists. While, music medicine is defined as mainly listening to prerecorded music provided by medical personnel or rarely listening to live music. In other words, music medicine aims to use music like medicines. It is often managed by a medical professional other than a music therapist, and it doesn't need a therapeutic relationship with the patients. Therefore, the essential difference between music therapy and music medicine is about whether a therapeutic relationship is developed between a trained music therapist and the client [7–9]. In the context of the clear distinction between these two major categories, it is clear that to evaluate the effects of music therapy and other music-based intervention studies on depression can be misleading. While, the distinction was not always clear in most of prior papers, and no meta-analysis comparing the effects of music therapy and music medicine was conducted. Just a few studies made a comparison of music-based interventions on psychological outcomes between music therapy and music medicine. We aimed to (1) compare the effect between music therapy and music medicine on depression; (2) compare the effect between different specific methods used in music therapy; (3) compare the effect of music-based interventions on depression among different population [7, 8].

## Materials and methods

### Search strategy and selection criteria

PubMed (MEDLINE), Ovid-Embase, the Cochrane Central Register of Controlled Trials, EMBASE, Web of Science, and Clinical Evidence were searched to identify studies assessing the effectiveness of music therapy on [depression](#) from inception to May 2020. The combination of “depress\*” and “music\*” was used to search potential papers from these databases. Besides searching for electronic databases, we also searched potential papers from the reference lists of included papers, relevant reviews, and previous meta-analyses. The criteria for selecting the papers were as follows:(1) randomised or quasi-randomised controlled trials; (2)

music therapy at a hospital or community, whereas the control group not receiving any type of music therapy; (3) depression rating scale was used. The exclusive criteria were as follows: (1) non-human studies; (2) studies with a very small sample size ( $n < 20$ ); (3) studies not providing usable data (including sample size, mean, standard deviation, etc.); (4) reviews, letters, protocols, etc. Two authors independently (YPJ, HZH) searched and screened the relevant papers. EndNote X7 software was utilized to delete the duplicates. The titles and abstracts of all searched papers were checked for eligibility. The relevant papers were selected, and then the full-text papers were subsequently assessed by the same two authors. In the last, a panel meeting was convened for resolving the disagreements about the inclusion of the papers.

### Data extraction

We developed a data abstraction form to extract the useful data: (1) the characteristics of papers (authors, publish year, country); (2) the characteristics of participators (sample size, mean age, sex ratio, pre-treatment diagnosis, study period); (3) study design (random allocation, allocation concealment, masking, selection process of participators, loss to follow-up); (4) music therapy process (music therapy method, music therapy period, music therapy frequency, minutes per session, and the treatment measures in the control group); (5) outcome measures (depression score). Two authors independently (TQS, ZH) abstracted the data, and disagreements were resolved by discussing with the third author (YPJ).

### Assessment of risk of bias in included studies

Two authors independently (TQS, ZH) assessed the risk of bias of included studies using Cochrane Collaboration's risk of bias assessment tool, and disagreements were resolved by discussing with the third author (YPJ) [10].

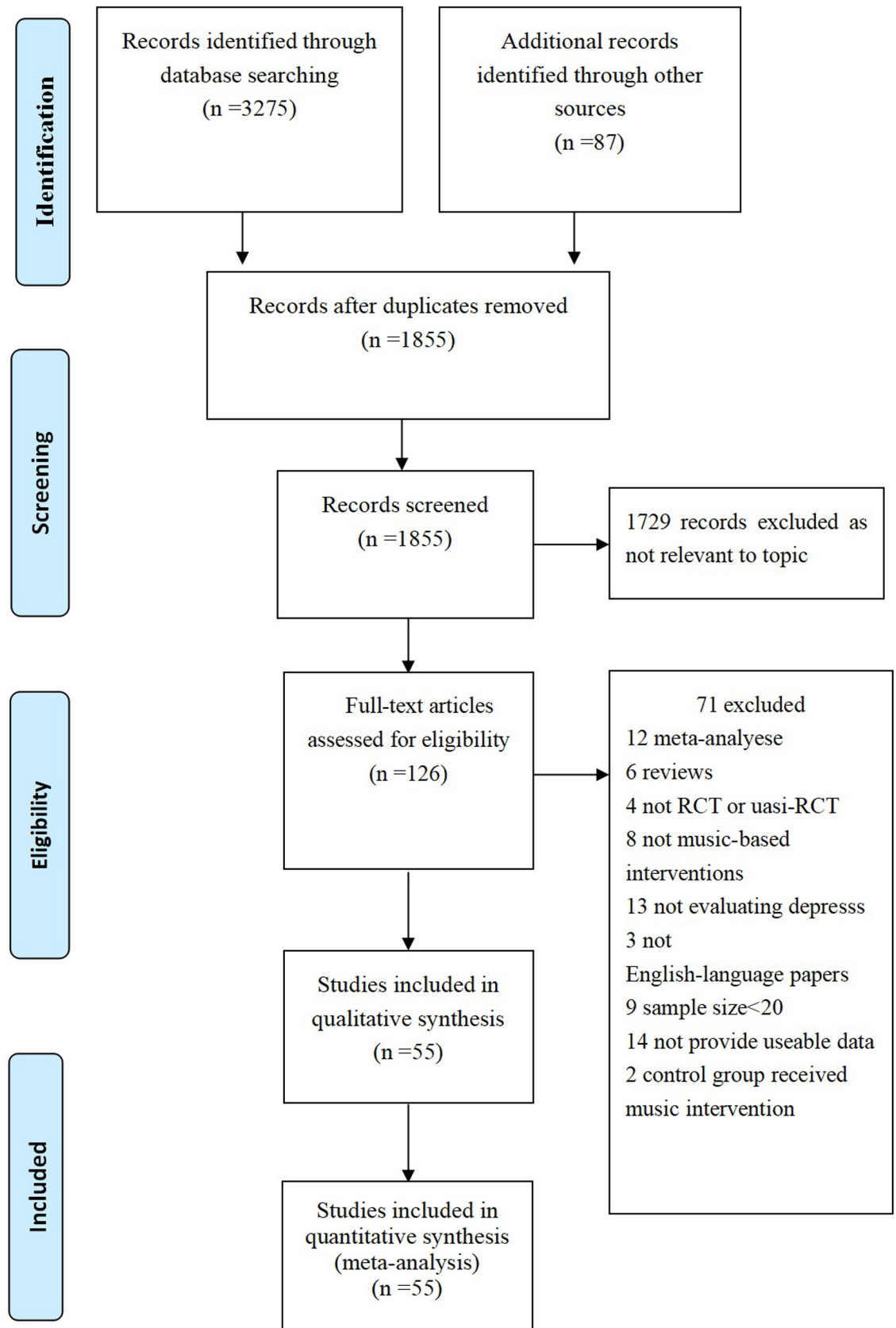
### Music therapy and music medicine

Music Therapy is defined as the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program. Music medicine is defined as mainly listening to prerecorded music provided by medical personnel or rarely listening to live music. In other words, music medicine aims to use music like medicines.

Music therapy mainly divided into active music therapy and receptive music therapy. Active music therapy, including improvisational, re-creative, and compositional, is defined as playing musical instruments, singing, improvisation, and lyrics of adaptation. Receptive music therapy, including music-assisted relaxation, music and imagery, guided imagery and music, lyrics analysis, and so on, is defined as music listening, lyrics analysis, and drawing with music. In other words, in active methods participants are making music, and in receptive music therapy participants are receiving music [6, 7, 9, 11–13].

### Evaluation of depression

Depression was evaluated by the common psychological scales, including Beck Depression Inventory (BDI), Children's Depression Inventory (CDI), Center for Epidemiologic Studies Depression (CES-D), Cornell Scale (CS), Depression Mood Self-Report Inventory for Adolescence (DMSRIA), Geriatric Depression Scale-15 (GDS-15); Geriatric Depression Scale-30 (GDS-30), Hospital Anxiety and Depression Scale (HADS), Hamilton Rating Scale for Depression (HRSD/HAMD), Montgomery-sberg Depression Rating Scale (MADRS), Patient



**Fig 1. Prisma 2009 flow diagram literature search and study selection.** PRISMA diagram showing the different steps of systematic review, starting from literature search to study selection and exclusion. At each step, the reasons for exclusion are indicated. Doi: 10.1371/journal.pone.0052562.g001.

<https://doi.org/10.1371/journal.pone.0240862.g001>

Reported Outcomes Measurement Information System (PROMIS), Self-Rating Depression Scale (SDS), Short Version of Profile of Mood States (SV-POMS).

## Statistical analysis

The pooled effect were estimated by using the standardized mean differences (SMDs) and its 95% confidence interval (95% CI) due to the different depression rate scales were used in the included papers. Heterogeneity between studies was assessed by I-square ( $I^2$ ) and Q-statistic ( $P < 0.10$ ), and a high  $I^2$  ( $> 50\%$ ) was recognized as heterogeneity and a random-effect model was used [14–16]. We performed subgroup analyses and meta-regression analyses to study the potential heterogeneity between studies. The subgroup variables included music intervention categories (music therapy and music medicine), music therapy methods (active music therapy, receptive music therapy), specific receptive music therapy methods (music-assisted relaxation, music and imagery, and guided imagery and music (Bonny Method), specific active music therapy methods (recreative music therapy and improvisational music therapy), music therapy mode (group therapy, individual therapy), music therapy period (weeks) (2–4, 5–12,  $\geq 13$ ), music therapy frequency (once weekly, twice weekly,  $\geq 3$  times weekly), total music therapy sessions (1–4, 5–8, 9–12, 13–16,  $> 16$ ), time per session (minutes) (15–40, 41–60,  $> 60$ ), inpatient settings (secure [locked] unit at a mental health facility versus outpatient settings), sample size (20–50,  $\geq 50$  and  $< 100$ ,  $\geq 100$ ), female predominance ( $> 80\%$ ) (no, yes), mean age (years) ( $< 50$ , 50–65,  $> 65$ ), country having music therapy profession (no, yes), pre-treatment diagnosis (mental health, depression, severe mental disease/psychiatric disorder). We also performed sensitivity analyses to test the robustness of the results by re-estimating the pooled effects using fixed effect model, using trim and fill analysis, excluding the paper without information on music therapy, excluding the papers with more high biases, excluding the papers with small sample size ( $20 < n < 30$ ), excluding the papers using an infrequently used scale, excluding the studies focused on the people with a severe mental disease. We investigated the publication biases by a funnel plot as well as Egger's linear regression test [17]. The analyses were performed using Stata, version 11.0. All P-values were two-sided. A P-value of less than 0.05 was considered to be statistically significant.

## Results

### Characteristics of the eligible studies

Fig 1 depicts the study profile, and a total of 55 RCTs were included in our meta-analysis [18–72]. Of the 55 studies, 10 studies from America, 22 studies from Europe, 22 studies from Asia, and 1 study from Australia. The mean age of the participators ranged from 12 to 86; the sample size ranged from 20 to 242. A total of 16 different scales were used to evaluate the depression level of the participators. A total of 25 studies were conducted in inpatient setting and 28 studies were in outpatients setting; 32 used a certified music therapist, 15 not used a certified music therapist (for example researcher, nurse), and 10 not reported relevant information. A total of 16 different depression rating scales were used in the included studies, and HADS, GDS, and BDI were the most frequently used scales (Table 1).

Of the 55 studies, only 2 studies had high risks of selection bias, and almost all of the included studies had high risks of performance bias (Fig 2).

Table 1. Characteristics of clinical trials included in this meta-analysis.

Studies	Country	Ample size	Mean age (SD)	Pre-intervention diagnosis	Music intervention method (total)	Intervenor or therapist	Intervention description	Control group	Outcome Measures
Biasutti et al., 2019	Italy	N = 45, Female = 29	84.6 (7.17)	Healthy or with cognitive impairment	Active music therapy (improvisational music therapy)	Certified music therapist	Twice weekly (70 min/session) for 6 weeks	45-minute gymnastic activities	GDS-15
Burrai et al., [48]	Italy	N = 159, Female = 124	73.05 (11.5)	Heart failure	Music medicine	Researchers	Once daily (30 min/session) for 36 weeks	Standard HF treatment	HADS
Burrai et al., [49]	Italy	N = 24, Female = 9	62.3 (2.8)	End-stage kidney disease	Music medicine	Nurse	Once daily (15 min/session) for 2 weeks	Standard hemodialysis	HADS
Chan et al., 2009	Hong Kong China	N = 47, Female = 26	>60	No mental illness	Music medicine	Researchers	Once weekly (30 min/session) for 4 weeks	Without any intervention	GDS-30
Chan et al., 2010	Hong Kong China	N = 42, Female = 23	>60	No mental illness	Music medicine	Researchers	Once weekly (45 min/session) for 4 weeks	Without any intervention	GDS-15
Chan et al., 2012	Singapore	N = 50, Female = 32	>55	No mental illness	Music medicine	Researchers	Once weekly (30 min/session) for 8 weeks	Without any intervention	GDS-15
Chen et al., 2015	Taiwan China	N = 71, Female = 69	18.5	Depressive disorder	Music medicine	Researchers	Twice weekly (40 min/session) for 10 weeks	Without any intervention	DMSRIA
Chen et al., 2018	China	N = 52, Female = 52	-	Breast cancer	Receptive music therapy	Certified music therapist	Once weekly (60 min/session) for 8 weeks	Standard care	HADS
Chen et al., 2019	Taiwan China	N = 65, Female = 56	72.7 (5.97)	No mental illness	Active music therapy (improvisational music therapy)	Not reported	Twice weekly (40 min/session) for 10 weeks	No music therapy	BDI
Cheung et al., 2019	Hong Kong, China	N = 60, Female = 25	13.2 (3.27)	Pediatric brain tumor with a significant level of depression	Active music therapy (recreative music therapy)	Certified music therapist	Once weekly (45 min/session) for 52 weeks	No music therapy	CES-D
Chirico et al., 2020	Italy	N = 64, Female = 64	55.95 (5.92)	Breast cancer	Receptive music therapy	Certified music therapist	20 min/session	Standard care	SV-POMS
Choi et al., 2008	Korea	N = 26, Female = 14	36.15 (10.2)	Psychiatric disorder	Active music therapy (recreative music therapy)	Certified music therapist	Once-two weekly (60 min/session) for 12 weeks	Routine care	BDI
Chu et al., 2014	Taiwan, China	N = 100, Female = 53	82(6.8)	Dementia	Active music therapy (improvisational music therapy)	Certified music therapist	Twice weekly (30 min/session) for 6 weeks	Standard care	CS
Cooke et al., 2010	Australia	N = 47, Female = 33	>65	Dementia	Active music therapy (improvisational music therapy)	Musicians	Thrice weekly (40 min/session) for 8 weeks	Educational/entertainment activities	GDS
Erkkilä et al., 2011	Finland	N = 79, Female = 62	35.6 (9.75)	Depression disorder	Active music therapy (improvisational music therapy)	Certified music therapist	Twice weekly (60 min/session) for 12 weeks	Standard treatment	MADRS

(Continued)

Table 1. (Continued)

Studies	Country	Ample size	Mean age (SD)	Pre-intervention diagnosis	Music intervention method (total)	Intervenor or therapist	Intervention description	Control group	Outcome Measures
Fancourt et al., 2019	UK	N = 62, Female = 48	54.5 (14.5)	Cancer carers	Active music therapy (improvisational music therapy)	Certified music therapist	Once weekly (90 min/session) for 12 weeks	No music therapy	HADS
Gok Ugur et al., 2017	Turkey	N = 64, Female = 22	76.35 (7.88)	No mental illness	Receptive music therapy (music and imagery)	Certified music therapist	Three days in a week for 8 weeks	No music therapy	GDS-15
Guétin et al., 2009	France	N = 30, Female = 22	86(5.6)	Moderate stages of Alzheimer's disease	Receptive music therapy (music-assisted relaxation)	Certified music therapist	Once weekly (20 min/session) for 16 weeks	Educational/entertainment activities	GDS-30
Hanser et al., 1994	USA	N = 30, Female = 23	67.9	Depressive disorder	Receptive music therapy (guided imagery and music)	Certified music therapist	Once weekly (1 h/session; 20 min/session) for 8 weeks	No music therapy	GDS
Hars et al., 2014	Switzerland	N = 134, Female = 129	75(7)	No mental illness	Music medicine	Not reported	Once weekly (1 h/session) for 26 weeks	No music therapy	HADS
Liao et al., 2018	China	N = 107, Female = 66	71.79 (7.71)	Mild to moderate depressive symptoms	Music medicine	Not reported	Once weekly (50 min/session) for 12 weeks	Routine health education	GDS-30
Low et al., 2020	USA	N = 43, Female = 33	50.07 (5.48)	Chronic pain	Active+receptive music therapy	Certified music therapist	Once weekly (90 min/session) for 12 weeks	Standard care	PROMIS
Mahendran et al., 2018	Singapore	N = 68, Female = 56	71.1 (5.3)	Mild cognitive impairment	Receptive music therapy (guided imagery and music)	Certified music therapist	Once weekly for 3 months, then fortnightly for 36 weeks.	No music therapy	GDS-15
Park et al., 2015	South Korea	N = 29, Female = 16	8.17 (1.47)	No mental illness	Active music therapy (improvisational music therapy)	Music therapist	Once weekly (120 min/session) for 15 weeks	Educational creative movement program	CDI
Pérez-Ros et al., 2019	Spain	N = 119, Female = 61	80.52 (7.44)	No mental illness	Active music therapy (improvisational music therapy)	Physiotherapists	5 times weekly (60 min/session) for 8 weeks	No music therapy	CS
Ploukou et al., 2018	Greece	N = 48, Female = 46	-	Oncology nurses without diseases	Music medicine	Not reported	Once weekly (60 min/session) for 4 weeks	No music therapy	HADS
Ribeiro et al., 2018	Brazil	N = 21, Female = 21	22.5 (6.5)	Mothers of preterm	Receptive music therapy (music and discuss)	Certified music therapist	Once weekly (30–40 min/session) for 7–9 weeks	No music therapy	BDI
Sigurdardóttir et al., 2019	Denmark	N = 38, Female = 25	25.4	Mild and moderate depression	Music medicine	Not reported	Twice weekly (20 min/session) for 4 weeks	No music therapy	HRSD-6, HRSD-17
Toccafondi et al., 2018	Italy	N = 242, Female = 147	>18	Cancer	Receptive music therapy	Certified music therapist	Once weekly	Standard care	HADS

(Continued)

Table 1. (Continued)

Studies	Country	Ample size	Mean age (SD)	Pre-intervention diagnosis	Music intervention method (total)	Intervenor or therapist	Intervention description	Control group	Outcome Measures
Trimmer et al., 2018	Canada	N = 28, Female = 15	43(13.8)	Depression and anxiety	Active music therapy (recreative music therapy)	Not reported	Once weekly (90 min/session) for 9 weeks	Treatment as usual	HADS
Volpe et al., 2018	Italy	N = 106, Female = 106	43.83 (12.7)	Psychosis	Active music therapy (improvisational music therapy)	Certified music therapist	Twice daily (60 min/session) for 6 weeks	Standard drug treatment	HADS
Wu et al., 2019	China	N = 60, Female = 60	36.2 (9.47)	Methamphetamine use disorder	Active+receptive music therapy	Certified music therapist	Once weekly (90 min/session) for 13 weeks	Standard treatment	SDS
Albornoz et al., 2011	Venezuela	N = 24, Female = 0	16–60	Depressed adults with substance abuse	Active music therapy (improvisational music therapy)	Therapist	Once weekly (120 min/session) for 12 weeks	Standard treatment	BDI, HRSD
Hendricks et al., 1999	USA	N = 20	14–15	Depression	Active+receptive music therapy	Therapist	Once weekly for 8 weeks	Individual psychotherapy	BDI
Hendricks et al., 2001	USA	N = 63	12–18	Depression	Music medicine	counsellor-researcher	Once weekly (60 min/session) for 12 weeks	Cognitive-based psychotherapy	BDI
Radulovic et al., 1996	Serbia	N = 60	21–62 (40)	Depression	Receptive music therapy	Therapist	Twice weekly (20 min/session) for 6 weeks	Treatment as usual	BDI
Zerhusen et al., 1995	USA	N = 60	70–82 (77)	Moderate to severe depression	Music medicine	Not reported	Twice weekly (30 min/session) for 10 weeks	psychological therapy or treatment as usual	BDI
Chang et al., 2008	Taiwan China	N = 236, Female = 236	22–41 (30.03)	Pregnant women	Music medicine	Music faculty members	Once a day (30 min/session) for 2 weeks	General prenatal care	EPDS
Chen et al., 2020	Taiwan China	N = 100 Female = 100	30.19 (9.50)	Beast cancer undergoing chemotherapy.	Receptive music therapy	Trained music therapist	Once weekly (45 min/session) for 3 weeks	Routine nursing care	HADS
Chen et al., 2016	China	N = 200, Female = 0	35.5 (9.75)	Prisoners with mild depression;	Active+receptive music therapy, including music and imagery, improvisation, and song writing	Music therapist	Twice weekly (90 min/session) for 3 weeks	Standard care	BDI
Esfandiari et al., 2014	Iran	N = 30, Female = 30	Not reported	Severe depressive disorder	Music medicine	not reported	90 min/session	Standard care	BDI
Fancourt et al., 2016	UK	N = 45, Female = 37	53.54 (13.85)	Mental health service users	Music medicine	Professional drummer	Once weekly (90 min/session) for 10 weeks	Without any intervention	HADS
Giovagnoli et al., 2017	Italy	N = 39, Female = 24	73.64 (7.11)	Mild to moderate Alzheimer's disease	Active music therapy (Improvisational music therapy)	Music therapist	Twice weekly (45 min/session) for 12 weeks	Cognitive training or neuroeducation	BDI
Harmat et al., 2008	Hungary	N = 94, Female = 73	22.6 (2.83)	Seep complaints	Music medicine	Investigators	Once a day (45 min/session) for 3 weeks	listening to an audiobook or no intervention	BDI

(Continued)



Table 1. (Continued)

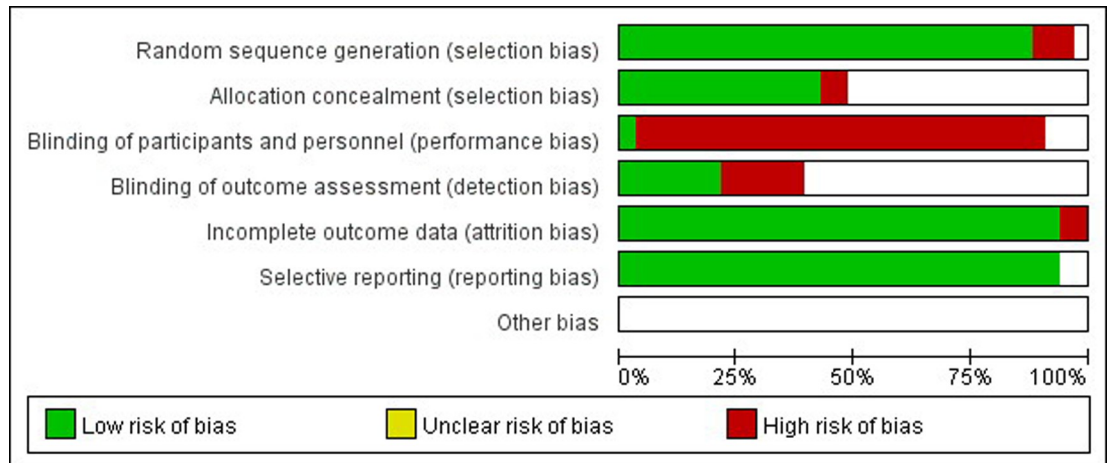
Studies	Country	Ample size	Mean age (SD)	Pre-intervention diagnosis	Music intervention method (total)	Intervenor or therapist	Intervention description	Control group	Outcome Measures
Koelsch et al., 2010	Germany	N = 154, Female = 78	24.6	No disease	Active music therapy	Music therapist	Not reported	Individual psychotherapy	POMS
Liao et al., 2018	China	N = 60, Female = 30	61.82 (13.20)	Cancer	Receptive music therapy+muscle relaxation training	not reported	Once a day (40 min/session) for 8 weeks	Muscle relaxation training	HADS
Lu et al., 2013	Taiwan China	N = 80, Female = 21	52.02 (7.64)	Schizophrenia	Active music therapy+receptive music therapy	Trained research assistant	Twice weekly (60 min/session) for 5 weeks	Usual care	CDSS
Mahendran et al., 2018	Singapore	N = 68, Female = 56	71.1 (5.05)	Mild cognitive impairment	Receptive music therapy	Music therapist	Weekly in the first 3 months, then fortnightly for 6 months.	Standard care without any intervention	GDS-15
Mondanaro et al., 2017	Italy	N = 60, Female = 35	48.20 (4.49)	Patients after spine surgery	Active music therapy (improvisational music therapy)	Music therapist	30-minute music therapy session during an 8-hour period within 72 hours after surgery	Standard care without any intervention	HADS
Nwebube et al., 2017	UK	N = 36, Female = 36	Not reported	Pregnant women	Music medicine	Investigators	Once a day (20 min/session) for 12 weeks	Standard care without any intervention	EPDS
Porter et al., 2017	Northern Ireland	N = 184, Female = 73	12.7 (2.5)	Adolescents with behavioural and emotional problems	Active music therapy (improvisational music therapy)	Music therapist	Once weekly (30 min/session) for 13 weeks	Usual care	CES-D
Raglio et al., 2016	Italy	N = 30, Female = 17	64 (10.97)	Amyotrophic lateral sclerosis	Active music therapy	Music therapist	Three times weekly (30 min/session) for 4 weeks	Standard care	HADS
Torres, et al., 2018	Spanish	N = 70, Female = 70	35-65 (51.3)	Fibromyalgia	Receptive music therapy	Music therapist	Once weekly (120 min/session) for 12 weeks	Without any additional service	ST/DEP
Wang et al., 2011	China	N = 80, Female = 21	19.35 (1.68)	Student	Receptive music therapy	Not reported	Not reported	Without any additional service	SDS
Yap et al., 2017	Singapore	N = 31, Female = 29	74.65 (6.4)	Elderly people	Active music therapy (improvisational music therapy)	Experienced instructors	Once weekly (60 min/session) for 11 weeks	Without any intervention	GDS

Note: BDI = Beck Depression Inventory; CDI = Children's Depression Inventory; CDSS = depression scale for schizophrenia; CES-D = Center for Epidemiologic Studies Depression; CS = Cornell Scale; DMSRIA = Depression Mood Self-Report Inventory for Adolescence; EPDS = Edinburgh Postnatal Depression Scale; GDS-15 = Geriatric Depression Scale-15; GDS-30 = Geriatric Depression Scale-30; HADS = Hospital Anxiety and Depression Scale; HRSD (HAM-D) = Hamilton Rating Scale for Depression; MADRS = Montgomery-sberg Depression Rating Scale; PROMIS = Patient Reported Outcomes Measurement Information System; SDS = Self-Rating Depression Scale; State-Trait Depression Questionnaire = ST/DEP; SV-POMS = short version of Profile of Mood States; NA = not available.

<https://doi.org/10.1371/journal.pone.0240862.t001>

## The overall effects of music therapy

Of the included 55 studies, 39 studies evaluated the music therapy, 17 evaluated the music medicine. Using a random-effects model, music therapy was associated with a significant



**Fig 2. Risk-of-bias graph and risk.**

<https://doi.org/10.1371/journal.pone.0240862.g002>

reduction in depressive symptoms with a moderate-sized mean effect (SMD =  $-0.66$ ; 95% CI =  $-0.86$  to  $-0.46$ ;  $P < 0.001$ ), with a high heterogeneity across studies ( $I^2 = 83\%$ ,  $P < 0.001$ ); while, music medicine exhibited a stronger effect in reducing depressive symptom (SMD =  $-1.33$ ; 95% CI =  $-1.96$  to  $-0.70$ ;  $P < 0.001$ ) (Fig 3).

Twenty studies evaluated the active music therapy using a random-effects model, and a moderate-sized mean effect (SMD =  $-0.57$ ; 95% CI =  $-0.90$  to  $-0.25$ ;  $P < 0.001$ ) was observed with a high heterogeneity across studies ( $I^2 = 86.3\%$ ,  $P < 0.001$ ). Fourteen studies evaluated the receptive music therapy using a random-effects model, and a moderate-sized mean effect (SMD =  $-0.73$ ; 95% CI =  $-1.01$  to  $-0.44$ ;  $P < 0.001$ ) was observed with a high heterogeneity across studies ( $I^2 = 76.3\%$ ,  $P < 0.001$ ). Five studies evaluated the combined effect of active and receptive music therapy using a random-effects model, and a moderate-sized mean effect (SMD =  $-0.88$ ; 95% CI =  $-1.32$  to  $-0.44$ ;  $P < 0.001$ ) was observed with a high heterogeneity across studies ( $I^2 = 70.5\%$ ,  $P < 0.001$ ) (Fig 4).

Among specific music therapy methods, recreative music therapy (SMD =  $-1.41$ ; 95% CI =  $-2.63$  to  $-0.20$ ;  $P < 0.001$ ), guided imagery and music (SMD =  $-1.08$ ; 95% CI =  $-1.72$  to  $-0.43$ ;  $P < 0.001$ ), music-assisted relaxation (SMD =  $-0.81$ ; 95% CI =  $-1.24$  to  $-0.38$ ;  $P < 0.001$ ), music and imagery (SMD =  $-0.38$ ; 95% CI =  $-0.81$  to  $0.06$ ;  $P = 0.312$ ), improvisational music therapy (SMD =  $-0.27$ ; 95% CI =  $-0.49$  to  $-0.05$ ;  $P = 0.001$ ), and music and discuss (SMD =  $-0.26$ ; 95% CI =  $-1.12$  to  $0.60$ ;  $P = 0.225$ ) exhibited a different effect respectively (Fig 5).

### Sub-group analyses and meta-regression analyses

We performed sub-group analyses and meta-regression analyses to study the homogeneity. We found that music therapy yielded a superior effect on reducing depression in the studies with a small sample size (20–50), with a mean age of 50–65 years old, with medium intervention frequency ( $< 3$  times weekly), with more minutes per session ( $> 60$  minutes). We also found that music therapy exhibited a superior effect on reducing depression among people with severe mental disease /psychiatric disorder and depression compared with mental health people. While, whether the country have the music therapy profession, whether the study used group therapy or individual therapy, whether the study was in the outpatients setting or the inpatient setting, and whether the study used a certified music therapist all did not exhibit a

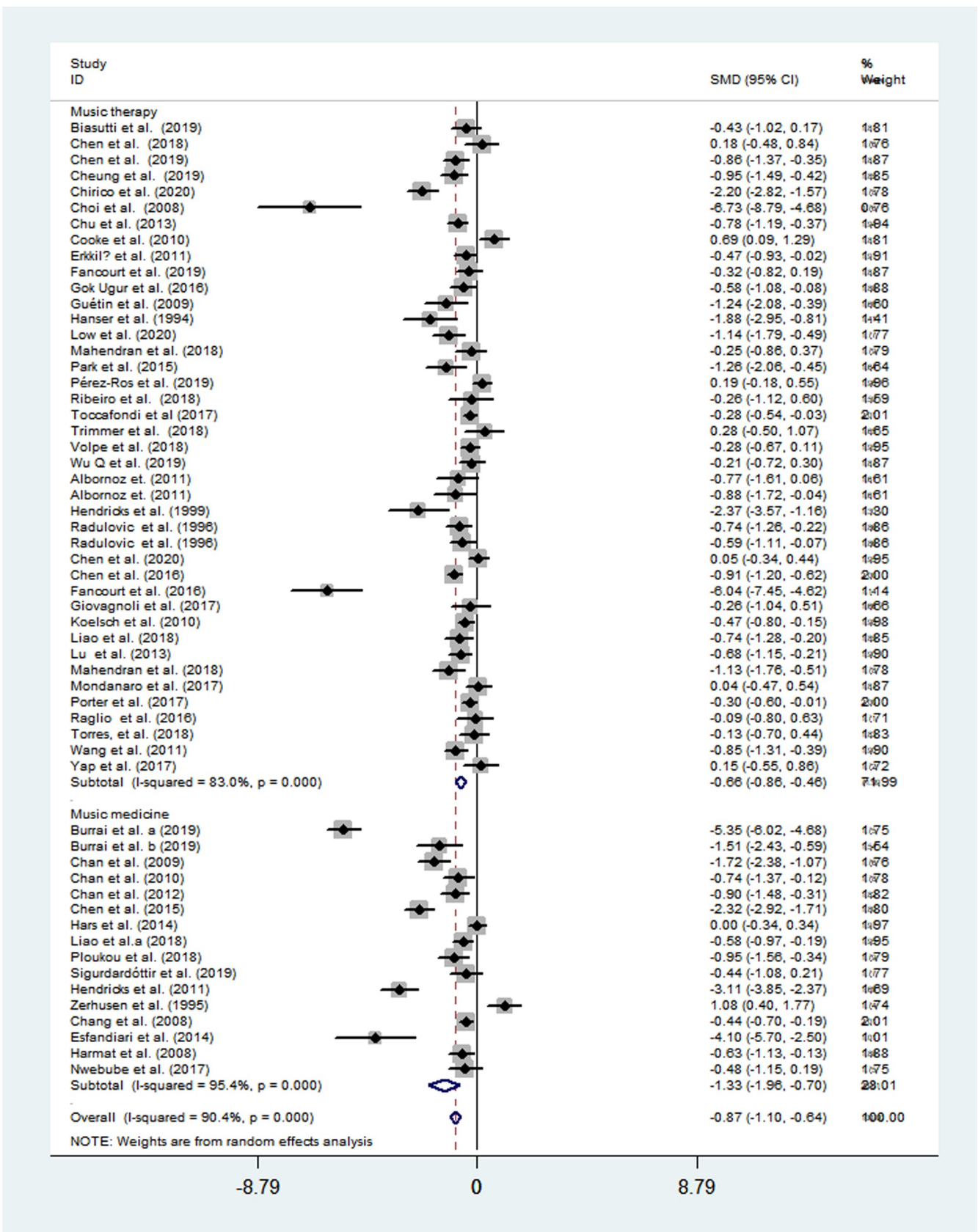


Fig 3. Effects of music therapy and music medicine to reduce depression.

<https://doi.org/10.1371/journal.pone.0240862.g003>

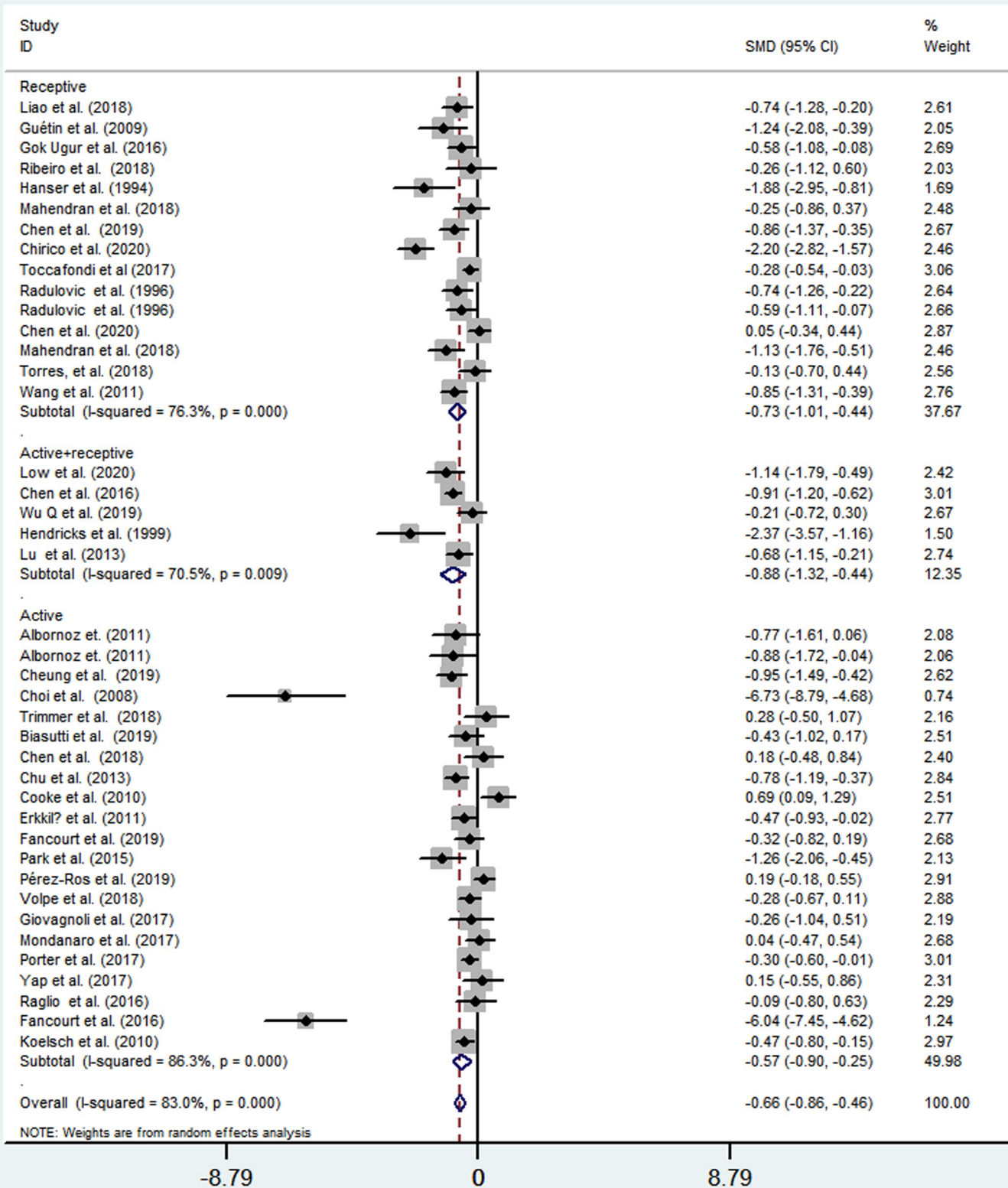


Fig 4. Effects of active music therapy, receptive therapy, and music therapy+receptive therapy to reduce depression.

<https://doi.org/10.1371/journal.pone.0240862.g004>

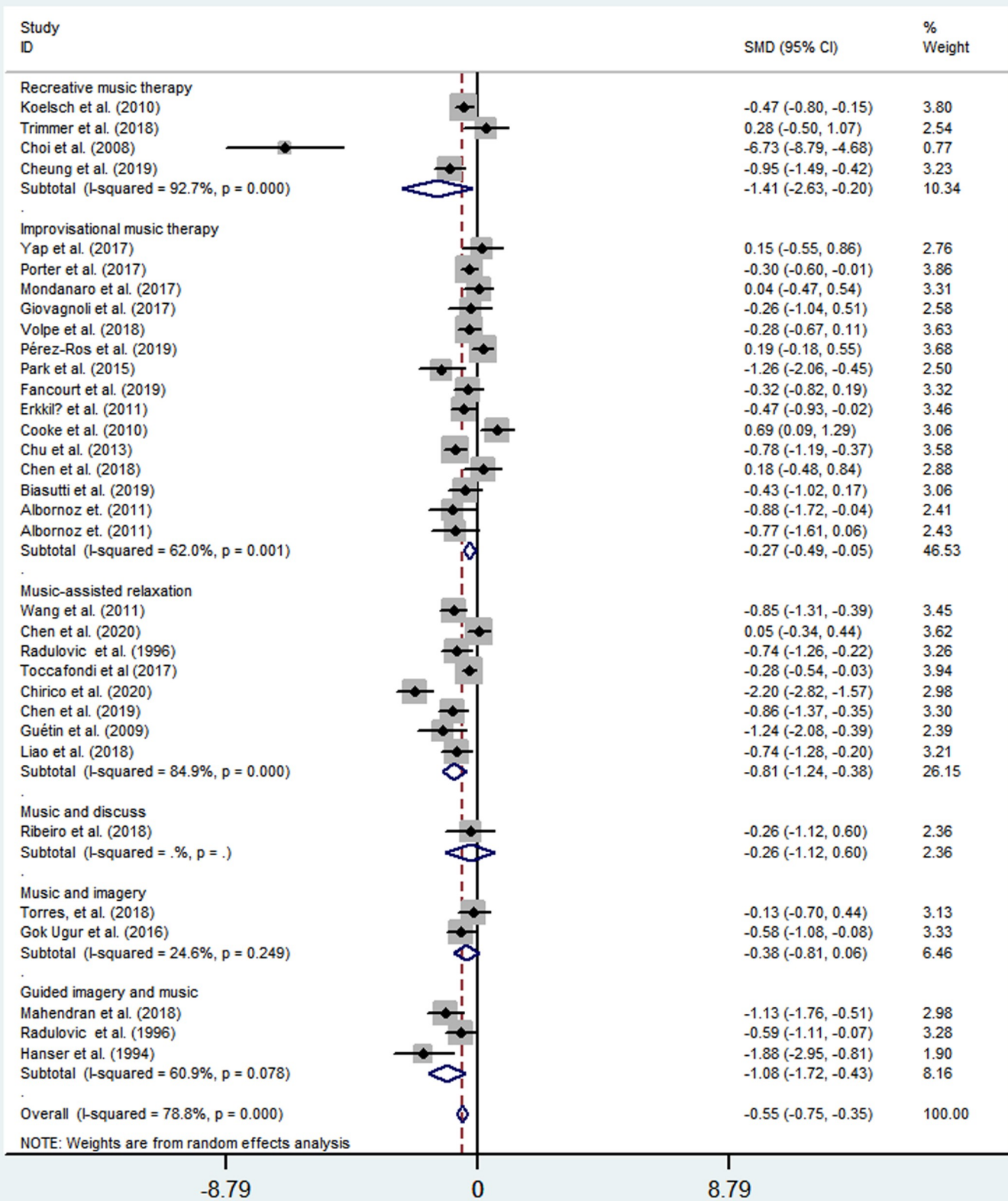


Fig 5. Effects of specific music therapy method to reduce depression.

<https://doi.org/10.1371/journal.pone.0240862.g005>

**Table 2. Subgroup analyses of music-based intervention to reduce depression.**

Subgroups	Music therapy					Music medicine				
	Trials number	Effects		Heterogeneity		Trials number	Effects		Heterogeneity	
		SMD (95%CI)	P	I <sup>2</sup> (%)	P		SMD (95%CI)	P	I <sup>2</sup> (%)	P
Sample size										
20–50	16	-1.24(-2.08, -0.39)	<0.001	143.19	<0.001	7	-1.21(-1.79, -0.62)	<0.001	26.30	<0.001
≥50, <100	17	-0.62(-0.84, -0.38)	<0.001	51.58	<0.001	5	-1.17(-2.45, 0.11)	0.073	86.86	<0.001
≥100	8	-0.36(-0.60, -0.11)	0.005	31.33	<0.001	4	-1.56(-3.10, -0.02)	0.047	206.10	<0.001
Female predominance (>80%)										
Yes	13	-0.73(-1.23, -0.22)	0.005	112.85	<0.001	8	-1.71(-2.76, -0.65)	0.001	247.54	<0.001
No	24	-0.58(-0.81, -0.36)	<0.001	109.59	<0.001	6	-0.93(-1.32, -0.54)	<0.001	12.51	0.028
Mean age (years)										
<50	20	-0.6(-0.85, -0.35)	<0.001	84.50	<0.001	5	-1.36(-2.30, -0.41)	0.005	69.99	<0.001
50–65	7	-1.43(-2.28, -0.58)	0.001	78.58	<0.001	2	-1.10(-1.66, -0.53)	<0.001	1.22	<0.001
>65	12	-0.48(-0.84, -0.13)	0.008	48.47	<0.001	6	-1.21(-2.66, 0.24)	0.102	237.19	<0.001
Pre-treatment diagnosis										
Mental health	23	-0.58(-0.85, -0.32)	<0.001	141.40	<0.001	10	-1.26(-2.04, -0.47)	0.002	218.03	<0.001
Depression	9	-0.79(-1.13, -0.46)	<0.001	20.83	<0.001	6	-1.49(-2.72, -0.25)	0.018	106.87	<0.001
Severe mental disease /psychiatric disorder	9	-0.78(-1.34, -0.23)	<0.001	62.14	<0.001	0	-	-	-	-
Intervention frequency										
Once weekly	21	-0.72 (-1.04, -0.41)	<0.001	118.78	<0.001	7	-1.11(-1.77, -0.44)	0.001	67.58	<0.001
Twice weekly	10	-0.79 (-1.13, -0.46)	<0.001	38.43	<0.001	3	-0.56(-2.49, 1.37)	0.570	53.98	<0.001
≥3 times weekly	6	-0.14 (-0.53, 0.25)	0.476	18.65	0.002	5	-1.67(-3.28, -0.06)	0.042	185.98	<0.001
Time per session (minutes)										
15–40	12	-0.52(-0.86, -0.19)	0.002	59.84	<0.001	9	-1.34(-2.38, -0.29)	0.012	245.42	<0.001
41–60	10	-0.56(-0.99, -0.13)	0.012	62.25	<0.001	6	-0.96(-1.65, -0.27)	0.006	57.46	<0.001
>60	12	-0.96(-1.46, -0.47)	<0.001	81.18	<0.001	1	-4.1(-5.7, -2.50)	<0.001	0	-
Country having music therapy profession										
Yes	39	-0.65(-0.86, -0.45)	<0.001	234.06	<0.001	13	-1.26(-1.99, -0.53)	0.001	309.93	<0.001
No	2	-0.83(-1.42, -0.23)	<0.001	0.03	0.864	3	-1.60(-2.86, -0.34)	0.003	16.49	<0.001
Group therapy or individual therapy										
Group therapy	30	-0.66 (-0.92, -0.41)	<0.001	177.02	<0.001	8	-1.23(-2.10, -0.36)	0.006	128.59	<0.001
Individual therapy	10	-0.67 (-1.05, -0.29)	0.001	56.14	<0.001	7	-1.57(-2.71, -0.42)	0.007	190.82	<0.001

(Continued)

Table 2. (Continued)

Subgroups	Music therapy					Music medicine				
	Trials number	Effects		Heterogeneity		Trials number	Effects		Heterogeneity	
		SMD (95%CI)	P	I <sup>2</sup> (%)	P		SMD (95%CI)	P	I <sup>2</sup> (%)	P
Setting										
Outpatient	16	-0.89(-1.30, -0.47)	<0.001	103.66	<0.001	12	-1.26(-1.94, -0.57)	<0.001	255.53	<0.001
Inpatient	22	-0.57(-0.83, -0.31)	<0.001	127.51	<0.001	3	-0.91(-3.10, 1.28)	0.414	54.87	<0.001
Used a certified music therapist										
Yes	32	-0.69 (-0.88, -0.49)	<0.001	131.76	<0.001	-	-	-	-	-
No	5	-0.93 (-2.12, 0.25)	0.123	82.69	<0.001	10	-1.71(-2.61, -0.81)	<0.001	234.94	<0.001

<https://doi.org/10.1371/journal.pone.0240862.t002>

remarkable different effect (Table 2). Table 2 also presents the subgroup analysis of music medicine on reducing depression.

In the subgroup analysis by total session, music therapy and music medicine both exhibited a stronger effects of short (1–4 sessions) and medium length (5–12 sessions) compared with long intervention periods (>13sessions) (Fig 6). Meta-regression demonstrated that total

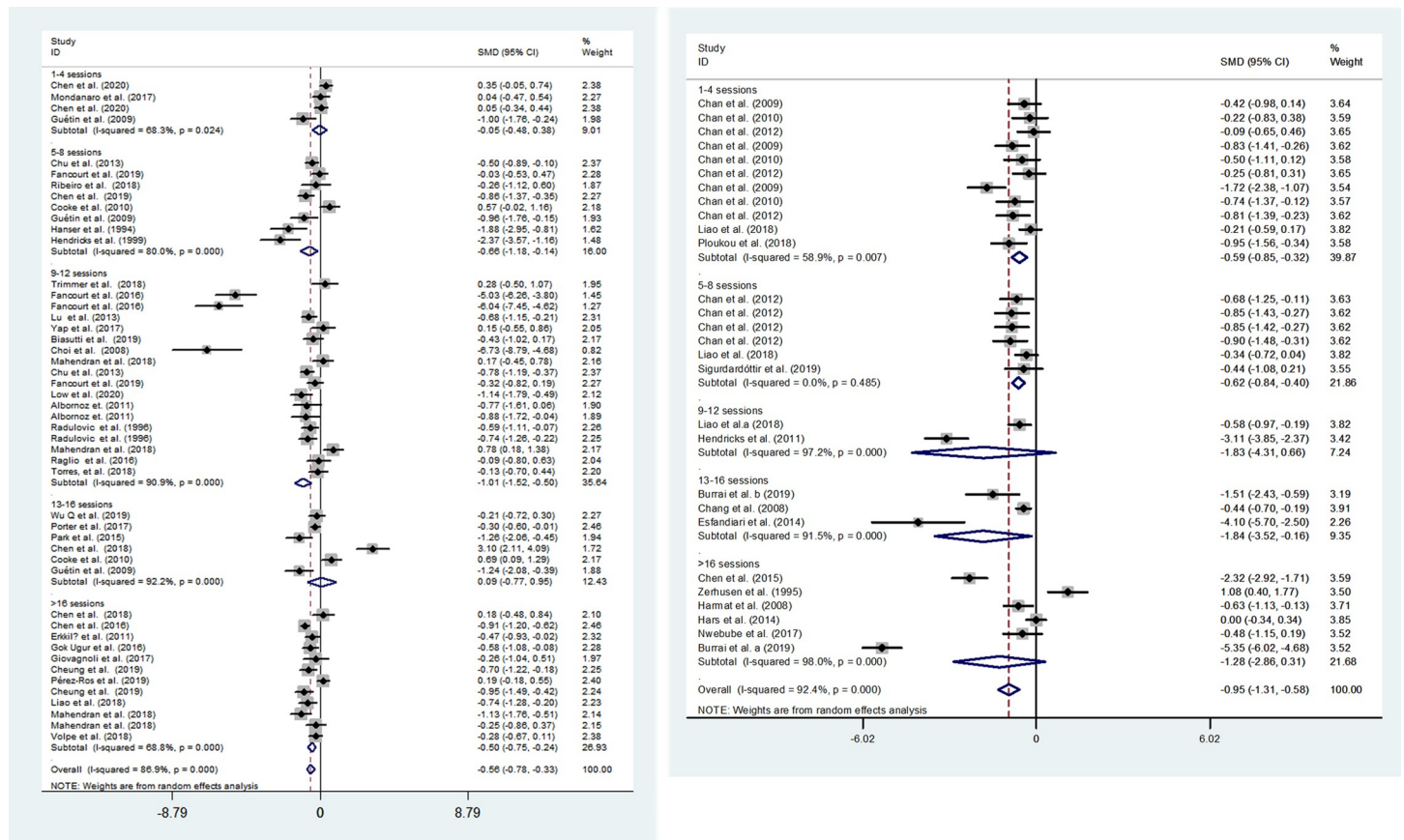


Fig 6. Effects of music therapy and music medicine to reduce depression by total sessions. A, evaluating the effect of music therapy; B, evaluating the effect of music medicine.

<https://doi.org/10.1371/journal.pone.0240862.g006>

music intervention session was significantly associated with the homogeneity between studies ( $P = 0.004$ ) (Table 3).

### Sensitivity analyses

We performed sensitivity analyses and found that re-estimating the pooled effects using fixed effect model, using trim and fill analysis, excluding the paper without information regarding music therapy, excluding the papers with more high biases, excluding the papers with small sample size ( $20 < n < 30$ ), excluding the studies focused on the people with a severe mental disease, and excluding the papers using an infrequently used scale yielded the similar results, which indicated that the primary results was robust (Table 4).

### Evaluation of publication bias

We assessed publication bias using Egger's linear regression test and funnel plot, and the results are presented in Fig 7. For the main result, the observed asymmetry indicated that either the absence of papers with negative results or publication bias.

### Discussion

Our present meta-analysis exhibited a different effect of music therapy and music medicine on reducing depression. Different music therapy methods also exhibited a different effect, and the recreative music therapy and guided imagery and music yielded a superior effect on reducing depression compared with other music therapy methods. Furthermore, music therapy and music medicine both exhibited a stronger effects of short and medium length compared with long intervention periods. The strength of this meta-analysis was the stable and high-quality result. Firstly, the sensitivity analyses performed in this meta-analysis yielded similar results, which indicated that the primary results were robust. Secondly, considering the insufficient statistical power of small sample size, we excluded studies with a very small sample size ( $n < 20$ ).

**Table 3. Meta-regression analysis of the main characteristics of the 33 studies.**

Characteristics	Music therapy		Music medicine	
	Coef. 95%CI	P	Coef. 95%CI	P
Sample size	0(-0.01, 0.03)	0.704	0(-0.01, 0.01)	0.926
Mean age (years)	0.01(-0.03, 0.05)	0.39	-	-
Setting				
Inpatient	1		1	
Outpatient	0.13(-1.98, 2.23)	0.901	1.48(-0.59, 3.55)	0.139
Pre-treatment diagnosis				
Mental health	1	1	1	
Depression	-0.24(-1.20, 0.72)	0.622	-0.24(-2.08, 1.61)	0.789
Severe mental disease /psychiatric disorder	-0.22(-1.18, 0.75)	0.652	-	
Music therapy method				
Active music therapy	1			
Receptive music therapy	0.13(-1.89, 2.14)	0.895	-	-
Active+receptive	0.48(-2.26, 3.21)	0.716	-	-
Total music intervention sessions	0.01(-0.05, 0.06)	0.83	-0.02(-0.03, -0.01)	0.004
Music intervention frequency	-0.08(-1.74, 1.58)	0.918	0.45(-0.66, 1.57)	0.376
Time per session (minutes)	-0.01(-0.04, 0.02)	0.482	-0.01(-0.07, 0.05)	0.778

<https://doi.org/10.1371/journal.pone.0240862.t003>



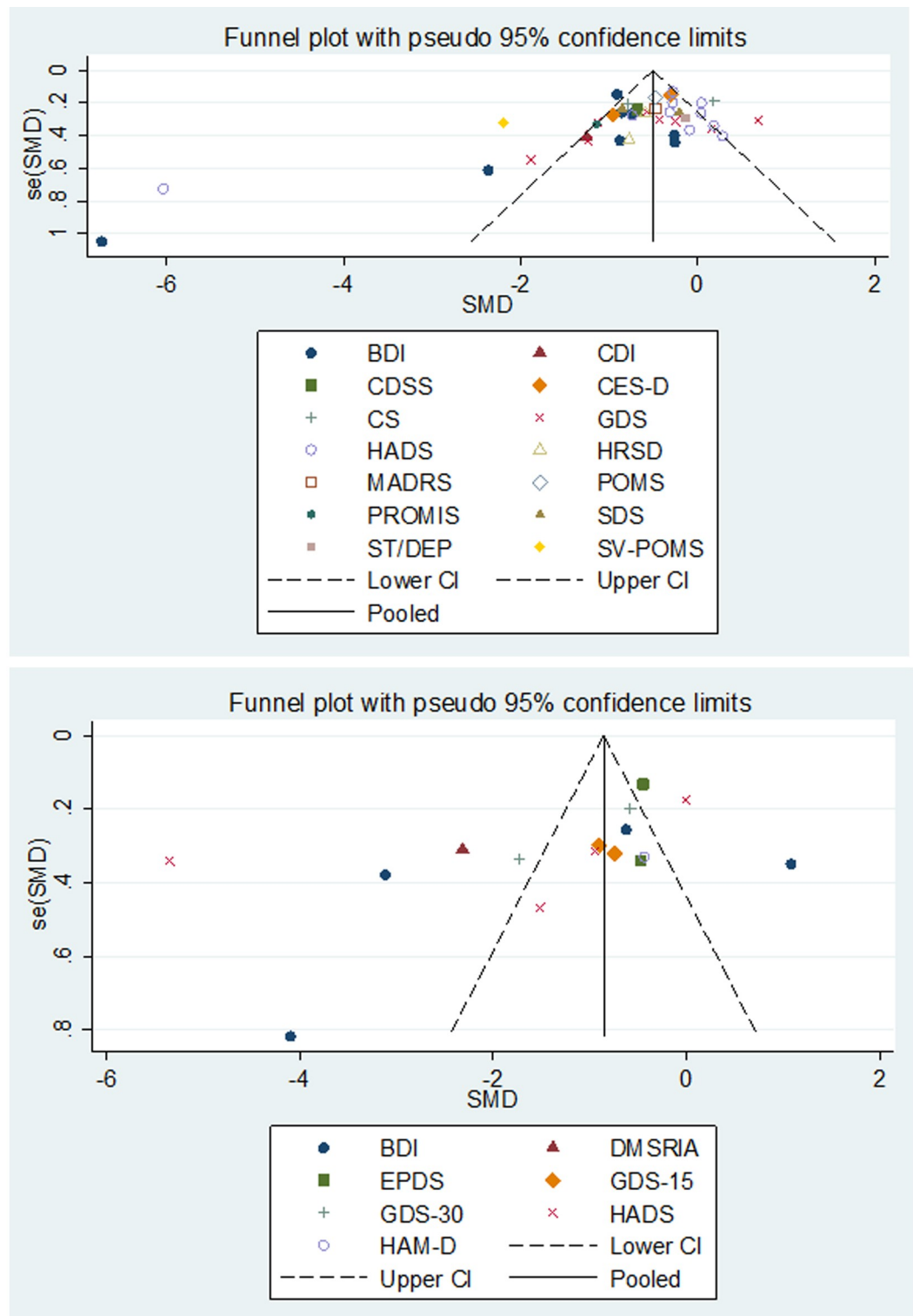
Table 4. Sensitivity analyses of the main outcomes [SMD (95%CI)].

Outcomes	Trials number	Effects		Heterogeneity		Egger's est	
		SMD (95% CI)	P	I <sup>2</sup> (%)	P	a	P
Music therapy							
Using fixed effect model	41	-0.50 (-0.58, -0.43)	<0.001	83	<0.001	-2.82(-4.71, -0.93)	0.005
Using trim and fill analysis	41	-0.66 (-0.86, -0.46)	<0.001	-	<0.001	-	-
Excluding the paper without information regarding music therapy (Chirico et al., 2020; Koelsch et al., 2010; Toccafondi et al., 2017; Porter et al., 2017)	37	-0.66 (-0.88, -0.43)	<0.001	82.2	<0.001	-3.03(-5.26, -0.81)	0.009
Excluding the papers with high bias (Toccafondi et al., 2017 and Fancourt et al., 2019)	39	-0.69 (-0.91, -0.47)	<0.001	83.6	<0.001	-2.95(-5.04, -0.86)	0.007
Excluding the papers with small sample size (20 < n < 30)	35	-0.57 (-0.77, -0.38)	<0.001	81.3	<0.001	2.22(-4.53, 0.08)	0.058
Excluding the studies focused on the people with a severe mental disease (Choi et al., 2008; Cheung et al. 2019)	32	-0.64(-0.86, -0.42)	<0.001	82.1	<0.001	-2.54(-4.67, -0.40)	0.022
Excluding the papers using an infrequently used scale (Erkkilä et al., 2011; Chen et al., 2015; Cheung et al., 2019; Chirico et al., 2020; Park et al., 2015; Sigurdardóttir et al., 2019; Wu et al., 2019; Low et al., 2020)	34	-0.62 (-0.84, -0.39)	<0.001	83.2	<0.001	-2.63(-4.67, -0.60)	0.013
Music medicine							
Using fixed effect model	16	-0.86(-0.98, -0.73)	<0.001	95.4	<0.001	-5.78(-11.65, 0.10)	0.053
Using trim and fill analysis	16	-1.33(-1.96, -0.70)	<0.001	-	<0.001	-	-
Excluding the papers with small sample size (20 < n < 30) [49]	15	-1.32(-1.98, -0.66)	<0.001	95.7	<0.001	-6.09(-12.53, 0.36)	0.062
Excluding the papers using an infrequently used scale (Chen et al., 2015)	14	-1.25(-1.92, -0.57)	<0.001	95.7	<0.001	-5.71(-12.38, 0.98)	0.98

<https://doi.org/10.1371/journal.pone.0240862.t004>

Some prior reviews have evaluated the effects of music therapy for reducing depression. These reviews found a significant effectiveness of music therapy on reducing depression among older adults with depressive symptoms, people with dementia, puerpera, and people with cancers [4, 5, 73–76]. However, these reviews did not differentiate music therapy from music medicine. Another paper reviewed the effectiveness of music interventions in treating depression. The authors included 26 studies and found a significant reduction in depression in the music intervention group compared with the control group. The authors made a clear distinction on the definition of music therapy and music medicine; however, they did not include all relevant data from the most recent trials and did not conduct a meta-analysis [77]. A recent meta-analysis compared the effects of music therapy and music medicine for reducing depression in people with cancer with seven RCTs; the authors found a moderately strong, positive impact of music intervention on depression, but found no difference between music therapy and music medicine [78]. However, our present meta-analysis exhibited a different effect of music therapy and music medicine on reducing depression, and the music medicine yielded a superior effect on reducing depression compared with music therapy. The different effect of music therapy and music medicine might be explained by the different participants, and nine studies used music therapy to reduce the depression among people with severe mental disease /psychiatric disorder, while no study used music medicine. Furthermore, the studies evaluating music therapy used more clinical diagnostic scale for depressive symptoms.

A meta-analysis by Li et al. [74] suggested that medium-term music therapy (6–12 weeks) was significantly associated with improved depression in people with dementia, but not short-



**Fig 7. Funnel plot illustrating proneness to publication bias for the included studies.** A, evaluating the publication bias of music therapy; B, evaluating the publication bias of music medicine; BDI = Beck Depression Inventory; CDI = Children’s Depression Inventory; CDSS = depression scale for schizophrenia; CES-D = Center for Epidemiologic Studies Depression; CS = Cornell Scale; DMSRIA = Depression Mood Self-Report Inventory for Adolescence; EPDS = Edinburgh Postnatal Depression Scale; GDS-15 = Geriatric Depression Scale-15; GDS-30 = Geriatric Depression Scale-30; HADS = Hospital Anxiety and Depression Scale; HRSD (HAM-D) = Hamilton Rating Scale for Depression; MADRS = Montgomery-sberg

Depression Rating Scale; PROMIS = Patient Reported Outcomes Measurement Information System; SDS = Self-Rating Depression Scale; State-Trait Depression Questionnaire = ST/DEP; SV-POMS = short version of Profile of Mood Stat.

<https://doi.org/10.1371/journal.pone.0240862.g007>

term music therapy (3 or 4 weeks). On the contrary, our present meta-analysis found a stronger effect of short-term (1–4 weeks) and medium-term (5–12 weeks) music therapy on reducing depression compared with long-term ( $\geq 13$  weeks) music therapy. Consistent with the prior meta-analysis by Li et al., no significant effect on depression was observed for the follow-up of one or three months after music therapy was completed in our present meta-analysis. Only five studies analyzed the therapeutic effect for the follow-up periods after music therapy intervention therapy was completed, and the rather limited sample size may have resulted in this insignificant difference. Therefore, whether the therapeutic effect was maintained in reducing depression when music therapy was discontinued should be explored in further studies. In our present meta-analysis, meta-regression results demonstrated that no variables (including period, frequency, method, populations, and so on) were significantly associated with the effect of music therapy. Because meta-regression does not provide sufficient statistical power to detect small associations, the non-significant results do not completely exclude the potential effects of the analyzed variables. Therefore, meta-regression results should be interpreted with caution.

Our meta-analysis has limitations. First, the included studies rarely used masked methodology due to the nature of music therapy, therefore the performance bias and the detection bias was common in music intervention study. Second, a total of 13 different scales were used to evaluate the depression level of the participants, which may account for the high heterogeneity among the trials. Third, more than half of those included studies had small sample sizes ( $< 50$ ), therefore the result should be explicated with caution.

## Conclusion

Our present meta-analysis of 55 RCTs revealed a different effect of music therapy and music medicine, and different music therapy methods also exhibited a different effect. The results of subgroup analyses revealed that the characters of music therapy were associated with the therapeutic effect, for example specific music therapy methods, short and medium-term therapy, and therapy with more time per session may yield stronger therapeutic effect. Therefore, our present meta-analysis could provide suggestion for clinicians and policymakers to design therapeutic schedule of appropriate lengths to reduce depression.

## Supporting information

**S1 Checklist. PRISMA checklist.**  
(DOC)

**S1 Dataset.**  
(XLSX)

## Author Contributions

**Conceptualization:** Qishou Tang, Peijie Ye.

**Methodology:** Zhaohui Huang.

**Software:** Zhaohui Huang.

**Writing – original draft:** Qishou Tang.

**Writing – review & editing:** Huan Zhou, Peijie Ye.

## References

1. World Health Organization. Depression. 2017. Retrieved from <http://www.who.int/mediacentre/factsheets/fs369/en/>.
2. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* (London, England) 2018; 392(10159): 1789–858. doi: 10.1016/S0140-6736(18)32855-3 PMID: 30497171
3. Wang PS, Aguilar-Gaxiola S, Alonso J, et al. Use of mental health services for anxiety, mood, and substance disorders in 17 countries in the WHO world mental health surveys. *Lancet* (London, England) 2007; 370(9590): 841–50. doi: 10.1016/S0140-6736(07)61038-9 PMID: 17603397
4. Kishita N, Backhouse T, Mioshi E. Nonpharmacological Interventions to Improve Depression, Anxiety, and Quality of Life (QoL) in People With Dementia: An Overview of Systematic Reviews. *J Geriatr Psychiatry Neurol* 2020; 33(1): 28–41. doi: 10.1177/0891988719856690 PMID: 31203712
5. Zhao K, Bai ZG, Bo A, Chi I. A systematic review and meta-analysis of music therapy for the older adults with depression. *Int J Geriatr Psychiatry* 2016; 31(11): 1188–98. doi: 10.1002/gps.4494 PMID: 27094452
6. American Music Therapy Association (2020). Definition and Quotes about Music Therapy. Available online at: <https://www.musictherapy.org/about/quotes/> (Accessed Sep 13, 2020).
7. Yinger OS, Gooding L. Music therapy and music medicine for children and adolescents. *Child Adolesc Psychiatr Clin N Am* 2014; 23(3): 535–53. doi: 10.1016/j.chc.2013.03.003 PMID: 24975624
8. Bradt J, Potvin N, Kesslick A, et al. The impact of music therapy versus music medicine on psychological outcomes and pain in cancer patients: a mixed methods study. *Supportive care in cancer: official journal of the Multinational Association of Supportive Care in Cancer* 2015; 23(5): 1261–71. doi: 10.1007/s00520-014-2478-7 PMID: 25322972
9. Wigram Tony. Inge Nyggard Pedersen&Lars Ole Bonde, A Comphensire Guide to Music Therapy. London and Philadelphia: Jessica Kingsley Publishers. 2002:143. doi: 10.1016/s0387-7604(02)00058-x PMID: 12142064
10. Higgins J, Altman D, Sterne J. Chapter 8: Assessing risk of bias in included studies. In I. J. Higgins, R. Churchill, J. Chandler & M. Cumpston (Eds.), *Cochrane Handbook for Systematic Reviews of Interventions* version 5.2.0 (updated June 2017). Cochrane 2017.
11. Wheeler BL. *Music Therapy Handbook*. New York, New York, USA: Guilford Publications, 2015.
12. Bruscia KE. *Defining Music Therapy*. 3rd Edition. University Park, Illinois, USA: Barcelona Publishers, 2014. doi: 10.1182/blood-2013-06-507582 PMID: 24574460
13. Wigram Tony. Inge Nyggard Pedersen&Lars Ole Bonde, A Comphensire Guide to Music Therapy. London and Philadelphia: Jessica Kingsley Publishen. 2002: 143. doi: 10.1016/s0387-7604(02)00058-x PMID: 12142064
14. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* (Clinical research ed) 2003; 327(7414): 557–60. doi: 10.1136/bmj.327.7414.557 PMID: 12958120
15. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Statistics in medicine* 2002; 21(11): 1539–58. doi: 10.1002/sim.1186 PMID: 12111919
16. Cochran WG. The combination of estimates from different experiments. *Biometrics* 1954; 10: 101–29.
17. M E, G DS, M S, C M. Bias in meta-analysis detected by a simple, graphical test. *BMJ* (Clinical research ed) 1997; 315(7109): 629–34. doi: 10.1136/bmj.315.7109.629 PMID: 9310563
18. Wu Q, Chen T, Wang Z, et al. Effectiveness of music therapy on improving treatment motivation and emotion in female patients with methamphetamine use disorder: A randomized controlled trial. *Subst Abus* 2019; 1–8. doi: 10.1080/08897077.2019.1675117 PMID: 31638882
19. Volpe U, Gianoglio C, Autiero L, et al. Acute Effects of Music Therapy in Subjects With Psychosis During Inpatient Treatment. *Psychiatry* 2018; 81(3): 218–27. doi: 10.1080/00332747.2018.1502559 PMID: 30351238
20. Trimmer C, Tyo R, Pikard J, McKenna C, Naeem F. Low-Intensity Cognitive Behavioural Therapy-Based Music Group (CBT-Music) for the Treatment of Symptoms of Anxiety and Depression: A Feasibility Study. *Behav Cogn Psychother* 2018; 46(2): 168–81. doi: 10.1017/S1352465817000480 PMID: 28988549

21. Toccafondi A, Bonacchi A, Mambrini A, Miccinesi G, Prosseda R, Cantore M. Live music intervention for cancer inpatients: The Music Givers format. *Palliat Support Care* 2018; 16(6): 777–84. <https://doi.org/10.1017/S1478951517000165> PMID: 28347381
22. Sigurdardóttir GA, Nielsen PM, Rønager J, Wang AG. A pilot study on high amplitude low frequency-music impulse stimulation as an add-on treatment for depression. *Brain Behav* 2019; 9(10): e01399. <https://doi.org/10.1002/brb3.1399> PMID: 31507100
23. Ribeiro MKA, Alcântara-Silva TRM, Oliveira JCM, et al. Music therapy intervention in cardiac autonomic modulation, anxiety, and depression in mothers of preterms: randomized controlled trial. *BMC Psychol* 2018; 6(1): 57. <https://doi.org/10.1186/s40359-018-0271-y> PMID: 30545420
24. Ploukou S, Panagopoulou E. Playing music improves well-being of oncology nurses. *Appl Nurs Res* 2018; 39: 77–80. <https://doi.org/10.1016/j.apnr.2017.11.007> PMID: 29422181
25. Pérez-Ros P, Cubero-Plazas L, Mejías-Serrano T, Cunha C, Martínez-Arnau FM. Preferred Music Listening Intervention in Nursing Home Residents with Cognitive Impairment: A Randomized Intervention Study. *J Alzheimers Dis* 2019; 70(2): 433–42. <https://doi.org/10.3233/JAD-190361> PMID: 31177232
26. Park S, Lee J-M, Baik Y, et al. A Preliminary Study of the Effects of an Arts Education Program on Executive Function, Behavior, and Brain Structure in a Sample of Nonclinical School-Aged Children. *J Child Neurol* 2015; 30(13): 1757–66. <https://doi.org/10.1177/0883073815579710> PMID: 25862737
27. Mahendran R, Gandhi M, Moorakonda RB, et al. Art therapy is associated with sustained improvement in cognitive function in the elderly with mild neurocognitive disorder: findings from a pilot randomized controlled trial for art therapy and music reminiscence activity versus usual care. *Trials* 2018; 19(1): 615. <https://doi.org/10.1186/s13063-018-2988-6> PMID: 30413216
28. Low MY, Lacson C, Zhang F, Kesslick A, Bradt J. Vocal Music Therapy for Chronic Pain: A Mixed Methods Feasibility Study. *J Altern Complement Med* 2020; 26(2): 113–22. <https://doi.org/10.1089/acm.2019.0249> PMID: 31750726
29. Liao SJ, Tan MP, Chong MC, Chua YP. The Impact of Combined Music and Tai Chi on Depressive Symptoms Among Community-Dwelling Older Persons: A Cluster Randomized Controlled Trial. *Issues Ment Health Nurs* 2018; 39(5): 398–402. <https://doi.org/10.1080/01612840.2017.1417519> PMID: 29436896
30. Liao SJ, Chong MC, Tan MP, Chua YP. Tai Chi with music improves quality of life among community-dwelling older persons with mild to moderate depressive symptoms: A cluster randomized controlled trial. *Geriatr Nurs* 2019; 40(2): 154–9. <https://doi.org/10.1016/j.gerinurse.2018.08.001> PMID: 30173939
31. Hars M, Herrmann FR, Gold G, Rizzoli R, Trombetti A. Effect of music-based multitask training on cognition and mood in older adults. *Age Ageing* 2014; 43(2): 196–200. <https://doi.org/10.1093/ageing/afu163> PMID: 24212920
32. Hanser SB, Thompson LW. Effects of a music therapy strategy on depressed older adults. *J Gerontol* 1994; 49(6): P265–P9. <https://doi.org/10.1093/geronj/49.6.p265> PMID: 7963281
33. Guétin S, Portet F, Picot MC, et al. Effect of music therapy on anxiety and depression in patients with Alzheimer's type dementia: randomised, controlled study. *Dement Geriatr Cogn Disord* 2009; 28(1): 36–46. <https://doi.org/10.1159/000229024> PMID: 19628939
34. Gök Ugur H, Yaman Aktaş Y, Orak OS, Saglambilen O, Aydin Avci İ. The effect of music therapy on depression and physiological parameters in elderly people living in a Turkish nursing home: a randomized-controlled trial. *Aging Ment Health* 2017; 21(12): 1280–6. <https://doi.org/10.1080/13607863.2016.1222348> PMID: 27592520
35. Fancourt D, Warran K, Finn S, Wiseman T. Psychosocial singing interventions for the mental health and well-being of family carers of patients with cancer: results from a longitudinal controlled study. *BMJ Open* 2019; 9(8): e026995. <https://doi.org/10.1136/bmjopen-2018-026995> PMID: 31401592
36. Erkkilä J, Punkanen M, Fachner J, et al. Individual music therapy for depression: randomised controlled trial. *Br J Psychiatry* 2011; 199(2): 132–9. <https://doi.org/10.1192/bjp.bp.110.085431> PMID: 21474494
37. Cooke M, Moyle W, Shum D, Harrison S, Murfield J. A randomized controlled trial exploring the effect of music on quality of life and depression in older people with dementia. *Journal of health psychology* 2010; 15(5): 765–76. <https://doi.org/10.1177/1359105310368188> PMID: 20603300
38. Chu H, Yang C-Y, Lin Y, et al. The impact of group music therapy on depression and cognition in elderly persons with dementia: a randomized controlled study. *Biol Res Nurs* 2014; 16(2): 209–17. <https://doi.org/10.1177/1099800413485410> PMID: 23639952
39. Choi AN, Lee MS, Lim HJ. Effects of group music intervention on depression, anxiety, and relationships in psychiatric patients: a pilot study. *J Altern Complement Med* 2008; 14(5): 567–70. <https://doi.org/10.1089/acm.2008.0006> PMID: 18564958

40. Chirico A, Maiorano P, Indovina P, et al. Virtual reality and music therapy as distraction interventions to alleviate anxiety and improve mood states in breast cancer patients during chemotherapy. *J Cell Physiol* 2020; 235(6): 5353–62. <https://doi.org/10.1002/jcp.29422> PMID: 31957873
41. Cheung AT, Li WHC, Ho KY, et al. Efficacy of musical training on psychological outcomes and quality of life in Chinese pediatric brain tumor survivors. *Psycho-oncology* 2019; 28(1): 174–80. <https://doi.org/10.1002/pon.4929> PMID: 30353603
42. Chen SC, Chou CC, Chang HJ, Lin MF. Comparison of group vs self-directed music interventions to reduce chemotherapy-related distress and cognitive appraisal: an exploratory study. *Supportive care in cancer: official journal of the Multinational Association of Supportive Care in Cancer* 2018; 26(2): 461–9.
43. Chen CJ, Sung HC, Lee MS, Chang CY. The effects of Chinese five-element music therapy on nursing students with depressed mood. *Int J Nurs Pract* 2015; 21(2): 192–9. <https://doi.org/10.1111/ijn.12236> PMID: 24593291
44. Chen CJ, Chen YC, Ho CS, Lee YC. Effects of preferred music therapy on peer attachment, depression, and salivary cortisol among early adolescents in Taiwan. *Journal of advanced nursing* 2019; 75(9): 1911–21. <https://doi.org/10.1111/jan.13975> PMID: 30746740
45. Chan MF, Wong ZY, Onishi H, Thayala NV. Effects of music on depression in older people: a randomised controlled trial. *J Clin Nurs* 2012; 21(5–6): 776–83. <https://doi.org/10.1111/j.1365-2702.2011.03954.x> PMID: 22035368
46. Chan MF, Chan EA, Mok E, Kwan Tse FY. Effect of music on depression levels and physiological responses in community-based older adults. *Int J Ment Health Nurs* 2009; 18(4): 285–94. <https://doi.org/10.1111/j.1447-0349.2009.00614.x> PMID: 19594648
47. Chan MF, Chan EA, Mok E. Effects of music on depression and sleep quality in elderly people: A randomised controlled trial. *Complement Ther Med* 2010; 18(3–4): 150–9. <https://doi.org/10.1016/j.ctim.2010.02.004> PMID: 20688261
48. Burrai F, Sanna GD, Moccia E, et al. Beneficial Effects of Listening to Classical Music in Patients With Heart Failure: A Randomized Controlled Trial. *J Card Fail* 2019. <https://doi.org/10.1016/j.cardfail.2019.12.005> PMID: 31877362
49. Burrai F, Lupi R, Luppi M, et al. Effects of Listening to Live Singing in Patients Undergoing Hemodialysis: A Randomized Controlled Crossover Study. *Biol Res Nurs* 2019; 21(1): 30–8. <https://doi.org/10.1177/1099800418802638> PMID: 30249121
50. Biasutti M, Mangiacotti A. Music Training Improves Depressed Mood Symptoms in Elderly People: A Randomized Controlled Trial. *Int J Aging Hum Dev* 2019; 91415019893988. <https://doi.org/10.1177/0091415019893988> PMID: 31814419
51. Zerhusen JD, Boyle K, Wilson W. Out of the darkness: group cognitive therapy for depressed elderly. *J Psychosoc Nurs Ment Health Serv* 1991; 29(9): 16–21. PMID: 1941727
52. Radulovic R. The using of music therapy in treatment of depressive disorders. Summary of Master Thesis. Belgrade: Faculty of Medicine University of Belgrade, 1996.
53. Hendricks CB, Robinson B, Bradley B, Davis K. Using music techniques to treat adolescent depression. *Journal of Humanistic Counseling, Education and Development* 1999; 38: 39–46.
54. Hendricks CB. A study of the use of music therapy techniques in a group for the treatment of adolescent depression. *Dissertation Abstracts International* 2001; 62(2-A): 472.
55. Albornoz Y. The effects of group improvisational music therapy on depression in adolescents and adults with substance abuse: a randomised controlled trial. *Nordic Journal of Music Therapy* 2011; 20(3): 208–24.
56. Yap AF, Kwan YH, Tan CS, Ibrahim S, Ang SB. Rhythm-centred music making in community living elderly: a randomized pilot study. *BMC complementary and alternative medicine* 2017; 17(1): 311. <https://doi.org/10.1186/s12906-017-1825-x> PMID: 28615007
57. Wang J, Wang H, Zhang D. Impact of group music therapy on the depression mood of college students. *Health* 2011; 3: 151–5.
58. Torres E, Pedersen IN, Pérez-Fernández JI. Randomized Trial of a Group Music and Imagery Method (GrpMI) for Women with Fibromyalgia. *J Music Ther* 2018; 55(2): 186–220. <https://doi.org/10.1093/jmt/thy005> PMID: 29788133
59. Raglio A, Giovanazzi E, Pain D, et al. Active music therapy approach in amyotrophic lateral sclerosis: a randomized-controlled trial. *Int J Rehabil Res* 2016; 39(4): 365–7. <https://doi.org/10.1097/MRR.000000000000187> PMID: 27437724
60. Porter S, McConnell T, McLaughlin K, et al. Music therapy for children and adolescents with behavioural and emotional problems: a randomised controlled trial. *J Child Psychol Psychiatry* 2017; 58(5): 586–94. <https://doi.org/10.1111/jcpp.12656> PMID: 27786359

61. Nwebube C, Glover V, Stewart L. Prenatal listening to songs composed for pregnancy and symptoms of anxiety and depression: a pilot study. *BMC complementary and alternative medicine* 2017; 17(1): 256. <https://doi.org/10.1186/s12906-017-1759-3> PMID: 28482901
62. Mondanaro JF, Homel P, Lonner B, Shepp J, Lichtensztein M, Loewy JV. Music Therapy Increases Comfort and Reduces Pain in Patients Recovering From Spine Surgery. *Am J Orthop* 2017; 46(1): E13–E22. PMID: 28235116
63. Lu SF, Lo C-HK, Sung HC, Hsieh TC, Yu SC, Chang SC. Effects of group music intervention on psychiatric symptoms and depression in patient with schizophrenia. *Complement Ther Med* 2013; 21(6): 682–8. <https://doi.org/10.1016/j.ctim.2013.09.002> PMID: 24280478
64. Liao J, Wu Y, Zhao Y, et al. Progressive Muscle Relaxation Combined with Chinese Medicine Five-Element Music on Depression for Cancer Patients: A Randomized Controlled Trial. *Chin J Integr Med* 2018; 24(5): 343–7. <https://doi.org/10.1007/s11655-017-2956-0> PMID: 28497396
65. Koelsch S, Offermanns K, Franzke P. Music in the treatment of affective disorders: an exploratory investigation of a new method for music-therapeutic research. *Music Percept Interdisc J* 2010; 27: 307–16.
66. Harmat L, Takács J, Bódizs R. Music improves sleep quality in students. *Journal of advanced nursing* 2008; 62(3): 327–35. <https://doi.org/10.1111/j.1365-2648.2008.04602.x> PMID: 18426457
67. Giovagnoli AR, Manfredi V, Parente A, Schifano L, Oliveri S, Avanzini G. Cognitive training in Alzheimer's disease: a controlled randomized study. *Neurological sciences: official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology* 2017; 38(8): 1485–93. <https://doi.org/10.1007/s10072-017-3003-9> PMID: 28577267
68. Fancourt D, Perkins R, Ascenso S, Carvalho LA, Steptoe A, Williamon A. Effects of Group Drumming Interventions on Anxiety, Depression, Social Resilience and Inflammatory Immune Response among Mental Health Service Users. *PLoS ONE* 2016; 11(3): e0151136. <https://doi.org/10.1371/journal.pone.0151136> PMID: 26974430
69. Esfandiari N, Mansouri S. The effect of listening to light and heavy music on reducing the symptoms of depression among female students. *Arts Psychother* 2014; 41: 211–3.
70. Chen XJ, Hannibal N, Gold C. Randomized Trial of Group Music Therapy With Chinese Prisoners: Impact on Anxiety, Depression, and Self-Esteem. *Int J Offender Ther Comp Criminol* 2016; 60(9): 1064–81. <https://doi.org/10.1177/0306624X15572795> PMID: 25733743
71. Chen SC, Yeh ML, Chang HJ, Lin MF. Music, heart rate variability, and symptom clusters: a comparative study. *Supportive care in cancer: official journal of the Multinational Association of Supportive Care in Cancer* 2020; 28(1): 351–60.
72. Chang MY, Chen CH, Huang KF. Effects of music therapy on psychological health of women during pregnancy. *J Clin Nurs* 2008; 17(19): 2580–7. <https://doi.org/10.1111/j.1365-2702.2007.02064.x> PMID: 18298503
73. Yang WJ, Bai YM, Qin L, et al. The effectiveness of music therapy for postpartum depression: A systematic review and meta-analysis. *Complement Ther Clin Pract* 2019; 37. <https://doi.org/10.1016/j.ctcp.2019.09.002> PMID: 31541788
74. Li HC, Wang HH, Lu CY, Chen TB, Lin YH, Lee I. The effect of music therapy on reducing depression in people with dementia: A systematic review and meta-analysis. *Geriatr Nurs* 2019; 40(5): 510–6. <https://doi.org/10.1016/j.gerinurse.2019.03.017> PMID: 31056209
75. Gramaglia C, Gambaro E, Vecchi C, et al. Outcomes of music therapy interventions in cancer patients—A review of the literature. *Crit Rev Oncol Hematol* 2019; 138: 241–54. <https://doi.org/10.1016/j.critrevonc.2019.04.004> PMID: 31121392
76. Chen Y-J, Li X-X, Pan B, et al. Non-pharmacological interventions for older adults with depressive symptoms: a network meta-analysis of 35 randomized controlled trials. *Aging Ment Health* 2019. <https://doi.org/10.1080/13607863.2019.1704219> PMID: 31880174
77. Leubner D, Hinterberger T. Reviewing the Effectiveness of Music Interventions in Treating Depression. *Frontiers in psychology* 2017; 8: 1109. <https://doi.org/10.3389/fpsyg.2017.01109> PMID: 28736539
78. Bradt J, Dileo C, Magill L, Teague A. Music interventions for improving psychological and physical outcomes in cancer patients. *The Cochrane database of systematic reviews* 2016; (8): CD006911. <https://doi.org/10.1002/14651858.CD006911.pub3> PMID: 27524661