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Outcomes of music therapy interventions in cancer patients—A review of the literature

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ABSTRACT

Background: Effectiveness of music-based interventions (MI) on cancer patients' anxiety, depression, pain and quality of life (QoL) is a current research theme. MI are highly variable, making it challenging to compare studies. Objective and methods: To summarize the evidence on MI in cancer patients, 40 studies were reviewed following the PRISMA statement. Studies were included if assessing at least one outcome among anxiety, depression, QoL and pain in patients aged ≥ 18, with an active oncological/onco-haematological diagnosis, participating to any kind of Music Therapy (MT), during/after surgery, chemotherapy or radiotherapy.
Results: A positive effect of MI on the outcomes measured was supported. Greater reductions of anxiety and depression were observed in breast cancer patients. MI involving patients admitted to a hospital ward were less effective on QoL.
Conclusion: The increasing evidence about MI effectiveness, tolerability, feasibility and appreciation, supports the need of MI implementation in Oncology, Radiotherapy and Surgery wards, and promotion of knowledge among health operators.

1. Introduction

Cancer is a very complex disease (Knox, 2010), with an estimate of 369,000 new diagnoses in Italy in 2017, 46% of which involving women. In Italy, every day approximately 1000 people receive a new diagnosis of infiltrating malignancy (Gori et al., 2015). Receiving an oncological diagnosis involves considerable psychological distress for the patient (Zabora et al., 2001) and reactions to diagnosis may include denial, fear of death, fear of recurrence, issues related to body and self-image, sexuality, relationships (with partner, family, friends), and lifestyle changes (Zaza et al., 2005). The illness itself or the necessary treatments may lead to a radical modification of patients' life habits. Especially in cases of advanced illness, symptoms can be very disabling (Zaza et al., 2005; Cheng and Zhang, 2016) and have a relevant impact on patients' physical well-being and quality of life (QoL), leading to emotional, physical and social suffering (Bradt et al., 2011; Tang et al., 2017) and eventually to elevated levels of psychological distress and depression (Bradt and Dileo, 2014; Massie, 2004; Watts et al., 2014; Fradelos et al., 2017).

On the other hand, patients' coping skills may modulate the psychobiological impact of stress and cancer treatment and thus shape the long-term outcome of the illness (Cheng and Zhang, 2016). Engagement coping (Compas et al., 2006) proved effective in contributing to improvements in physical health and psychosocial adjustment, and to lower levels of anxiety and depression in cancer patients (Cheng and Zhang, 2016). A negative association has been described between time since diagnosis and resilience, suggesting that resilient individuals may ultimately be worn down by the diagnosis of a life-threatening disease

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(Manne et al., 2015). From a clinical standpoint, promoting a sense of purpose in one's life and facilitating expression of positive emotions may prove beneficial (Fredrickson, 2001). Existing interventions that focus on these skills, such as meaning-based interventions, seem promising for cancer populations; nonetheless, matching the individual patient's characteristics with the most helpful and cost-effective psychosocial interventions may be challenging (Clark et al., 2003; Lee et al., 2006).

Recent trends of modern cancer care include approaches based on integration and holistic thinking (Bernad et al., 2010), with different types of psychosocial care being currently available for cancer patients. Previous works suggest that non-pharmacological factors possibly play an important role in how patients experience or interpret physical symptoms and psychological distress during the oncological treatment phase (Thune-Boyle et al., 2006; Montgomery and Bovbjerg, 2010). Specifically, the idea that patients with cancer may benefit from musical expression and musical experiences has been supported by Music Therapy (MT) research (Stanczyk, 2011a). Music is a form of art with the potential to affect people spiritually, emotionally, socially and physically (Stanczyk, 2011b). Therefore, MT might play an important role in the improvement of both psychological and physiological conditions of cancer patients, helping them coping with negative emotions. MT in cancer care should address the psycho-physiological needs arising from the disease, focusing on the relief of anxiety, depressive symptoms and pain (Stanczyk, 2011a; Gebuza et al., 2017; Palmer et al., 2015; Rossetti et al., 2017; Burrai et al., 2014; Lesiuk, 2015), with the aim to eventually foster the improvement of QoL (Hanser et al., 2006; Uggla et al., 2016; Mattei and Rodriguez, 2013). Other effects of MT may include relaxation (Burrai et al., 2014) and reduction of side effects of chemo and radiation therapy (Greenlee et al., 2014; Moradian and Howell, 2015; Zhou et al., 2015; Mattei et al., 2013).

A clear distinction exists between *music-medicine (MM)* and *MT*. While the term MM refers to the patient listening to recorded music, and is an intervention usually delivered by healthcare workers, MT means the use of music in all its forms in the context of the therapist-patient relationship (Kamioka et al., 2014; Bradt et al., 2016). Notwithstanding the several existing concepts of MT, one of the most used definitions available in the literature was proposed in 2005 by the American Association of Music Therapy (AMTA, 2005), which qualifies it as "an established health profession in which music is used within a therapeutic relationship to address physical, emotional, cognitive, and social needs of individuals".

Overall, there are two main types of MT: Receptive and Active. The first one includes any intervention where the patient simply listens to music with the aid of a reproducer, and is actively involved in the process of perception, imagination and elaboration under the guidance of the therapist. In active MT the patient is directly involved in the production of sounds, through singing, use of instruments, improvisation (Bruscia, 2014; Atiwannapat et al., 2016).

With the main goal of adding to the existing knowledge about MT applications in oncological settings, the current systematic review analyzed the available research studies on MT interventions during the treatment of oncological patients (including surgical, chemotherapeutic or radiotherapeutic treatments), evaluating their effects on at least one of the following outcomes: anxiety, depressive symptoms, quality of life, pain.

2. Methods

A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA Statement; (Liberati et al., 2009)]. The Medline database was searched on January 12th 2018, using the following "key words":

"(Music Therapy) AND cancer[MeSH Major Topic] AND (("anxiety"[MeSH Terms] OR "anxiety"[All Fields]) OR ("depressive disorder"[MeSH Terms] OR ("depressive"[All Fields] AND "disorder"[All Fields]) OR "depressive disorder"[All Fields] OR "depression"[All Fields] OR "depression"[MeSH Terms]) OR ("quality of life"[MeSH Terms] OR ("quality"[All Fields] AND "life"[All Fields]) OR "quality of life"[All Fields])) AND ("adult"[MeSH Terms] OR "adult"[MeSH Terms:noexp] OR "aged"[MeSH Terms])"

Afterward, on June 28th 2018, a new literature revision was conducted through Embase with the following "key words":

*(TITLE-ABS-KEY ("Music Therapy" AND cancer) AND TITLE-ABS KEY ((*anxiety* OR *depression* OR "quality of life"))).*

Two independent reviewers (E.G. and C.G.) assessed the articles identified by the above "key words". After removing duplicates, titles were screened first, and those clearly not in line with the purpose of the review were excluded. Then abstracts were assessed, and last full texts were read, eventually leading to the inclusion or exclusion of the papers. Possible disagreement between reviewers was resolved by joint discussion with a third review author (P.Z.). Quality of studies was assessed with the Newcastle Ottawa Scale (NOS) (Wells et al., 2009).

To be included in the review, studies had to: (a) deal with patients with an active oncological or onco-haematological diagnosis, aged 18 years old or more; (b) involve the application of any kind of MT or MM during or after surgery and/or radiotherapy and/or chemotherapy/targeted therapy; (c) evaluate via questionnaires the effects of MT interventions on at least one of the following outcomes: anxiety, depressive symptoms, QoL. Only articles in English were considered eligible. Studies which did not match the inclusion criteria described above were excluded.

Data extracted from the selected studies were recorded in a datasheet using a standardized coding form, including the following categorical and numerical variables: general information about the study (author/s, year of publication, duration of the study, title, journal title, volume, pages, country, study type, sample size, number in experimental group, number in control group, lost at follow up), participants' information (sex, age, ethnicity, level of education, diagnosis and illness stage, treatment: surgery, chemotherapy, radiotherapy, palliative care, combined; medical and psychiatric comorbidities), intervention information (MT or MM, music selection, music preference: patient-preferred versus researcher selected; duration and frequency of the intervention, total session number, group or individual session, setting), outcome information (questionnaire used, study results, anxiety, depression, pain, QoL).

Descriptive statistics used frequencies and percentages in the case of qualitative variables and means, standard deviations (SDs) and maxima and minima in the case of quantitative variables. Group differences in categorical variables were evaluated using the chi-squared test and group differences in continuous variables were assessed using a t-test. A p value $< .05$ was considered statistically significant. Analyses were performed using STATA 15 (StataCorp, 2017).

3. Results

As described in the PRISMA flow diagram (Fig. 1; Moher et al., 2009), the initial search identified 414 titles; at the end of the selection process, 40 studies were included in the qualitative synthesis.

Selected studies, main features and their results are shown in Table 1, including data on country of studies, patients' treatment, setting and intervention type, use of preferred or live music, outcomes and measures findings, and the NOS score.

3.1. General information

Most articles (Rossetti et al., 2017; Hanser et al., 2006; Zhou et al., 2015; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Jasemi et al.,

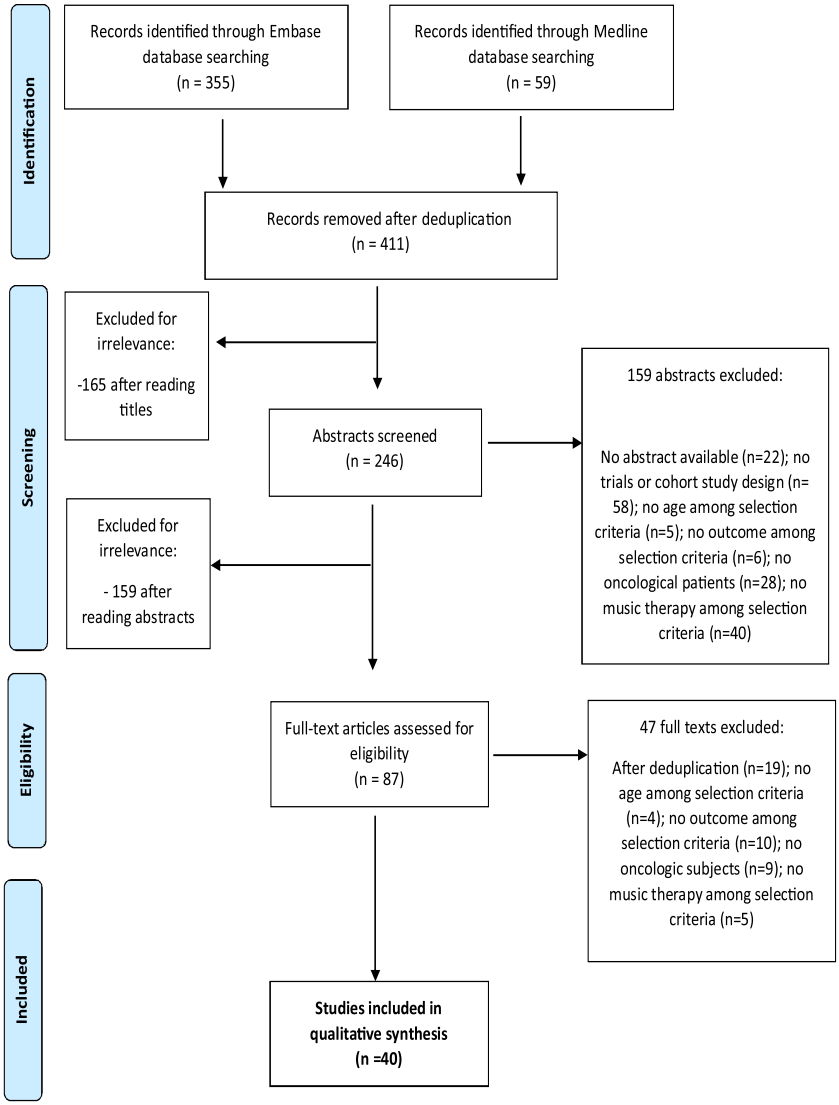

Fig. 1. Prisma Flow-chart.

2016; Preissler et al., 2016; Yates and Silverman, 2015; Bradt et al., 2015; Wei, 2014; Fredenburg and Silverman, 2014; Romito et al., 2013; Awikunprasert et al., 2012; O'Callaghan et al., 2012; Li et al., 2011; Hanser et al., 2006; Kwekkeboom, 2003; Tuinmann et al., 2017; Li et al., 2012; Bozcuk et al., 2006; Sabo and Michael, 1996) included in the review were Randomized Controlled Trials (RCTs; n = 33; 84.2%); furthermore, the selection included 3 (7.9%) cohort studies (Lesiuk, 2015; Chaput-McGovern and Silverman, 2012; Tuinmann et al., 2017), 1 case-control study (Letwin and Silverman, 2017) and 3 retrospective studies (Ramirez et al., 2018; Krishnaswamy and Nair, 2016; Wang et al., 2015).

All studies but one (Krishnaswamy and Nair, 2016) reported detailed information about the number of centers involved: most were conducted in a single center (n = 34; 87.2%) (Rossetti et al., 2017; Lesiuk, 2015; Hanser et al., 2006; Zhou et al., 2015; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Arruda et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Bradt et al., 2015; Wang et al., 2015; Wei, 2014; Fredenburg and Silverman, 2014; Romito et al., 2013; Awikunprasert et al., 2012; Chaput-McGovern and Silverman, 2012; Li et al., 2011; Kwekkeboom, 2003; Tuinmann et al., 2017; Li et al., 2012; Bozcuk et al., 2006; Clark et al., 2006; Hilliard, 2003; Zhou et al., 2011; Smith et al., 2001; Burns et al., 2008; Liao et al., 2013; Burns, 2001; Sabo and Michael, 1996), while 5 studies were multicenter (12.8%) (Ramirez et al., 2018; O'Callaghan et al., 2012; Bulfone et al., 2009; Palmer et al., 2015; Cassileth et al., 2003). Sample sizes ranged from 4 to 293 patients (mean = 41.05; SD = 45.77). Thirty-one studies involved a control group, composed by a mean of 33.23 participants (SD = 18.69; min 4 – max 85). Twenty-eight reports published information about patients lost at follow-up, whose mean number was 4.68 (SD = 6.37; min 0 – max 19) (Rossetti et al., 2017; Lesiuk, 2015; Hanser et al., 2006; Gallagher et al., 2018; Jasemi et al., 2016; Arruda et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Bradt et al., 2015; Wei, 2014; Chaput-McGovern and Silverman, 2012; O'Callaghan et al., 2012; Li et al., 2011; Kwekkeboom, 2003; Li et al., 2012; Bozcuk et al., 2006; Clark et al., 2006; Bulfone et al., 2009; Hilliard, 2003; Zhou et al., 2011; Smith et al., 2001; Palmer et al., 2015; Burns et al., 2008; Liao et al., 2013; Burns, 2001; Sabo and Michael, 1996).

3.2. Participants' features

According to the inclusion criteria adopted for this review, all studies involved patients aged more than 18 years old (mean age = 53.53; SD = 5.20; min18 – max 63.1). Most studies involved patients of both genders (n = 25; 65.8%) (Rossetti et al., 2017; Hanser et al., 2006;

Table 1
Main features of the studies included in the review.

STUDY	COUNTRY	PATIENTS	TREATMENT/SETTING	INTERVENTION TYPE	PREFERRED/ LIVE MUSIC	INTERVENTION METHODOLOGY	OUTCOMES AND MEASURES	FINDINGS	NOS
Arruda et al., 2016	Brazil	n: 41 Mean age: NS (> 18) Gender: mixed Diagnosis: mixed oncology	Only use of analgesics NS	MM	N/N	30 min session of individual music listening over a period of three days	Depression: BDI Pain: VAS	Music promoted an improvement of pain and depression	4
Awikunprasert et al., 2012	Thailand	n: 20 Mean age: 52.76 Gender: mixed Diagnosis: mixed oncology	CT, RT and surgery/Hospice	MT	N/N	Singing and praying 5 times a week for 12 weeks	QoL: HQLI-R	Increase of QoL, highest in the music + exercise treatment group	4
Bieligmeyer et al., 2018	Germany	n: 21 Mean age: 54.4 Gender: mixed Diagnosis: mixed oncology	CT/ hospital room	MT	N/N	25 min session with music therapist at patient bedside	QoL and Pain: EORTC-QLQ C30	Subjective well-being following the vibroacoustic MI	3
Bozcuk et al., 2006	Turkey	n: 18 Mean Age: 45.6 Gender: women Diagnosis: breast cancer	CT/ CT Session	MM	N/N	Recorded music played in the room during a single CT session	QoL: EORTC-QLQ C30	No statistically significant effect of MT on the outcomes assessed	5
Bradt et al., 2015	USA	n: 31 Mean age: 53.8 Gender: mixed Diagnosis: mixed oncology	Inpatient or outpatient cancer treatment/NS	Combined	Y/Y	2 sessions involving interactive music making with a music theapist and 2 sessions listening to pre-recorded music without the therapist	Anxiety and Depression: VAS	MM and MT sessions equally effective in improving anxiety, mood, relaxation, and pain	4
Bulfone et al., 2009	Italy	n: 60 Mean Age: 50.95 Gender: women Diagnosis: breast cancer	CT/CT Session	MM	N/N	Single session, 15 min of listening to recorded music	Anxiety: STAI	Reduction of anxiety	7
Burns, 2001	USA	n: 8 Mean Age: 48 Gender: women Diagnosis: mixed oncology	Any/ Outpatient visit	MT	N/N	10 weekly sessions of GIM MT	Anxiety and Depression: POMS QoL: QOL-CA	Reduction of anxiety and depression QoL improvement	6
Burns et al., 2008	USA	n: NS Mean Age: 54 Gender: mixed Diagnosis: hematological malignancies	CT/ Hematology-Oncology Ward	Combined	Y/N	Two weekly 45-minute sessions of GIM MT for 4 weeks. Daily exercises of listening and meditation	Anxiety: STAI	No statistically significant effect of MT on the outcomes assessed	6
Cassileth et al., 2003	Ireland	n: 62 Mean Age: 52 Gender: mixed Diagnosis: hematological malignancies	CT/ Hematology-Oncology Ward	Combined	NS/Y	Individual 30 min MT sessions, using active or receptive technique depending on patient's choice. Frequency and total number of sessions varied	Anxiety and Depression: POMS	Reduction of anxiety and depression	7
Chaput-McGovern and Silverman, 2012	USA	n: 27 Mean age: 59.67 Gender: mixed Diagnosis: mixed oncology (post-surgical)	Surgery/ Surgical Oncology Unit	MM	Y/Y	20 min MT session with patient-preferred live music. Once a week for approximately 3 hours for two years (not including summer sessions)	10-point Likert Scale Questionnaire composed for the study	Significant differences in relaxation, anxiety, and pain between pre-test and post-test and pre-test and follow-up measures No significant differences from post-test to follow up (treatments gains maintained)	2

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Table 1 (*continued*)

STUDY	COUNTRY	PATIENTS	TREATMENT/SETTING	INTERVENTI-ON TYPE	PREFERRED/ LIVE MUSIC	INTERVENTION METHODOLOGY	OUTCOMES AND MEASURES	FINDINGS	NOS
Chen et al., 2018a,b	Taiwan	n: 40 Mean age: Gender: women Diagnosis: breast cancer	CT	MT	N/Y	8 weekly 60 min sessions with receptive song, nature sounds, classical music	Anxiety and Depression: HADS	Reduction of anxiety, depression, and distorted cognition during CT and beyond	3
Clark et al., 2006	USA	n: 63 Mean Age: 57.7 Gender: mixed Diagnosis: mixed oncology	RT/ Patient's Home	MT	Y/N	Listening to recorded music; other relaxation techniques (e.g. Muscle relaxation or breathing exercises)	Anxiety and Depression: HADS	Reduction of anxiety: no effect on depression	7
Firmeza et al., 2017	Brazil	n: 40 Mean age: 33-80 Gender: mixed Diagnosis: head-neck cancer	Surgical unit; CT unit; RT; surgery + CT + RT; CT / dedicated hospital room	MM	N/N	30 min session of classical music listening; researcher close to the participant for the first and last 5 min of the listening	Anxiety: STAI scale	Greater reduction of anxiety in the experimental group	4
Fredenburg and Silverman, 2014	USA	n: 12 cases + 20 controls Mean age: 55.58 (controls 51.45) Gender: mixed Diagnosis: hematological malignancies	Recovering from a current/ previous BMT: returning to the hospital for complications; CT and/or RT in preparation for BMT/BMT unit	Combined	Y/Y	Single 30-min session; live music suited to the participants' preferences	Depression: I-PANAS-SF	Improvement of depression and pain	4
Gallagher et al., 2018	USA	n: 293 Mean age: 60 Gender: mixed Diagnosis: mixed oncology + non oncology	Palliative care/ Palliative care unit	MT	Y/Y	More than one music listening session, verbal/cognitive, vocal physical, verbal/emotional participation, and music-assisted relaxation	Anxiety, depression and pain: Rogers Happy/Sad Faces Assessment	Positive effect on pain, anxiety, depression, shortness of breath, mood, facial expression, and verbalization	4
Hanedan Uslu, 2017	Turkey	n: 36 Mean age: NS Gender: mixed Diagnosis: mixed oncology	RT/ RT room	MT	N/Y	15 min session with receptive song with Turkish folk, classical and popular music	Anxiety: STAI	Reduction of anxiety levels	3
Hanser et al., 2006	USA	n: 70 + 35 (controls) Mean age: 53 (controls 50) Gender: women Diagnosis: breast cancer (stage 4)	CT, Hormonal Therapy, Acupunture; RT; Massage Therapy, Reiki Therapy, Other, None/ Palliative care unit	MT	Y/Y	Three 45-min individual sessions of music listening and active music involvement to condition a relaxation or pleasant response	QoL: 27-item FACT-G Anxiety and Depression: HADS Relaxation: standard 10 cm VAS	Significant immediate effects of MT with improvements in reported comfort, relaxation, and happiness, as well as diminished physiologic stress arousal; no significant differences over time	4
Jasemi et al., 2016	Iran	n: 60 Mean age: 18–65 Gender: mixed Diagnosis: mixed oncology	Not specified/Not specified	MM	N/N	Two min session of individual listening to relaxing music and sounds Three sessions on three consecutive days	Anxiety and Depression: HADS	Anxiety and depression levels significantly decreased in experimental group	5
Krishnaswamy and Nair, 2016	India	n: 14 Mean age: not assessed Gender: NS Diagnosis: NS	Palliative care inpatients/ palliative care structure	NS	N/N	20 min session of individual Indian music listening	Anxiety: HAM-A Pain: NRS	Significant reduction of pain, but not of anxiety	2

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Table 1 (*continued*)

STUDY	COUNTRY	PATIENTS	TREATMENT/SETTING	INTERVENTION TYPE	PREFERRED/ LIVE MUSIC	INTERVENTION METHODOLOGY	OUTCOMES AND MEASURES	FINDINGS	NOS
Kwekkeboom, 2003	USA	n: 58 Mean age: 53.28 ± 15.71 Gender: mixed Diagnosis: diagnostic cancer procedures	Biopsy or port replacemnent/ Diagnostic cancer settings/ surgical unit	MM	Y/N	Session of preferred music listening	Anxiety: STAI Pain: numeric rating scale from 0 to 10	Outcomes achieved with music did not differ from those achieved with simple distraction No significant difference among TAU, MM or distraction interventions	3
Li et al., 2012	Germany	n: 20 Mean age: 49.3 Gender: female Diagnosis: breast or ovaric cancer	CT/Gynecological cancer unit	MM	N/N	30 min listening to professionally recorded MC sounds The PMR instructions and MC sounds both lasted for approximately 25 min. Verbal introduction (4 min) before and silence period (5 min) after each treatment (total listening time of 34 min)	Anxiety: STAI Quality of life: FB questionnaire	Both listening to recorded MC sounds and practising PMR reduce state anxiety and promoted psychological and social state in the two groups	4
Lesiu, 2015	USA	n: 15 Mean Age: 48.5 Gender: women Diagnosis: breast cancer	CT/CT Session	MT	N/N	Weekly sessions of Mindfulness-Based MT for 4 weeks	Depression: POMS	Reduction of depression	7
Letwin and Silverman, 2017	USA	n: 8 Mean age: 53.4 Gender: mixed Diagnosis: mixed oncology	CT, RT and no treatment/ Palliative care and oncology unit	MM	N/N	30-45 min session with music therapist with therapist-selected receptive song	Pain: 10-point Likert-type scale	Improvement of resilience and reduction of pain	3
Li et al., 2011	China	n: 120 Mean age: 45.01 ± 9.38 Gender: women Diagnosis: breast cancer (total mastectomy)	Surgery/ Surgical breast unit, CT unit, home	MM	Y/N	30 min session of listening to preferred music twice a day during the hospital stay after radical mastectomy and the two CT periods	Pain: The Chinese version of SF-MPQ, including also a VAS and the PPI of the standard MPQ	MT reduced the PRI-total score in the intervention group Similar results were found for VAS and PPI scores	3
Liao et al., 2013	China	n: 160 Mean Age: 63.1 Gender: mixed Diagnosis: mixed oncology	Palliative Care/ Hospice	MM	N/N	First intervention: listening to recorded chinese traditional music. Second intervention: listening to pop/commercial music Listening for 30 minutes a day, from Monday to Friday for 3 weeks	QoL: HQLI-R	QoL improvement	8
O'Callaghan et al., 2012	Australia	n: 100 Mean age: 57.5 Gender: mixed Diagnosis: mixed oncology (RT with curative approach)	RT/RT unit	MM	Y/N	Listening to recorded music during RT session	Anxiety: STAI	Anxiety decreased in both music and control groups following RT Perceived support from the MI; treatment duration seemed shorter owing to MI	5
Palmer et al., 2015	USA	n: 207 Mean age: 59.4 Gender: women Diagnosis: breast cancer	Surgery/ Surgery Ward	MT	Y/Y	Group 1: first MT session at hospital admission, with patient's preferred song played and sung live Group 2: at hospital admission, listening to recorded music chosen by the patient Both groups then listened to recorded music during surgery	Anxiety: VAS	Reduction of anxiety	6

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Table 1 (*continued*)

STUDY	COUNTRY	PATIENTS	TREATMENT/SETTING	INTERVENTI-ON TYPE	PREFERRED/ LIVE MUSIC	INTERVENTION METHODOLOGY	OUTCOMES AND MEASURES	FINDINGS	NOS
Ramirez et al., 2018	Spain	n: 20 Mean age: 69 Gender: mixed Diagnosis: mixed oncology	Palliative care/ Palliative care unit	Combined	N/Y	30 min session with receptive song, active song, relaxation intervention with instrumental, vocal, classical and popular music	Anxiety, Depression and Pain: ESAS	Decrease in tiredness, anxiety and breathing difficulties Increased well-being	3
Romito et al., 2013	Italy	n: 31 cases + 31 control Mean age: 54.14 (control 54.21) Gender: female Diagnosis: breast cancer	CT undergoing adjuvant treatment;; mastectomy / Cancer clinic during CT	MM	N/N	Listening to music, relaxation and picture visualization and activation by synaesthesiae by means of pictures sounds and autobiographical narrative	Anxiety and Depression: emotion thermometers tool	Significant reduction in stress, anxiety, depression and anger in the experimental group	3
Rossetti et al., 2017	USA	n: 78 Mean Age: 58.5 Gender: mixed Diagnosis: mixed oncology	RT/RT simulation session	MT	Y/Y	Two MT sessions. In the first one: the therapist played live a song of his choice. Second session during the RT simulation, listening to preferred music	Anxiety: STAI	Reduction of anxiety	5
Sabo and Michael, 1996	USA	n: 97 Mean Age: NS Gender: mixed Diagnosis: mixed oncology	CT/CT session	MM	N/N	Four sessions; patients listened to a personal message of encouragement recorded by their primary care physician, followed by recorded music	Anxiety: STAI	Reduction of anxiety	3
Smith et al., 2001	USA	n: NS Mean Age: 62.8 Gender: mixed Diagnosis: abdominal malignancies	RT/RT Session	MM	N/N	Patients listened to recorded music during RT sessions	Anxiety: STAI	No statistically significant effect of MT on the outcomes assessed	8
Tuinmann et al., 2017	Germany	n: 66 Mean age: 50.6 Gender: mixed Diagnosis: hematological malignancies	CT/ Oncology Ward	Combined	NY	Two weekly MT sessions of at least 20 minutes using active or receptive technique depending on patients' choice	Anxiety and Depression: HADS QoL: EORTC-LQ C30	No statistically significant improvement of global QoL for patients receiving additional MT, except for pain	6
Wang et al., 2015	China	n: 30 cases + 30 control Mean age: 53.5 (control 53.8) Gender: mixed Diagnosis: lung cancer	Surgical resection/ Intensive care unit	MT	N/N	15 min session of music relaxation and music meditation methods with music therapist before surgery; at 3, 7, 15, and 19 hours after surgery, 1 hour of MT in the intensive care unit	Anxiety: SAS	Compared with the control group, the MT group had significantly lower VAS score, systolic and diastolic blood pressure, heart rate, and SAS score within 24 hours after surgery	3
Wei, 2014	China	n: 38 Mean age: 45.56 Gender: NS Diagnosis: mixed oncology	RT or CT/Dedicated room	MM	Y/N	30 min, five times a week for 4 weeks	QoL: EORTC-QLQ C30	Improvement of patients' sleep and QoL	4
Yates and Silverman., 2015	USA	n: 26 Mean age: 57.73 (control Group 57.45) Gender: mixed Diagnosis: mixed oncology	Surgical oncology unit (type of treatment NS)/Patient's room	MM	Y/Y	20-30 min of patient's preferred music played live	Anxiety and Depression: QMS	Decrease of anxiety but not of depression in the group of patients	4

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Table 1 (*continued*)

STUDY	COUNTRY	PATIENTS	TREATMENT/SETTING	INTERVENTION TYPE	PREFERRED/ LIVE MUSIC	INTERVENTION METHODOLOGY	OUTCOMES AND MEASURES	FINDINGS	NOS
Zhou et al., 2011	China	n: 120 Mean Age: 45 Gender: women Diagnosis: breast cancer	Surgery/ Surgery Ward	MM	N/N	Patients listened to recorded music for 30 minutes twice a day, for the whole hospital stay Patients practiced muscle relaxation exercises	Anxiety: STAI Depression: ZSDS	Reduction of anxiety and depression	6
Zhou et al., 2015	China	n: 170 Mean Age: 47.01 Gender: women Diagnosis: breast cancer	Surgery/ Surgery Ward	MM	N/N	Recorded music 30 min a day. Patients also practiced muscle relaxation exercises	Anxiety: STAI; Depression: ZSDS	Reduction of anxiety and depression	5

BDI = Beck Depression Inventory; BMT = blood and marrow transplantation; CT = Chemotherapy; EORTC = European Organization for Research and Treatment; EORTC- QLQ-C30 = European Organization for Research and Treatment Quality of Life Questionnaire-Core 30; ESAS = Edmonton Symptom Assessment System; FB = Facebook Questionnaire; FACT-G = Functional Assessment of Cancer Therapy: Genera;, GA-VAS = Global Anxiety-Visual Analogue Scale; GIM = Guided Imagery and Music; HADS= Hospital Anxiety and Depression Scale ; HAM-A = Hamilton Anxiety Rating Scale; HQLI-R = Hospice Quality of Life Index – Revised; MC = monochord; MI = Music Intervention; MM = Music Medicine; MPQ = McGill Pain Questionnaire; MT = Music Therapy; N = No; NA = Not Applicable; NPRS = Numeric Pain Rating Scale; NS = Not Specified; PANAS-SF = Positive and Negative Affect Schedule; PMR = Progressive Muscle Relaxation; POMS = Profile of Mood States Questionnaire; PPI = Present Pain Intensity; QMS = Quality Management System; QOL-CA = Quality of Life-Cancer Scale; RT = Radiotherapy; SAS = Symptom Assessment Scale; SF-MPQ = Short-Form of McGill Pain Questionnaire; SSAI = Spielberger State-Anxiety Inventory; STAI = State-Trait Anxiety Inventory; TAU = Treatment as Usual; VAS = Visual Analogue Scale; Y = Yes; ZSDS = Zung Self-Rating Depression Scale.

Zhou et al., 2015; Ramirez et al., 2018; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Krishnaswamy and Nair, 2016; Preissler et al., 2016; Yates and Silverman, 2015; Wang et al., 2015; Romito et al., 2013; Awikunprasert et al., 2012; Chaput-McGovern and Silverman, 2012; Kwekkeboom, 2003; Bozcuk et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Burns et al., 2008; Burns, 2001; Cassileth et al., 2003), while 13 (34.2%) were focused on female samples (Lesiuk, 2015; Hanser et al., 2006; Zhou et al., 2015; Gallagher et al., 2018; Fredenburg and Silverman, 2014; Romito et al., 2013; Li et al., 2011; ; Li et al., 2012; Bozcuk et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Palmer et al., 2015; Burns, 2001); two studies did not mention this kind of information (Krishnaswamy and Nair, 2016; Wang et al., 2015). Patients' educational level was reported by less than half of the articles (n = 18; 45%) (Lesiuk, 2015; Gallagher et al., 2018; Chen et al., 2018a; Letwin and Silverman, 2017; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Yates and Silverman, 2015; Wang et al., 2015; Awikunprasert et al., 2012; Li et al., 2011; Kwekkeboom, 2003; Clark et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Smith et al., 2001; Liao et al., 2013); 3 studies excluded illiterates (7.5%) (Clark et al., 2006; ; Bulfone et al., 2009; Smith et al., 2001), and 4 (10%) included only patients with at least a primary school degree (Wang et al., 2015; Awikunprasert et al., 2012; Li et al., 2011; Kwekkeboom, 2003); 8 articles included patients with any level of education (Lesiuk, 2015; Zhou et al., 2015; Gallagher et al., 2018; Chen et al., 2018a; Letwin and Silverman, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Zhou et al., 2011).

From a clinical standpoint, half of the studies involved patients with different types of oncological disease (Rossetti et al., 2017; Ramirez et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Wang et al., 2015; Awikunprasert et al., 2012; Chaput-McGovern and Silverman, 2012; O'Callaghan et al., 2012; Kwekkeboom, 2003; Clark et al., 2006; Hilliard, 2003; Liao et al., 2013; Burns, 2001; Sabo and Michael, 1996); 11 studies (28.9%) included only patients with breast cancer (Lesiuk, 2015; Hanser et al., 2006; Zhou et al., 2015; Gallagher et al., 2018; Fredenburg and Silverman, 2014; Li et al., 2011; Li et al., 2012; Bozcuk et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Palmer et al., 2015).

Most of the patients enrolled in the studies selected for this review were treated with chemotherapy (Lesiuk, 2015; Gallagher et al., 2018; Chen et al., 2018a; Romito et al., 2013; Tuinmann et al., 2017; Bozcuk et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Burns et al., 2008; Cassileth et al., 2003; Sabo and Michael, 1996), followed by surgical treatment (Zhou et al., 2015; Preissler et al., 2016; Bradt et al., 2015; Chaput-McGovern and Silverman, 2012; Li et al., 2011; Kwekkeboom, 2003; Li et al., 2012; Palmer et al., 2015). Fourteen studies specified information about staging of the disease (Rossetti et al., 2017; Lesiuk, 2015; Hanser et al., 2006; Hanedan Uslu, 2017; Firmeza et al., 2017; Yates and Silverman, 2015; Fredenburg and Silverman, 2014; Romito et al., 2013; Li et al., 2011; Kwekkeboom, 2003; Tuinmann et al., 2017; Li et al., 2012; Bozcuk et al., 2006; Clark et al., 2006; Bulfone et al., 2009; Burns et al., 2008) (see Table 1 for more details).

3.3. Music intervention features

Most articles included in the analysis used receptive music techniques (n = 28; 71.8%) (Rossetti et al., 2017; Lesiuk, 2015; Hanser et al., 2006; Ramirez et al., 2018; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Krishnaswamy and Nair, 2016; Bradt et al., 2015; Wang et al., 2015; Fredenburg and Silverman, 2014; Awikunprasert et al., 2012; O'Callaghan et al., 2012; Tuinmann et al., 2017; Li et al., 2012; Bozcuk et al., 2006; Clark et al., 2006;

Hilliard, 2003; Zhou et al., 2011; Smith et al., 2001; Palmer et al., 2015; Burns et al., 2008; Liao et al., 2013; Cassileth et al., 2003); 9 studies adopted combined techniques (23.1%) (Zhou et al., 2015; Ramirez et al., 2018; Preissler et al., 2016; Yates and Silverman, 2015; Wei, 2014; Chaput-McGovern and Silverman, 2012; Kwekkeboom, 2003; Bulfone et al., 2009; Burns, 2001); 2 protocols included the use of active MT (5.1%) (Romito et al., 2013; Li et al., 2011). MT sessions were usually delivered on an individual basis (n = 34; 87.2%) (Rossetti et al., 2017; Hanser et al., 2006; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Krishnaswamy and Nair, 2016; Bradt et al., 2015; Wang et al., 2015; Awikunprasert et al., 2012; O'Callaghan et al., 2012; Tuinmann et al., 2017; Li et al., 2012; Bozcuk et al., 2006; Clark et al., 2006; Hilliard, 2003; Zhou et al., 2011; Smith et al., 2001; Palmer et al., 2015; Burns et al., 2008; Liao et al., 2013; Cassileth et al., 2003). Regarding further features and type of treatment, 12 studies included interventions provided by a trained therapist (30.8%) (Rossetti et al., 2017; Lesiuk, 2015; Hanser et al., 2006; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Hanedan Uslu, 2017; Fredenburg and Silverman, 2014; Awikunprasert et al., 2012; Clark et al., 2006; Palmer et al., 2015; Sabo and Michael, 1996); 19 articles (Zhou et al., 2015; Letwin and Silverman, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Arruda et al., 2016; Preissler et al., 2016; Wang et al., 2015; Wei, 2014; Romito et al., 2013; Chaput-McGovern and Silverman, 2012; Li et al., 2011; Kwekkeboom, 2003; Li et al., 2012; Bozcuk et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Smith et al., 2001; Liao et al., 2013; Cassileth et al., 2003) investigated MM interventions (48.7%) (Zhou et al., 2015; Letwin and Silverman, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Arruda et al., 2016; Preissler et al., 2016; Wang et al., 2015; Wei, 2014; Romito et al., 2013; Chaput-McGovern and Silverman, 2012; Li et al., 2011; Kwekkeboom, 2003; Li et al., 2012; Bozcuk et al., 2006; Bulfone et al., 2009; Zhou et al., 2011; Smith et al., 2001; Liao et al., 2013; Cassileth et al., 2003); 8 studies used a combined technique (20.5%) (Ramirez et al., 2018; Yates and Silverman, 2015; Bradt et al., 2015; O'Callaghan et al., 2012; Tuinmann et al., 2017; Hilliard, 2003; Burns et al., 2008; Cassileth et al., 2003); 1 study did not report information about this topic (Krishnaswamy and Nair, 2016). Most interventions were delivered in a 1–4 sessions format (n = 21, 77.8%) (Rossetti et al., 2017; Lesiuk, 2015; Hanser et al., 2006; Ramirez et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Hanedan Uslu, 2017; Firmeza et al., 2017; Jasemi et al., 2016; Arruda et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Wei, 2014; Fredenburg and Silverman, 2014; Romito et al., 2013; Chaput-McGovern and Silverman, 2012; O'Callaghan et al., 2012; Kwekkeboom, 2003; Bozcuk et al., 2006; Bulfone et al., 2009; Hilliard, 2003; Palmer et al., 2015; Sabo and Michael, 1996), 3 studies used 5–8 sessions (11.1%) (Bradt et al., 2015; Awikunprasert et al., 2012; Tuinmann et al., 2017), and 3 articles examined the results of a treatment approach including more than 8 sessions (11.15%) (Wang et al., 2015; Liao et al., 2013; Burns, 2001). Overall, sessions had a mean length of 31.93 min (SD = 16.20; min 15 – max 90). Concerning setting, most interventions were delivered in hospital wards, but a wide variability was found across studies. See Table 2 for further details.

Table 2
Music intervention features.

		N (%)
Session frequency	Less than once a week	1 (4.3)
	Once a week	2 (8.7)
	Twice a week	2 (8.7)
	Five times a week	2 (8.7)
	Once a day	2 (8.7)
	Twice a day	4 (17.4)
	Single session	9 (39.1)
	Over a period of three days	1 (4.3)
Setting	Chemotherapy Room	5 (12.5)
	Home	2 (5.0)
	Hospice	4 (10.0)
	Hospital Ward	13 (32.5)
	Intensive Care Unit	1 (2.5)
	Not Reported	7 (17.5)
	Outpatient Care Room	2 (5.0)
	Radiotherapy Room	4 (10.0)
	Variable	2 (5.0)

Table 3
Outcomes and questionnaires used by the selected studies.

Outcome	Questionnaire	N (%)
Anxiety	Global Anxiety-Visual Analogue Scale (GA-VAS)	1 (3.8)
	Hospital Anxiety and Depression Scale (HADS)	5 (19.2)
	Hamilton Anxiety Rating Scale (HAM-A)	1 (3.8)
	Profile of Mood States (POMS) Questionnaire	2 (7.7)
	Quality Management System (QMS)	1 (3.8)
	Rogers Happy/Sad Faces Assessment	1 (3.8)
	Symptom Assessment Scale (SAS)	1 (3.8)
	Spielberger State-Anxiety Inventory (SSAI)	1 (3.8)
	State-Trait Anxiety Inventory (STAI)	11 (42.3)
	Visual Analogue Scale (VAS)	1 (3.8)
	Other	1 (3.8)
Depression	Beck Depression Inventory (BDI)	1 (3.8)
	Hospital Anxiety and Depression Scale (HADS)	5 (31.3)
	Positive and Negative Affect Schedule (PANAS-SF)	1 (6.3)
	Other	1 (6.3)
	Profile of Mood States (POMS) Questionnaire	3 (18.8)
	Quality Management System (QMS)	1 (6.3)
	Rogers Happy/Sad Faces Assessment	1 (6.3)
	Visual Analogue Scale (VAS)	1 (6.3)
	Zung Self-Rating Depression Scale (ZSDS)	2 (15.38)
Pain	10-point Likert scale	5 (38.46)
	European Organization for Research and Treatment (EORTC) Quality of Life Questionnaire-Core 30 (QLQ-C30)	2 (15.38)
	Numeric Pain Rating Scale (NPRS)	2 (15.38)
	Rogers Happy/Sad Faces Assessment	1 (7.69)
	Short-Form McGill Pain Questionnaire (SF-MPQ-2)	1 (7.69)
	Visual Analogue Scale (VAS)	2 (15.38)
Quality of Life	27-item Functional Assessment of Cancer Therapy: General (FACT-G)	1 (10.0)
	European Organization for Research and Treatment (EORTC) Quality of Life Questionnaire-Core 30 (QLQ-C30) EORTC-QLQ C30	4 (40.0)
	Facebook (FB) Questionnaire	1 (10.0)
	Hospice Quality of Life Index (HQLI-R)	3 (30.0)
	Quality of Life-Cancer Scale (QOL-CA)	1 (10.0)

3.4. Outcomes

Studies included in the analysis used several different questionnaires to evaluate outcomes (see Table 3 for details). Most of the questionnaires used self-report measures (n = 18; 45%), while some studies used clinician-administered questionnaires (n = 12; 30%) (Rossetti et al., 2017; Lesiuk, 2015; Zhou et al., 2015; Ramirez et al., 2018; Letwin and Silverman, 2017; Yates and Silverman, 2015; Bradt et al., 2015; Wei, 2014; Fredenburg and Silverman, 2014; Tuinmann et al., 2017; Clark et al., 2006; Zhou et al., 2011); 10 studies did not report this type of information (25%) (Firmeza et al., 2017; Arruda et al., 2016; Krishnaswamy and Nair, 2016; Wang et al., 2015; Romito et al., 2013; Bozcuk et al., 2006; Bulfone et al., 2009; Liao et al., 2013; Cassileth et al., 2003; Sabo and Michael, 1996). Most studies reported a positive effect of MT interventions on the outcomes measured.

3.4.1. Anxiety

Anxiety reduction was reported by 20 studies (Rossetti et al., 2017; Hanser et al., 2006; Zhou et al., 2015; Ramirez et al., 2018; Ramirez et al., 2018; Letwin and Silverman, 2017; Hanedan Uslu, 2017; Firmeza et al., 2017; Preissler et al., 2016; Yates and Silverman, 2015; Bradt et al., 2015; Fredenburg and Silverman, 2014; Romito et al., 2013;

Chaput-McGovern and Silverman, 2012; Hanser et al., 2006; Li et al., 2011; Clark et al., 2006; Bulfone et al., 2009; Palmer et al., 2015; Zhou et al., 2015; Rossetti et al., 2017; Burns, 2001; Sabo and Michael, 1996) out of the 26 (Rossetti et al., 2017; Hanser et al., 2006; Ramirez et al., 2018; Gallagher et al., 2018; Hanedan Uslu, 2017; Firmeza et al., 2017; Arruda et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Bradt et al., 2015; Fredenburg and Silverman, 2014; Romito et al., 2013; Chaput-McGovern and Silverman, 2012; O'Callaghan et al., 2012; Kwekkeboom, 2003; Tuinmann et al., 2017; Li et al., 2012; Clark et al., 2006; Bulfone et al., 2009; Smith et al., 2001; Palmer et al., 2015; Burns et al., 2008; Burns, 2001; Cassileth et al., 2003; Sabo and Michael, 1996) assessing this outcome (74.1%). A statistically significant association was found between anxiety reduction and the type of MT intervention ($p = .042$); with more detail, all studies where MT was performed by professional therapists reported a significant decrease of anxiety symptoms (Rossetti et al., 2017; Hanser et al., 2006; Ramirez et al., 2018; Gallagher et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Yates and Silverman, 2015; Bradt et al., 2015; Fredenburg and Silverman, 2014; Awikunprasert et al., 2012; Tuinmann et al., 2017; Clark et al., 2006; Hilliard, 2003; Palmer et al., 2015; Burns et al., 2008; Burns, 2001; Cassileth et al., 2003). Moreover, the association between anxiety reduction and type of cancer yielded a significant result ($p = .015$), being more common in patients affected by breast cancer. Regarding type and features of the MT intervention, as shown in Table 4, no statistically significant correlation was found between anxiety reduction and total number of sessions, use of patients' preferred music or techniques used ($p > .05$).

3.4.2. Depression

A decrease in depressive symptoms was described by 12 studies (Lesiuk, 2015; Hanser et al., 2006; Zhou et al., 2015; Ramirez et al., 2018; Gallagher et al., 2018; Firmeza et al., 2017; Preissler et al., 2016; Yates and Silverman, 2015; Wei, 2014; Fredenburg and Silverman, 2014; Zhou et al., 2011; Burns, 2001) of the 16 selected studies (Lesiuk, 2015; Hanser et al., 2006; Zhou et al., 2015; Ramirez et al., 2018; Gallagher et al., 2018; Firmeza et al., 2017; Jasemi et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Wei, 2014; Fredenburg and Silverman, 2014; Tuinmann et al., 2017; Clark et al., 2006; Zhou et al., 2011; Burns, 2001; Cassileth et al., 2003) assessing this outcome (75%). All the studies assessing depression as a treatment outcome reported a significant reduction in depressive symptoms after the MT intervention (Lesiuk, 2015; Hanser et al., 2006; Zhou et al., 2015; Ramirez et al., 2018; Gallagher et al., 2018; Firmeza et al., 2017; Jasemi et al., 2016; Preissler et al., 2016; Yates and Silverman, 2015; Wei, 2014; Fredenburg and Silverman, 2014; Tuinmann et al., 2017; Clark et al., 2006; Zhou et al., 2011; Burns, 2001; Cassileth et al., 2003) (see Table 4).

As for anxiety, an association was found between reduction of

Table 4
Outcomes analysis in the selected studies.

Variables		Anxiety Reduction			Depression Reduction			Pain Reduction			QoL improvement		
		n/y	χ2 (DF)	p	n/y	χ2 (DF)	p	n/y	χ2 (DF)	p	n/y	χ2 (DF)	p
Setting	Chemotherapy Room	0/3	χ2 (7,	.44	0/2	χ2 (4,	.37	1/0	χ2 (4,	.44	1/0	χ2 (4,	.04
	Home	0/1	n = 22) = 6.87		1/0	n = 11) = 1.-		0/2	n = 10) = 3.75		0/1	n = 10) = 10.0	
	Hospice	0/1			0/1	78		2/2			0/2		
	Hospital Ward	3/6			2/4			n/a			4/0		
	Outpatient Care Room	0/2			0/1			0/1			0/2		
	Intensive Care Unit	0/1			n/a			n/a			n/a		
	Radiotherapy Room	2/2			n/a			n/a			n/a		
	Variable	1/0			n/a			1/1			n/a		
	Total	6/16			3/8			4/6			5/5		
Technique Used	Active	0/1	χ2 (2,	.17	0/1	χ2 (1,	.59	n/a	χ2 (1,	.19	0/2	χ2 (2, n = 11) =	.35
	Combined	4/4	n = 15) = 3.57		2/3	n = 16) = 5.-		0/3	n = 13) = 1.73		1/1	2.07	
	Receptive	3/15			2/8	14		4/6			4/3		
	Total	7/20			4/12			4/9			5/6		
Patient's Preferred Music	No	2/13	χ2 (1, n = 23) =	.48	1/7	χ2 (1,	.82	2/6	χ2 (1, n = 13) =	.57	3/4	χ2 (1, n = 8)	.28
	Yes	2/6	.49		1/5	n = 14) = .0-		2/3	.32		1/0	=1.14	
	Total	4/19			2/12	5		4/9			4/4		
Diagnosis	Breast Cancer	0/7	χ2 (5,	.02	0/6	χ2 (1,	.02	n/a			1/1	χ2 (2, n = 4) = .5	.37
	Hematological Malignancies	3/0	n = 14) = 14.0		2/1	n = 9) = 1.0- 7		n/a			1/0		
	Gynaecological Malignancies	0/1			n/a			n/a			0/1		
	Head-Neck Cancer	0/1			n/a			n/a			n/a		
	Lung Cancer	0/1			n/a			n/a			n/a		
	Abdmoninal Malignancies	1/0			n/a			n/a			n/a		
	Total	4/10			2/7			n/a			2/2		
Treatment type	Chemotherapy	3/4	χ2 (4, n = 22) =	.68	2/3	χ2 (4,	.37	1/0	χ2 (4, n = 10) =	.31	3/1	χ2 (4, n = 9) =	.37
	Combined	0/1	2.31		0/1	n = 10) = .2-		1/1	4.79		1/1	4.28	
	Palliative Care	1/1			0/1	8		0/2			0/2		
	Radiotherapy	2/3			1/0			1/0			n/a		
	Surgical	1/6			0/2			1/3			1/0		
	Total	7/15			3/7			4/6			5/4		
Number of Sessions	1 To 4	3/12	χ2 (2, n = 18) =	.70	1/7	χ2 (2,	.87	2/6	χ2 (2, n = 10) =	.24	3/2	χ2 (2,	.49
	5 To 8	0/2	.72		0/1	n = 10) = 4.-		0/1	2.86		0/1	n = 9) = 1.44	
	More Than 8	0/1			0/1	29		1/0			1/2		
	Total	3/15			1/9			3/7			4/5		
Type of MT	Combined	4/3	χ2 (2, n = 27) =	.04	2/2	χ2 (4,	.41	0/3	χ2 (2,	.21	1/1	χ2 (2,	.57
	MM	3/9	6.36		1/5	n = 16) = 4.-		2/5	n = 13) = 3.16		3/2	n = 11) = 1.12	
	MT	0/8			1/5	28		2/1			1/3		
	Total	7/20			4/12			4/9			5/6		

n/y = no/yes; n/a = not applicable; DF = degrees of freedom; MM = Music Medicine; MT = Music Therapy.

depressive symptoms and type of cancer (breast cancer; p = .023). No statistically significant association emerged among reduction of depressive symptoms, type of music intervention, number of session or use of patients' preferred music (Table 4).

3.4.3. Pain

Nine (Ramirez et al., 2018; Bieligmeyer et al., 2018; Jasemi et al., 2016; Arruda et al., 2016; Preissler et al., 2016; Bradt et al., 2015; Wei, 2014; Chaput-McGovern and Silverman, 2012; Li et al., 2011) of the 13 studies (69.2%) reporting about pain described a reduction of this outcome (Ramirez et al., 2018; Chen et al., 2018a; Bieligmeyer et al., 2018; Jasemi et al., 2016; Arruda et al., 2016; Yates and Silverman, 2015; Bradt et al., 2015; Wei, 2014; Chaput-McGovern and Silverman, 2012; Li et al., 2011; Kwekkeboom, 2003; Clark et al., 2006). Pain was assessed as an outcome only in studies limited to samples of patients affected by breast cancer. No statistically significant correlation was found among pain reduction, type of music intervention, number of sessions, use of patients' preferred music (Table 4).

3.4.4. Quality of life

An improvement in QoL was reported by 6 (Hanser et al., 2006; Romito et al., 2013; Awikunprasert et al., 2012; Hilliard, 2003; Liao et al., 2013; Burns, 2001) out of 11 studies (54.5%) (Hanser et al., 2006; Chen et al., 2018a; Wang et al., 2015; Romito et al., 2013; Awikunprasert et al., 2012; Tuinmann et al., 2017; Bozcuk et al., 2006; Hilliard, 2003; Liao et al., 2013; Burns, 2001) focused on this treatment outcome. An association was found between QoL improvement and setting where the MT intervention was delivered (p < .05); specifically, an improvement of QoL was less common when the treatment setting was a hospital ward. The analyses failed to find any correlation between improvement in QoL and any other variable associated with the music intervention (e.g.: number of sessions, use of patients' preferred music, type of intervention) (Table 4).

4. Discussion

Despite the increasing interest in this field of research, only a few systematic reviews about the topic of MT in cancer patients are available in the existing literature (Bradt et al., 2016; Nightingale et al., 2013).

The current review included 40 articles, most of which were RCTs, analysing the impact of MT interventions in cancer patients on four main outcomes: anxiety, depression, pain and QoL. Overall, the studies included in this analysis seem to support a positive effect of MT on these outcomes, which is consistent with previous research suggesting the effectiveness of music-based interventions in cancer patients (Nightingale et al., 2013; Bro et al., 2018).

4.1. MT intervention

A great variability was observed concerning setting and number of sessions of the MT intervention; overall, the current review failed to find correlations among any of the outcomes assessed and the specific features of the MT intervention received by patients. A previous review of 28 studies, involving depressed patients (Leubner and Hinterberger, 2017), showed a correlation between a longer treatment duration and better outcomes. Nonetheless, neither setting, nor number of sessions or treatment duration seemed to affect the results of MT in the current review.

Moreover, contrary to previous evidence (Chen et al., 2018b), our results failed to find any outcome difference based on the use of patient's preferred music, suggesting that music could have a beneficial effect independently of patient's musical taste.

Notwithstanding differences in treatment type, duration, frequency, and setting, overall MT interventions seemed effective at least on one of the assessed outcomes. This observation suggests that MT as adjunctive treatment may be beneficial for oncological patients independent of a specific treatment format, and therefore MT interventions can be tailored to the unique needs of different patients and settings.

It is likely that music *per se* operates at a deep emotional level, further enhanced by the relationship with the therapist and other group members when the intervention is delivered in a group setting, and that its efficacy depends on this premise rather than on the specific features of the MT treatment approach (Zeppegno et al., 2018).

4.2. Questionnaires

A variety of assessment tools were used to measure outcomes in the selected studies: more than eight different questionnaires were used for each outcome, limiting the possibility to compare the results. The use of standardised assessment tools is warranted for future research, to make study results easily comparable.

4.3. Outcomes

A reduction of anxiety, depressive and pain-related symptoms was reported by 74%, 75% and 69% of the studies assessing these specific outcomes, respectively. An improvement of QoL was described by 54% of the studies focused on this topic. These results seem to support the importance of the use of music as an adjunctive treatment for cancer patients. MT, as any other form of art therapy, is part of a holistic approach to the oncological patient, where the goal is not only the cure of the biological disease but also the overall care of patients' well-being. Three main objectives can be identified in the treatment of oncological patients: first, to cure in the objective sense of the term; second, to take care, which entails a deep relational meaning; last but not least, to help the individual develop skills to care for him/herself (Zeppegno et al., 2010).

Cancer is a disease that, biologically and psychologically, invades, causing the sensation of losing control over life events. Therefore, patients' attempt to find an explanation for the pain experience could also be a way to try to regain control over their disease (Torre and Filiberti, 2010).

Interestingly, an association was found between anxiety reduction and MT delivered by a professional therapist. Those findings would suggest the importance of the therapeutic relationship entailed by MT (Lee et al., 2016) as a further support to cancer patients.

A significant association was found between type of cancer and both anxiety reduction and decrease of depressive symptoms. With more detail, women affected by breast cancer seemed to get greater benefit from MT intervention, in terms of anxiety and depressive symptoms reduction, compared to patients with other oncological diagnoses. These results are in line with previous literature data (Chen et al., 2018b) and provide a strong support for the implementation of MT interventions as adjunct treatments in the daily clinical practice of oncological patients, especially for women affected by breast cancer.

Globally, the articles included in the analysis showed a reduction in pain perception after MT interventions (Krishnaswamy and Nair, 2016; Nilsson, 2008; Archie et al., 2013), independently of any of the variables assessed, including setting, and type of music intervention. Again, this underscores the importance of music as an effective, additional therapeutic tool.

Previous studies (Bozcuk et al., 2006; Snyder and Wieland, 2003; Sherman et al., 2004) suggested that a combination of MT and "traditional" treatment could possibly improve cancer patients' QoL. The analysis of the studies assessed in the current review found a statistically significant correlation between QoL and MT setting. Interestingly, all studies reporting about interventions performed in hospital wards failed to find a QoL improvement. We can hypothesize that this result is not merely due to the treatment setting itself, but also (or rather) to the meaning that being admitted to an hospital ward (likely because of an active phase of the disease) has for patients, which may hinder the

possibility for MT to have a positive impact on QoL.

4.4. Strengths and limitations

Literature data about the effectiveness of MT interventions in oncological patients are still controversial due to the heterogeneity of the available studies, making comparisons challenging. The lack of standardization both of interventions and assessment measures underlines the importance of reviews as the current one about this topic, to offer a global vision of the existing literature and suggesting focuses for a further development and/or improvement of MT interventions.

5. Conclusions

The healing power of music has been documented in several traditions across the world. Music engages a variety of brain areas, involved in emotion, motivation, cognition, and motor functions; so musical interventions have been used to increase socialization and cognitive, emotional, and neuromotor functioning. Music activates the frontal system, where the cortical network associated with emotions is located; it is not only capable of eliciting emotions but it also acts regulating them (Lee et al., 2016; Raglio et al., 2016).

The results of this review emphasize the importance of MT interventions on anxiety, depressive and pain-related symptoms, as well as on QoL. Music is a powerful therapeutic tool: it is quite inexpensive and easy to use in almost every clinical setting and at every stage of the disease. Moreover, literature data included in this qualitative synthesis support a specific efficacy of MT interventions on patients affected by breast cancer. Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females worldwide; improving physiological and psychological outcomes in this frequent disease is therefore highly recommended (Chen et al., 2018b; Greenlee et al., 2017; Kaye et al., 2018).

Our review adds more information to the existing knowledge in this field, which is based on few other reviews trying to collect and standardise literature data on this topic (Bradt et al., 2016; Krishnaswamy and Nair, 2016; Nightingale et al., 2013; Archie et al., 2013); unfortunately, lack of uniformity in the studies included makes this work challenging. Accordingly, it would be important for future research to use consistent scales or statistical methodology to allow comparisons among researches.

Finally, the increasing evidence of MT effectiveness, its tolerability, ease of application and use, the advantageous cost-benefit ratio and the appreciation shown by patients support the importance of continuing research in this field. It should be supported the implementation and clinical use of MT interventions in Medical Oncology, Radiation Oncology and Surgery Departments, promoting greater knowledge on this subject among health operators.

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Conflict of interest

The authors confirm that this article content has no conflict of interest.

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