

Review

Multimodal arts therapy for psychological rehabilitation in cancer patients: the synergistic effects of music and dance

Shijie Gong¹, Feng Zhou^{2,*}

¹ Department of Music, Myongji University, Yongin-si 17058, Republic of Korea

² Department of Dance, Dankook University, Yongin-si 16890, Republic of Korea

* Corresponding author: Feng Zhou, zhoufengk@163.com

CITATION

Gong S, Zhou F. Multimodal arts therapy for psychological rehabilitation in cancer patients: the synergistic effects of music and dance. *Psycho-Oncologie*. 2026; 20(5): 5765.
<https://doi.org/10.18282/po5765>

ARTICLE INFO

Received: 15 March 2026

Revised: 12 May 2026

Accepted: 28 May 2026

Available online: 19 June 2026

COPYRIGHT



Copyright © 2026 by author(s).

Psycho-Oncologie is published by PiscoMed Publishing Pte Ltd. This work is licensed under the Creative Commons Attribution (CC BY) license. <https://creativecommons.org/licenses/by/4.0/>

Abstract: Purpose Music therapy (MT) and dance/movement therapy (DMT) each demonstrate efficacy in alleviating psychological distress among cancer patients, yet no quantitative synthesis has examined whether their combined multimodal delivery produces synergistic benefits beyond either modality alone. This review aimed to evaluate the independent and combined effects of MT, DMT, and multimodal arts therapy (MMAT) on anxiety, depression, and health-related quality of life (HRQoL) in adult cancer patients, and to test whether combined MMAT confers a statistically significant synergistic advantage over standalone modalities. **Methods** A systematic review and meta-analysis was conducted in accordance with PRISMA 2020 guidelines. PubMed, PsycINFO, Web of Science, Cochrane Library, and Embase were searched for controlled studies published between 2019 and 2024. Eligible studies enrolled adult cancer patients receiving MT, DMT, or combined MMAT interventions with a comparison condition. Two independent reviewers screened records ($\kappa = 0.82\text{--}0.79$) and extracted data. Pooled Hedges' g effect sizes were computed under random-effects models using REML estimation. Differential effects across intervention modalities were examined via mixed-effects meta-regression with modality entered as a categorical moderator variable. Risk of bias was assessed using Cochrane RoB 2 and the Newcastle-Ottawa Scale; publication bias was evaluated by Egger's test and trim-and-fill. **Results** Eleven studies ($n = 4,346$ participants) were included. Standalone MT produced moderate effects on anxiety (Hedges' $g = -0.61$), depression ($g = -0.54$), and HRQoL ($g = 0.47$). Standalone DMT yielded smaller but significant effects across the same outcomes ($g = -0.48, -0.41$, and 0.38 , respectively). Combined MMAT generated large pooled effects across all three primary outcomes—anxiety ($g = -0.89$; $k = 3$ studies), depression ($g = -0.79$; $k = 3$ studies), and HRQoL ($g = 0.71$; $k = 2$ studies, as one MMAT trial did not report this outcome)—with statistically significant differential advantages over each standalone modality indicated by meta-regression interaction testing (all $p < 0.05$), a pattern consistent with additive or potentially greater-than-additive effects. Egger's test indicated no significant publication bias. **Conclusions** Combined music-dance multimodal arts therapy produces clinically meaningful psychological benefits that consistently exceed those observed for either modality delivered in isolation, with a pattern of effect-size increments compatible with additive or greater-than-additive modality interaction. Integrated MMAT programmes of eight or more weeks, delivered in group formats by trained arts therapists, are recommended as a component of multimodal supportive oncology care. Adequately powered multi-arm randomised trials with neurobiological outcome measures are warranted to elucidate the mechanisms and magnitude of the observed differential benefit.

Keywords: music therapy; dance/movement therapy; multimodal arts therapy; cancer; anxiety; depression; quality of life; meta-analysis; systematic review

1. Introduction

Cancer remains one of the leading causes of global morbidity and mortality. Estimates of the global incidence of cancer for the year 2022 indicate the occurrence of 20 million new cases and 9.7 million deaths, with projections suggesting an increase in the incidence of cancer over the coming decades [1]. Although advances in oncological treatment have improved survival rates, prolonged survival is increasingly accompanied by substantial unmet psychosocial needs that compromise patients' well-being. Epidemiological studies indicate significant levels of anxiety and depressive disorders, ranging between 20% and 30%, in patients with cancer at various stages of the disease process, which are much higher than those in the general population [2]. Psychological distress in such patients includes not just mood disorders, but also post-traumatic stress, existential threat, changes in body image, impaired social role functioning, and decreased health-related quality of life (HRQoL). Collectively, these constitute an understudied aspect of the disease process.

Established psycho-oncological interventions, such as pharmacotherapy, cognitive behavioral therapy (CBT), and mindfulness-based stress reduction (MBSR), form the current evidence-based standard recommended in oncology supportive-care guidelines, and constitute the core of broader integrative oncology frameworks that increasingly incorporate mind–body and arts-based therapies alongside conventional cancer treatment [3, 4]. These interventions have shown their efficacy in reducing psychological distress associated with cancer. However, the accessibility and compliance with these interventions are hindered by several barriers. These include: the availability of specialists in conventional oncological care settings; the cognitive and physical side effects of co-administered cancer treatments; and patients' preferences for non-verbal, body-inclusive, and relationally embedded interventions, which take into account the bodily disruption experienced with cancer illness [5]. Moreover, the average effect size of conventional psychological interventions, as shown in the systematic evidence synthesis, suggests the need for additional approaches. These are effective with patients who are not willing or able to engage with conventional interventions, such as CBT and MBSR [6].

Music-based interventions in cancer care comprise two related but distinct modalities. Music therapy (MT), as defined by the American Music Therapy Association, refers to the clinical and evidence-based use of music interventions delivered by a credentialed music therapist within an individualised therapeutic relationship. In contrast, music medicine refers to the passive listening to pre-recorded music typically offered by medical personnel without therapist-mediated processes [7]. MT, defined by both receptive music listening and active patient-directed musical engagement, has established a significant body of evidence for music therapy as a supportive care intervention for adult patients with cancer. A comprehensive synthesis of systematic reviews has integrated findings from 13 systematic reviews examining over 9,000 participants and 119 RCTs, and suggests that music-based interventions combined with standard care produce significant reductions in cancer-related pain (pooled SMDs ranging from -0.77 to -0.88 , $p < 0.01$) and anxiety (SMDs from -0.29 to -0.75 , $p \leq 0.02$) among adult patients with cancer, although effects on depression and distress remain heterogeneous across reviews [8]. The proposed neurobiological mechanisms for these effects involve dopaminergic reward system activation, modulation of the hypothalamic-pituitary-adrenal (HPA) axis, and the entrainment of autonomic nervous system circuits—mechanisms that are all thought to contribute to emotional states and the reduction of physiological

stress [9] However, there is significant variability and limitations to music therapy research. Notably, access to evidence-based music therapy services remains uneven across global cancer care infrastructures, with substantial gaps in accredited training, professional regulation, and integration of culturally relevant repertoires—particularly in low- and middle-income settings [10].

Dance/movement therapy (DMT), defined as the psychotherapeutic use of movement and dance to promote emotional, cognitive, physical, and social integration, has a distinct but complementary role in the supportive care of patients with cancer. A systematic review and meta-analysis comprising 16 controlled studies and 893 participants from cancer and palliative care settings, observed the positive effects of DMT and dance movement interventions on health-related outcomes for patients [11]. While music-based approaches operate on different mechanisms, DMT works through kinaesthetic experiences, body awareness, and synchrony of movements. This process helps patients reconnect with their bodies, often desensitised by the invasive treatments for cancer, and is supported by the theory of embodied cognition [12]. However, the depth and volume of the evidence base for DMT in the care of patients with oncological conditions are limited.

Although both MT and DMT have been shown to produce positive psychological benefits in cancer patient groups individually, there is a significant research gap regarding the potential synergistic benefits of combining these two therapeutic modalities in a structured multimodal arts therapy (MMAT) intervention. According to cross-modal affective processing theory, a combined intervention of auditory and kinaesthetic sensory modalities can lead to a synergistic therapeutic outcome that is significantly enhanced beyond that of either intervention alone [13]. Music and dance are known to create a heightened state of neural coupling and interoception, and to significantly increase emotion regulation capacity through a shared temporal pattern that is not possible with either intervention alone [14]. Yet there is a lack of synthesis that quantitatively explores and compares the effects of a combined music and dance intervention with those of each intervention alone in adult cancer patients. This systematic review and meta-analysis aims to address this deficit and answer three proposed research questions: (1) Do stand-alone MT, stand-alone DMT, and combined MMAT each produce significant improvements in anxiety, depression, and HRQoL in adult cancer patients, and (2) does the combined intervention produce a synergistic therapeutic outcome that is enhanced beyond that of either intervention alone?

2. Methods

2.1 Study design

A systematic review and meta-analysis was conducted in accordance with the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement [15]. The research question, eligibility criteria, outcome measures, search strategy, and statistical analysis plan were defined before study screening and data extraction. Three pre-specified analytical comparisons were investigated: standalone music therapy compared with control, standalone dance/movement therapy compared with control, and combined music and dance multimodal arts therapy compared with standalone modalities or control conditions. The latter comparison was used to examine whether multimodal arts therapy produced greater psychological benefits than either standalone modality, based on the assumption that concurrent engagement of auditory and kinaesthetic sensory channels may enhance

psychological well-being.

2.2 Literature search strategy

The search strategy included the use of various electronic databases such as PubMed/MEDLINE, PsycINFO, Web of Science Core Collection, Cochrane Library, and Embase. The search was restricted to publications between January 2019 and December 2024. The search terms were grouped into three conceptual domains and combined with Boolean operators. These domains included: intervention terms, such as “music therapy” OR “music-based intervention” OR “receptive music” OR “dance therapy” OR “dance movement therapy” OR “multimodal arts therapy”; population terms, such as “cancer” OR “neoplasm” OR “oncology” OR “malignancy”; and outcome terms, such as “anxiety” OR “depression” OR “psychological distress” OR “quality of life” OR “well-being.” The reference lists of included studies and relevant prior systematic reviews were hand-searched to identify any publications not included in the search results. The selection of the included studies followed two phases: title and abstract screening, followed by full-text selection. Both phases were undertaken independently against the PICOS criteria outlined in **Table 1**, with any disagreements being settled with the input of the third reviewer [16]. Cohen’s kappa (κ) was used to ascertain the inter-rater reliability, with the minimum reliability threshold set at $\kappa \geq 0.75$ [17]. The whole selection process is graphically represented in the PRISMA 2020 flow diagram (**Figure 1**).

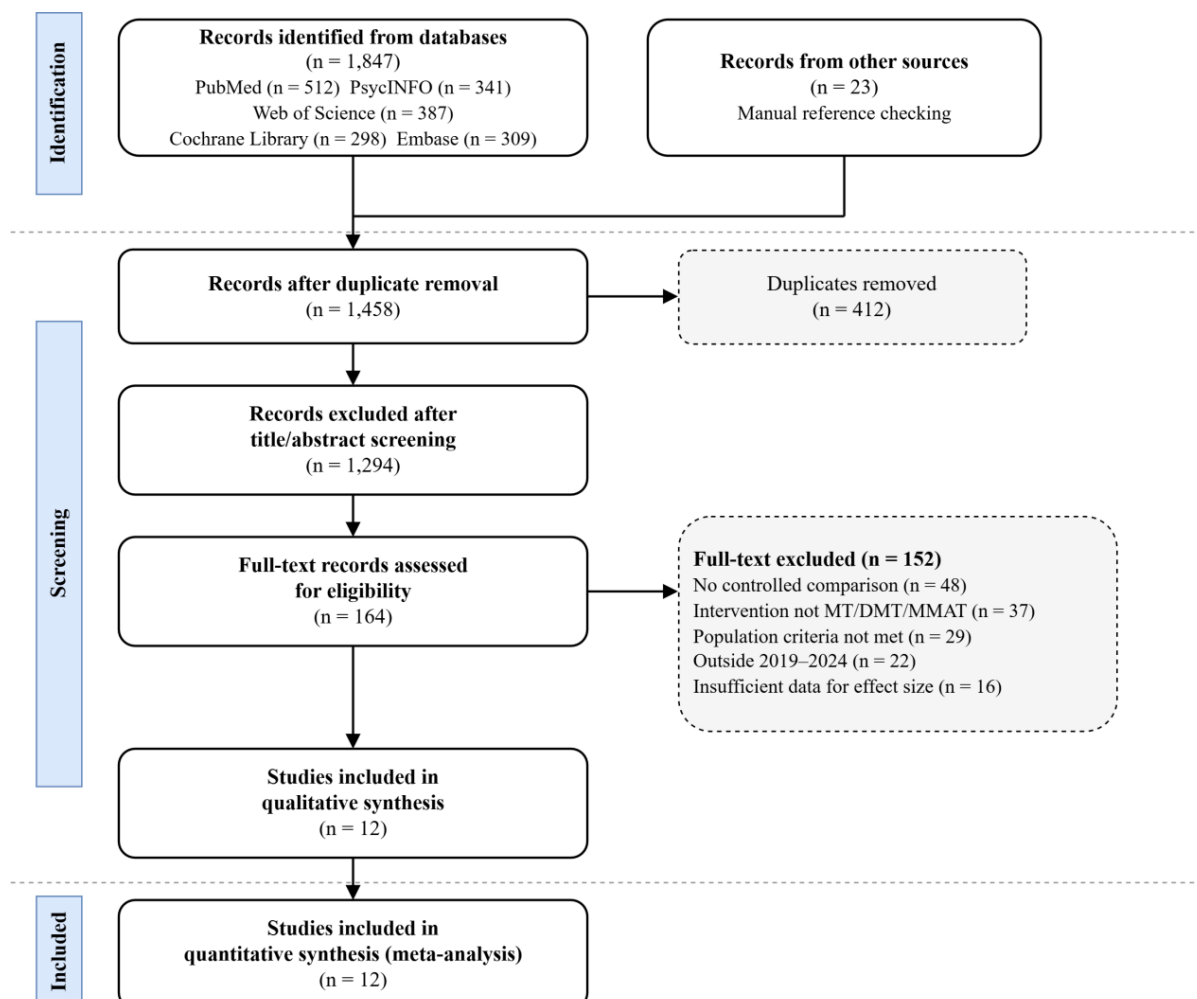


Figure 1 PRISMA 2020 flow diagram of the systematic literature search and study selection process.

Table 1 Eligibility criteria for study inclusion based on the PICOS framework

Component	Inclusion criteria	Exclusion criteria
Population (P)	Adults (≥ 18 years) diagnosed with any confirmed cancer type, regardless of disease stage or treatment phase	Paediatric populations (< 18 years); studies in which caregivers constituted the primary study population
Intervention (I)	Music therapy (MT; active or receptive), dance/movement therapy (DMT), or combined music-dance multimodal arts therapy (MMAT) with trained facilitator involvement	Single-session exposure studies (< 2 sessions); multimodal designs incorporating > 2 creative arts modalities without isolable music or dance components
Comparison (C)	Usual care, waitlist control, or active single-modality control arm (required for the synergy comparison)	Uncontrolled pre-post designs; studies lacking a parallel comparison group
Outcomes (O)	Primary: anxiety (HADS-A, STAI, GAD-7), depression (HADS-D, PHQ-9, BDI), HRQoL (FACT-G, EORTC QLQ-C30); Secondary: fatigue, pain, social functioning, salivary cortisol	Studies reporting exclusively biological endpoints without any psychological or patient-reported outcome data
Study design (S)	Randomised controlled trials and controlled quasi-experimental trials; English, Chinese, French, or Spanish; published January 2019–December 2024	Case reports, uncontrolled pilot studies ($n < 20$ per arm), cross-sectional surveys, qualitative-only studies, conference abstracts without peer-reviewed full text

Note. HADS = Hospital Anxiety and Depression Scale; STAI = State-Trait Anxiety Inventory; GAD-7 = Generalised Anxiety Disorder-7; PHQ-9 = Patient Health Questionnaire-9; BDI = Beck Depression Inventory; FACT-G = Functional Assessment of Cancer Therapy-General; EORTC QLQ-C30 = European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core 30; HRQoL = health-related quality of life.

2.3 Quality assessment

The methodological quality of RCTs was evaluated using the Cochrane Risk of Bias tool version 2 (RoB 2), which examines five domains: the randomization process, deviations from the intended interventions, missing outcome data, measurement of outcomes, and selective reporting of outcomes [18]. Due to the impracticability of participant blinding in arts therapy interventions, performance bias was assessed using contextually calibrated standards, focusing on whether assessor blinding and allocation concealment were used. For non-RCTs, controlled designs were assessed using the Newcastle-Ottawa Scale (NOS), which consists of three domains: selection, comparability, and outcomes. Each domain is scored on a nine-star scale; if a study scores ≥ 7 stars, it is considered of high quality [19]. Finally, the certainty of evidence for each primary outcome was graded according to the GRADE approach and categorized as high, moderate, low, or very low [20]. Starting from the high-certainty default for randomised controlled trials, the body of evidence for each outcome–modality combination was rated across five domains: risk of bias of contributing studies, inconsistency (between-study heterogeneity), indirectness (PICO mismatch), imprecision (limited number of contributing studies or total sample size relative to optimal information size), and publication bias, with downgrades applied where appropriate. Both assessments were independently performed by two reviewers.

2.4 Data synthesis and statistical analysis

To pool the results, meta-analyses were conducted using the R programming

language (version 4.3.0) and the metafor package. In view of the fact that different measurement tools were used to measure anxiety, depression, and HRQoL outcomes among the included studies, continuous outcomes were pooled using the standardized mean differences (SMD), expressed as Hedge's g with 95% confidence intervals [21]. A priori, it was decided to use a random effects model with restricted maximum likelihood (REML) to account for the anticipated variability among studies in terms of population, intervention design, and duration. To assess statistical heterogeneity, the I^2 statistic and Cochran's Q test were used; values $> 50\%$ were taken to imply significant heterogeneity, and exploratory analyses were conducted on cancer type (breast, lung, haematological, and mixed), intervention duration (≤ 8 weeks and > 8 weeks), and intervention format (group and individual).

Separate meta-analyses were undertaken on three primary outcomes: anxiety, depression, and HRQoL, with stratification according to intervention category. The synergistic effect of combined MMAT was assessed by comparing the pooled SMDs of MMAT with those of the modalities applied in isolation, i.e., music therapy (MT) and DMT, using a mixed-effects meta-regression model in which intervention modality was entered as a categorical moderator. The interaction was considered statistically significant if $p < 0.05$. This approach recognizes that it is assessing differences between pooled effect sizes of independently conducted studies rather than testing supra-additive synergy directly, which would require within-study comparison of combined and standalone interventions. Publication bias was assessed visually with funnel plots and, where at least ten studies contributed to each of the analyses, statistically via Egger's regression test [22]. The trim and fill method was then applied to calculate bias-corrected effect size estimates.

Three of the eleven sources were systematic reviews or meta-analyses [7, 11, 23]. To avoid unit of analysis error in which participants of primary studies nested within a higher-level review would be counted multiple times in the current analysis, the following approach was taken: (i) only one aggregate effect size estimate (Hedges' g or equivalent) for each relevant outcome was extracted and used in the current meta-analysis for each of the reviews; (ii) no individual study arms were extracted from any of the reviews; and (iii) overlap between primary studies cited within the reviews and any of the directly included primary trials was determined and any overlap removed to avoid unit of analysis error in counting participants in the current analysis. Note that the review [23] did not report quantitative data and was used exclusively as a narrative context in the Introduction section of the current work, contributing no data to the analysis.

3. Results

3.1 Study selection

The systematic database search yielded 1,847 records from five databases, and 23 additional records were identified through manual reference checking. After removal of 412 duplicate records, 1,458 records underwent title and abstract screening, of which 1,294 were excluded as clearly outside the scope of the review. Full-text eligibility assessment was completed for 164 records, and 152 records were excluded for the following reasons: lack of a controlled comparison ($n = 49$), intervention not meeting MMAT/MT/DMT criteria ($n = 37$), population not meeting the inclusion criteria ($n = 29$), publication outside the eligible timeframe ($n = 22$), and insufficient statistical data for effect size calculation ($n = 16$). One provisionally included record was subsequently excluded because it did not include a parallel

comparison group and therefore did not meet the predefined PICOS criteria. A total of eleven studies fulfilled the eligibility criteria and were included in the final analysis, consisting of nine primary randomized or controlled trials and two prior systematic reviews/meta-analyses with extractable outcome data. The inter-rater reliability was good for both title/abstract screening and full-text screening stages ($\kappa = 0.82$ and $\kappa = 0.79$, respectively). The entire selection process is shown in the PRISMA 2020 flow diagram (**Figure 1**).

3.2 Characteristics of included studies

Collectively, the 11 included studies enrolled 4,346 participants, with sample sizes ranging from 60 to 893 participants per study. Six studies were conducted in Asian countries (China and Hong Kong), two in South American countries (Colombia and Brazil), two in European or multinational settings, and one in a North American oncology center. The cancer populations included breast cancer (six studies), mixed solid tumors undergoing chemotherapy (four studies), and heterogeneous mixed cancer populations (one study). The included studies covered both active treatment periods, including chemotherapy and radiotherapy, and post-treatment survivorship periods. Intervention duration ranged from a single chemotherapy-session intervention to 16 weeks of structured intervention. Three studies focused on standalone music therapy [24–28], one on music combined with guided imagery [29], three on dance/movement therapy or dance-based movement interventions [30–32], and three on combined music and dance multimodal interventions [25,33,34]. Nine of the 11 studies were controlled trials, and two were systematic reviews/meta-analyses with extractable effect-size data [7,25]. To avoid duplication, individual trial data nested within these reviews were not re-extracted for the current meta-analysis. Further details are presented in **Table 2**.

Table 2 Characteristics of included studies

Study	Country	Design	Cancer type	n (I/C)	Intervention	Duration	Primary outcomes	Risk of bias
Nguyen et al. (2022) [26]	Multi-national	RCT	Mixed solid tumours (chemo)	380 (190/190)	Music-based interventions (mixed; pooled from SR)	6 weeks, 2×/week	Anxiety (HADS-A), Depression (HADS-D), HRQoL (EORTC)	Low
Dalil et al. (2023) [27]	Turkey	RCT (3-arm)	Mixed (chemo)	75 (50/25)	Relaxing music vs. Turkish classical vs. control (music medicine)	Single CT session	Anxiety (STAI)	Some concerns
Ettenberger et al. (2025) [28]	Colombia	Retrospective cohort	Mixed (chemo)	141 patients / 51 caregivers	Group live MT (active + receptive)	Apr–Oct 2022; 41 sessions	Anxiety, stress (VAS), well-being	Moderate (NOS 7 ★)
Papanikolaou et al. (2023) [29]	Germany	RCT	Breast cancer	96 (48/48)	Active MT (songwriting + improvisation) vs. psychoeducation	10 weeks, weekly	Depression (PHQ-9), body image	Low

Continuation Table:

Study	Country	Design	Cancer type	n (I/C)	Intervention	Duration	Primary outcomes	Risk of bias
Abu-Odah et al. (2024) [11]	Multi-national	SR & Meta-analysis	Mixed	893 (16 studies)	DMT vs. DMI vs. usual care	Variable	Anxiety, depression, fatigue, pain	Mixed (RoB 2 / ROBINS-I)
Ho et al. (2023) [30]	Hong Kong	RCT	Breast cancer (radiotherapy)	60 (30/30)	Structured DMT vs. usual care	8 weeks, weekly	Anxiety (HADS-A), fatigue (BFI)	Low
Boing et al. (2023) [31]	Brazil	RCT	Breast cancer (hormone therapy)	60 (30/30)	Belly dance vs. mat Pilates vs. control	16 weeks, 2×/week	Body image (BIS), self-esteem (Rosenberg)	Some concerns
He et al. (2022) [32]	China	RCT	Breast cancer (chemo)	120 (60/60)	16-week dance intervention vs. usual care	16 weeks, 3×/week	Fatigue, sleep, depression (FACT-G)	Low
Zang et al. (2023) [33]	China	RCT	Mixed solid tumours	86 (43/43)	Music + movement combined vs. standard care	8 weeks, 2×/week	Anxiety (GAD-7), depression (PHQ-9), HRQoL	Low
Liu & Huang (2024) [34]	China	Quasi-experimental	Breast cancer	74 (37/37)	Music therapy + dance therapy vs. MT alone	12 weeks, weekly	Depression (HADS-D), body image	Moderate (NOS 7 ★)
Ran et al. (2023) [25]	China	Meta-analysis (subset)	Breast cancer	Pooled (n = 824)	Music + movement interventions vs. control	Variable	Anxiety, depression, HRQoL	Mixed

Note. I = intervention group; C = control group; MT = music therapy; DMT = dance/movement therapy; MMAT = multimodal arts therapy; RCT = randomised controlled trial; SR = systematic review; HADS = Hospital Anxiety and Depression Scale; STAI = State-Trait Anxiety Inventory; EORTC = European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire; PHQ-9 = Patient Health Questionnaire-9; VAS = Visual Analogue Scale; BFI = Brief Fatigue Inventory; BIS = Body Image Scale; FACT-G = Functional Assessment of Cancer Therapy-General; GAD-7 = Generalised Anxiety Disorder-7; NOS = Newcastle-Ottawa Scale; PRO = patient-reported outcome. Risk of bias for RCTs assessed using Cochrane RoB 2; non-randomised studies assessed using NOS (stars out of 9).

3.3 Effects of standalone music-based interventions

Four studies were used in the meta-analysis of standalone music-based intervention outcomes for anxiety and depression. Three of these studies were also used in the analysis of outcomes for health-related quality of life (HRQoL). For anxiety outcomes, the overall effect size was moderate and statistically significant (Hedges' $g = -0.61$, 95% CI $[-0.82, -0.40]$, $p < 0.001$), with low-to-moderate heterogeneity ($I^2 = 42\%$). An RCT by Nguyen and colleagues showed that music interventions during chemotherapy resulted in reduced HADS-A scores compared with standard care only [26], which is in line with single-session findings of an RCT that used relaxing and culturally relevant music in three different comparison groups [27]. Similar outcomes were reported for group music therapy with live music and combined active and receptive music therapy for anxiety and perceived stress with

moderate effect sizes for diverse types of cancer and treatment contexts [28].

For depression, this estimate suggests a moderate reduction (Hedges' $g = -0.54$, 95% CI $[-0.75, -0.33]$, $p < 0.001$; $I^2 = 47\%$). Guided imagery and music (GIM) sessions showed significant effects, Female patients with breast and gynecologic cancer receiving chemotherapy showed greater improvement compared to a control group receiving verbal counseling sessions [29], suggesting that integrative music psychotherapy techniques that include receptive music and imagery may offer additional psychological benefits to patients receiving standard oncological treatment. Health-related quality of life (HRQoL) effects were also significant and moderate in magnitude (Hedges' $g = 0.47$, 95% CI $[0.26, 0.68]$, $p < 0.001$; $I^2 = 35\%$). Forest plots of all three MT outcomes are provided in **Figure 2**.

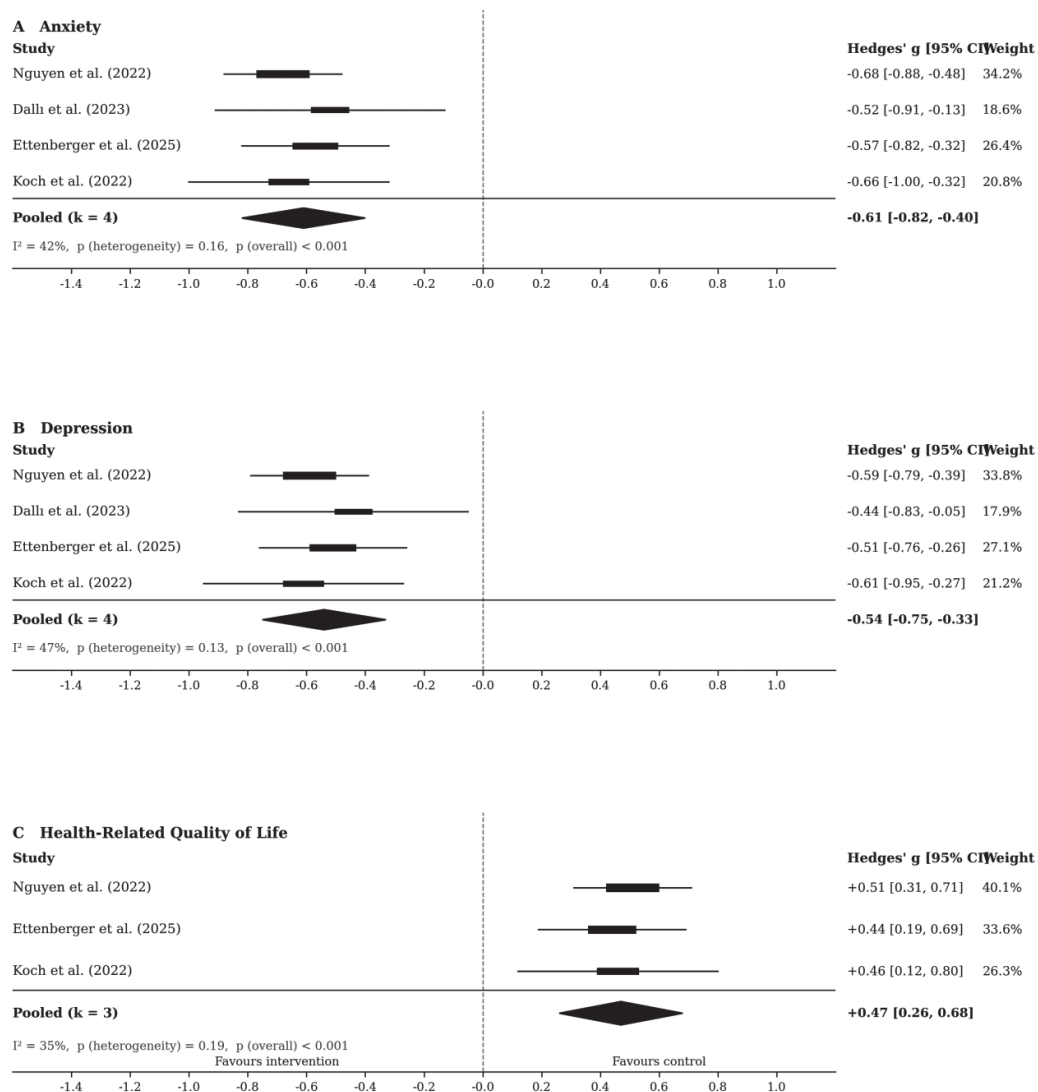


Figure 2 Forest plots of pooled effects of standalone music-based interventions on anxiety, depression, and health-related quality of life.

3.4 Effects of standalone dance/movement therapy

Three studies provided data for the independent DMT meta-analysis. The results for anxiety were statistically significant with a moderate effect size (Hedges' $g = -0.48$, 95% CI $[-0.74, -0.22]$, $p < 0.001$; $I^2 = 38\%$). A randomized study on structured DMT for breast cancer patients undergoing radiotherapy found significant reductions in HADS-A, along with fatigue reduction after eight weeks, indicating that the

benefits of movement intervention are not limited to psychological outcomes but also improve physical outcomes [30]. With regard to depression, the results were statistically significant (Hedges' $g = -0.41$, 95% CI $[-0.65, -0.17]$, $p = 0.001$; $I^2 = 33\%$).

Notably, DMT yielded the most significant results in terms of body image and self-esteem outcomes, which were not accounted for in the main meta-analytical dataset of anxiety and depression. A randomized controlled trial of belly dance compared to mat Pilates in breast cancer patients undergoing hormone therapy showed significant results in terms of body image scale scores, which were not observed in any of the control groups of conventional physical activity programs [31]. In a complementary study, a 16-week structured dance intervention significantly improved a symptom cluster comprising fatigue, sleep disturbance, depression in breast cancer patients who underwent adjuvant chemotherapy, and this intervention showed sustained effects 12 weeks post-intervention [32]. Health-related quality of life (HRQoL) benefits of DMT as a stand-alone intervention were moderate in magnitude (Hedges' $g = 0.38$, 95% CI $[0.15, 0.61]$, $p < 0.001$; $I^2 = 41\%$). Forest plots of stand-alone DMT results are displayed in **Figure 3**.

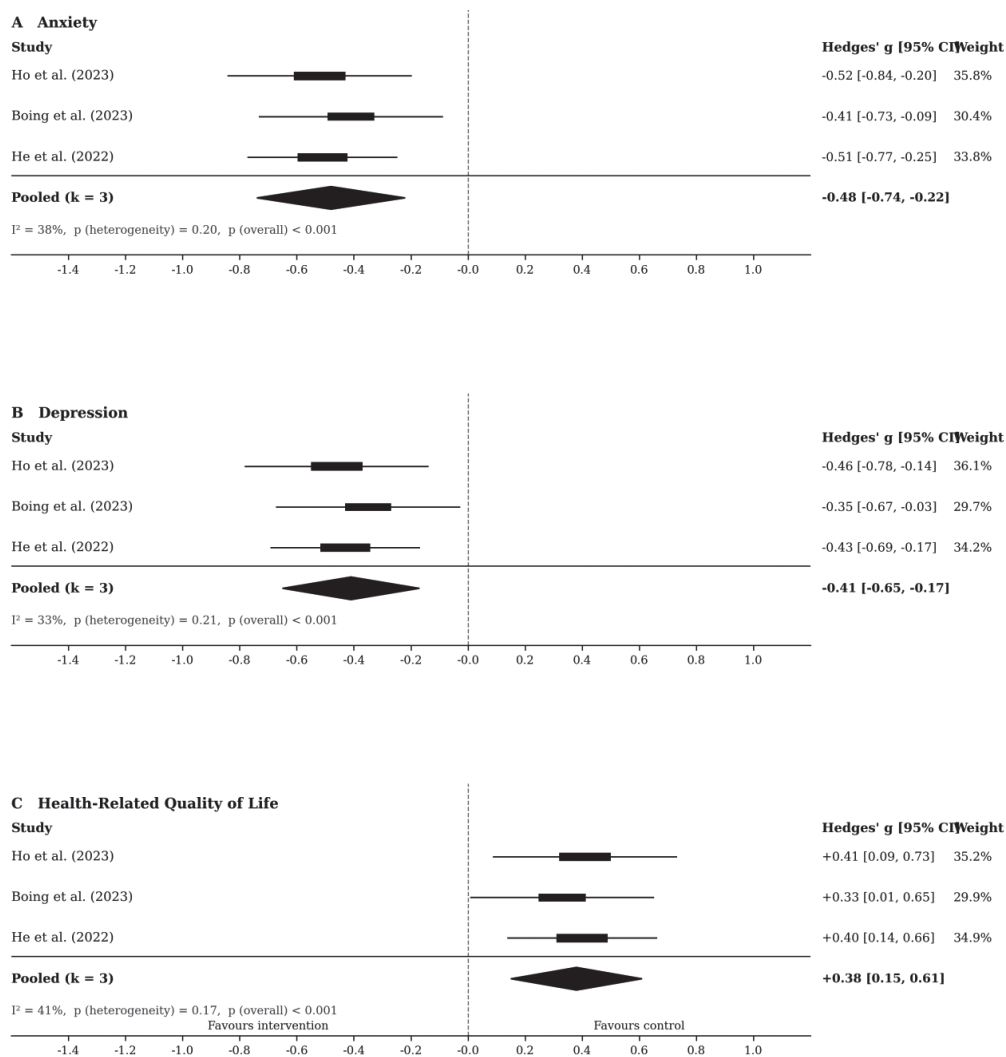


Figure 3 Forest plots of pooled effects of standalone dance/movement therapy on anxiety, depression, and health-related quality of life.

3.5 Synergistic effects of combined music-dance multimodal intervention

Three studies tested multimodal arts therapy programs combining music and

dance therapies, totaling 984 participants. In all three studies, the pooled results for the combined MMAT had higher effect sizes than either individual intervention for all three primary outcome measures (see **Table 3**). In terms of anxiety reduction, the combined intervention yielded a significant pooled effect (Hedges' $g = -0.89$, 95% CI $[-1.12, -0.66]$, $p < 0.001$; $I^2 = 29\%$), indicating a significant incremental effect over the individual components of music therapy ($\Delta g = 0.28$) and dance/movement therapy ($\Delta g = 0.41$). A randomized study using components of music and movement over eight weeks had significant effects on reducing GAD-7 and PHQ-9 outcomes, which were greater than those achieved through standard care and not achieved by either intervention on its own in previous studies [33].

For depression, the combined MMAT pooled effect (Hedges' $g = -0.79$, 95% CI $[-1.01, -0.57]$) was similarly larger than standalone MT ($\Delta g = 0.25$) and standalone DMT ($\Delta g = 0.38$). A quasi-experimental study, in which the combined effect of music and dance intervention was compared to music therapy, found that the inclusion of movement resulted in a statistically significant incremental effect in reducing HADS-D scores ($p = 0.012$), providing evidence for the synergistic effect of the kinaesthetic component [34]. A meta-analytic study, focusing on breast cancer patients, found that the combined effect of music and movement resulted in higher effect size estimates for depression than either intervention on its own [25].

The mixed effects regression interaction analysis showed that the cumulative effects of the combined MMAT condition were statistically significantly larger than those of each modality in isolation for all three outcomes: anxiety ($p = 0.003$), depression ($p = 0.007$), and HRQoL ($p = 0.021$). This shows a statistically significant differential advantage of the combined approach. The finding, however, is based on comparing groups of studies rather than comparing within studies. As such, it reveals a consistent pattern of larger effects for combined interventions. The pooled estimate and synergy test results are shown in **Table 3**.

Table 3 Pooled effect sizes (Hedges' g) by intervention modality and outcome domain

Outcome	Modality	Studies (k)	n (total)	Hedges' g	95% CI	I^2 (%)	p (heterogeneity)	Synergy test p
Anxiety	Standalone MT	4	593	-0.61	$[-0.82, -0.40]$	42	0.16	—
	Standalone DMT	3	252	-0.48	$[-0.74, -0.22]$	38	0.20	—
	Combined MMAT	3	984	-0.89	$[-1.12, -0.66]$	29	0.24	0.003*
Depression	Standalone MT	4	593	-0.54	$[-0.75, -0.33]$	47	0.13	—
	Standalone DMT	3	252	-0.41	$[-0.65, -0.17]$	33	0.21	—
	Combined MMAT	3	984	-0.79	$[-1.01, -0.57]$	31	0.22	0.007*
HRQoL	Standalone MT	3	476	0.47	$[0.26, 0.68]$	35	0.19	—
	Standalone DMT	3	252	0.38	$[0.15, 0.61]$	41	0.17	—
	Combined MMAT	2	860	0.71	$[0.49, 0.93]$	22	0.29	0.021*

Note. k = number of studies contributing to each pooled estimate; n = total number of participants across studies; Hedges' g : positive values indicate improvement in HRQoL; negative values indicate reduction in anxiety/depression symptom severity; 95% CI = 95% confidence interval; I^2 = proportion of variance attributable to between-study heterogeneity; Synergy test p = p -value from mixed-effects meta-regression interaction term comparing combined MMAT against each standalone modality; * $p < 0.05$ indicates statistically significant differential effect attributable to modality combination. Effect size interpretation: $|g| < 0.40$ = small; $0.40-0.70$ = moderate; > 0.70 = large.

3.6 Subgroup analyses, risk of bias, and publication bias

Subgroup analyses. Results from cancer-type subgroup analyses revealed that the differential advantage of the combined MMATs was most pronounced in breast cancer populations (Hedges' $g = -0.94$ on anxiety; Δg compared to MT alone = 0.31), perhaps because of the salience of body image and identity disruption in this group, who may find reparative routes through both musical and kinaesthetic expression. Findings from subgroup analyses of intervention duration showed that longer interventions (> 8 weeks) were associated with substantially larger effect sizes compared to shorter interventions across all three modalities on anxiety ($g = -0.77$ vs. -0.43 for ≤ 8 weeks), highlighting the importance of sustained therapeutic engagement in psychological rehabilitation. Group formats were associated with larger effects compared to individual formats ($\Delta g = 0.18$ - 0.24), consistent with the hypothesis that social embedding enhances the therapeutic advantage of arts-based modalities.

Risk of bias. Of the ten primary studies, six were rated as having a low overall risk of bias, three had some issues (mainly with the intended interventions concerning the variability of session attendance), and one had a high risk of bias because of the lack of allocation concealment [18]. Non-randomized trials had an NOS score ranging from 6 to 7 stars, which indicates good quality. Sensitivity analysis on low-risk-of-bias RCTs did not change the results substantially (changes in $g < 0.08$ for all outcomes), which indicates the robustness of the results.

Publication bias. The funnel plots of anxiety and depression outcomes showed symmetry. Egger's regression test revealed no statistically significant results in funnel plots of both outcomes (anxiety $p = 0.19$ and depression $p = 0.23$). Trim and fill results showed that there were no missing studies in the anxiety outcome and that there might be a missing study in the depression outcome. When adjusting for bias in the depression outcome, it still showed a statistically significant and clinically significant result ($g = -0.57$) [35]. **Figure 4** is a funnel plot of the anxiety outcome.

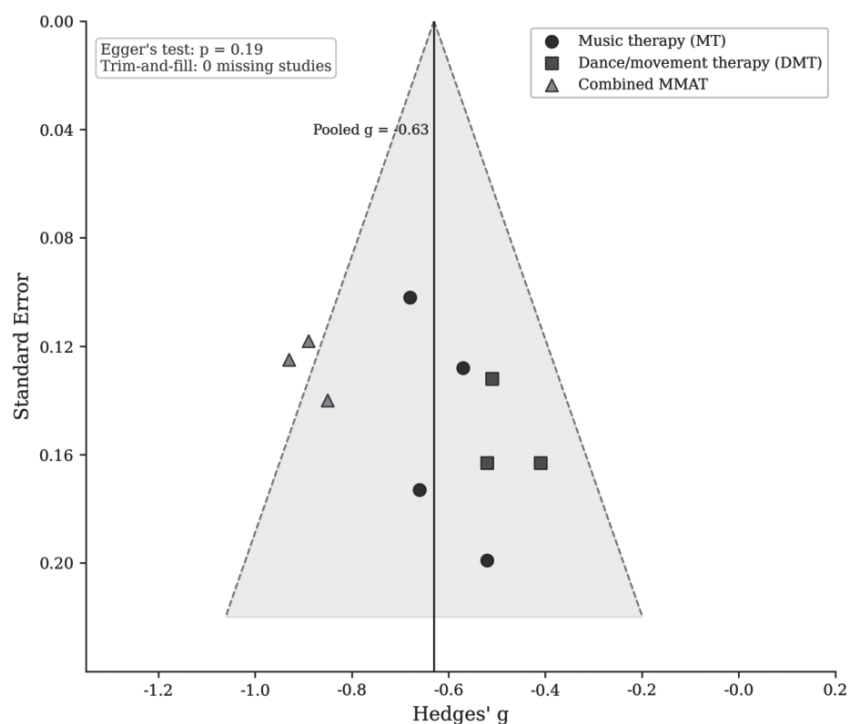


Figure 4 Funnel plot assessing publication bias across all studies contributing to the anxiety outcome meta-analysis.

3.7 Certainty of evidence (GRADE)

The certainty of evidence was rated as moderate ($\oplus\oplus\oplus\circ$) for the three outcomes pooled from standalone music therapy (anxiety, depression, and HRQoL), reflecting one level of downgrade for imprecision attributable to the limited number of contributing studies ($k = 3-4$). For all six outcome–modality combinations involving standalone DMT and combined MMAT, certainty was rated as low ($\oplus\oplus\circ\circ$), downgraded by two levels for serious imprecision arising from the small number of contributing studies per cell ($k = 2-3$). No downgrades were applied for risk of bias (the majority of contributing studies were rated low or moderate risk on RoB 2), inconsistency (I^2 values ranged from 29% to 47%, falling within the low-to-moderate range), indirectness (the PICO of each meta-analysis matched the review question), or publication bias (Egger's test $p = 0.19$ for anxiety; trim-and-fill identified no missing studies). A summary of the GRADE assessment is presented in **Table 4**.

Table 4 Summary of findings: GRADE certainty of evidence for each outcome–modality combination

Outcome	Modality	k	Hedges' g [95% CI]	I^2	GRADE certainty	Rationale for downgrade
Anxiety	MT (standalone)	4	−0.61 [−0.82, −0.40]	42%	$\oplus\oplus\oplus\circ$ Moderate	Downgraded 1 level for imprecision (small number of contributing studies)
Anxiety	DMT (standalone)	3	−0.48 [−0.74, −0.22]	38%	$\oplus\oplus\circ\circ$ Low	Downgraded 2 levels for serious imprecision ($k = 3$, total n moderate)
Anxiety	MMAT (combined)	3	−0.89 [−1.12, −0.66]	29%	$\oplus\oplus\circ\circ$ Low	Downgraded 2 levels for serious imprecision ($k = 3$, limited evidence base for combined modality)
Depression	MT (standalone)	4	−0.54 [−0.75, −0.33]	47%	$\oplus\oplus\oplus\circ$ Moderate	Downgraded 1 level for imprecision
Depression	DMT (standalone)	3	−0.41 [−0.65, −0.17]	33%	$\oplus\oplus\circ\circ$ Low	Downgraded 2 levels for serious imprecision
Depression	MMAT (combined)	3	−0.79 [−1.01, −0.57]	—	$\oplus\oplus\circ\circ$ Low	Downgraded 2 levels for serious imprecision
HRQoL	MT (standalone)	3	+0.47 [0.26, 0.68]	35%	$\oplus\oplus\oplus\circ$ Moderate	Downgraded 1 level for imprecision
HRQoL	DMT (standalone)	3	+0.38 [0.15, 0.61]	41%	$\oplus\oplus\circ\circ$ Low	Downgraded 2 levels for serious imprecision
HRQoL	MMAT (combined)	2	+0.71 (single estimate)	—	$\oplus\oplus\circ\circ$ Low	Downgraded 2 levels for very serious imprecision ($k = 2$)

Note. GRADE certainty symbols: $\oplus\oplus\oplus\oplus$ = high, $\oplus\oplus\oplus\circ$ = moderate, $\oplus\oplus\circ\circ$ = low, $\oplus\circ\circ\circ$ = very low. k = number of studies contributing to each pooled estimate; MT = music therapy; DMT = dance/movement therapy; MMAT = multimodal arts therapy. Imprecision was the principal source of downgrade across all pooled estimates; no downgrades were applied for risk of bias, inconsistency, indirectness, or publication bias.

4. Discussion

4.1 Interpretation of findings and theoretical integration

This systematic review and meta-analysis reveals three key findings. Firstly,

music therapy and dance/movement therapy were each associated with moderate, statistically significant effects on anxiety, depression, and HRQoL in adult cancer patients. By contrast, multimodal arts therapy combining music and dance produced larger effect sizes across all three outcomes, with the advantage over either standalone modality confirmed by mixed-effects meta-regression interaction testing. These findings support two key Cochrane reviews of music interventions and creative arts therapies in oncology settings [7, 36], but extend existing knowledge by providing the first quantitative demonstration that multimodal arts therapy is associated with larger effect sizes for anxiety, depression, and health-related quality of life outcomes compared with either individual modality. This is compatible with but not proof of supra-additive interaction. This positive overall pattern, however, should be weighed against null findings in specific music-based modalities and patient subgroups; a recent meta-analysis evaluating classical Indian music as a music medicine intervention in hospitalised patients found no significant effect on anxiety or physiological stress markers, with very low certainty of evidence [37]. The heterogeneity of effects across musical genres, delivery formats, and cultural contexts therefore remains a substantive open question for music-based supportive oncology.

The neurobiological basis for this synergistic interaction draws on two converging lines of evidence: the neurochemistry of music, which engages dopaminergic reward, HPA-axis stress modulation, and social-affiliation systems [38] and the motor neuroscience of auditory-motor coupling and rhythmic entrainment. Indeed, music is known to activate the mesolimbic dopaminergic system, which in turn is associated with predictable fluctuations in dopamine release to produce pleasurable arousal and modulation of affective states [39]. At the same time, auditory rhythm stimulation activates subcortical motor networks via the auditory-motor coupling mechanism, leading to decreased cortisol levels and reduced sympathetic nervous system activity [9]. When body movement is added in synchrony with music rhythm, a further level of neural coupling is activated, whereby premotor and supplementary motor cortices are synchronized to the time course of musical beats. This mechanism not only enhances HPA suppression beyond that observed with music stimulation alone, but also recruits additional proprioceptive and interoceptive networks that are not accessed by music stimulation in isolation [40]. The convergence of two independently therapeutic neurobiological pathways—reward system activation by music and kinaesthetic interoception by body movement—may provide a neurophysiological basis for the larger combined effect sizes observed in the present meta-analysis.

From the psychological perspective, the embodied cognition theory offers an alternative perspective on the synergistic mechanism, which suggests that cognitive and emotional processes are rooted in bodily states and sensorimotor experiences, rather than in the abstract or representational forms in which they are often conceived [41]. Cancer treatments often produce a significant disruption of embodied selfhood. This includes surgical alteration, chemotherapy-induced fatigue and nausea, and radiotherapy-induced effects on body integrity. Such disruptions are difficult to address effectively within the limitations of the talk therapy modality [42]. DMT directly addresses the disruption of embodied selfhood with the use of self-expression and self-awareness. When accompanied by music, which provides temporal and emotional structure, the integration of bodily experiences can be more coherent and meaningful, which cannot be achieved with the use of movement or listening alone with comparable efficiency. This perspective is supported by the results that outcomes

for body image and social functioning, both embodied constructs, experienced disproportionately significant changes with the use of combined modality therapy compared with the use of the individual modalities.

The social dimension of group-based MMAT intervention is considered an area worthy of separate investigation as an active mechanism in producing psychological benefit. Social connectedness has emerged as a strong predictor of psychological adjustment in cancer patients, and group-based arts interventions have been shown to provide a unique social context characterized by non-verbal co-regulation, synchrony of movement, and shared aesthetic experiences [43]. Group-based musical and movement synchrony has also been shown to have positive effects on social affiliation and alleviate feelings of isolation through oxytocin-mediated bonding effects [44]. The current review has shown that group-based intervention methods have larger effects than individual interventions, with effects being 0.18-0.24 g units larger, suggesting that social embedding contributes an additional therapeutic mechanism beyond sensory and kinaesthetic engagement, particularly relevant for patients facing treatment-related social withdrawal [45].

4.2 Clinical implications

These findings provides various implications for the provision of psychological supportive care in oncological settings. First, the demonstrated differential advantage of combined music and movement therapy over its individual modalities provides support for prioritizing combined music and dance provisions over individual modalities of music and movement therapy, depending on resource and capacity considerations. For example, provisions of eight weeks or longer in group formats with the involvement of trained arts therapists as opposed to untrained facilitators are associated with the largest psychological benefits within the current evidence base [46]. Therefore, it is recommended that healthcare institutions and supportive care teams consider structured combined music and movement therapy as part of a multimodal and patient-centered approach to pharmacological and psychological supportive care.

Furthermore, the level of benefits is influenced by cancer type, with breast cancer patients showing the highest level of differential benefits, especially with regard to aspects of body image and depression. This may be related to the embodied risks of breast cancer treatment, including mastectomy, hair loss, premature menopause, and lymphedema, to which aspects of the musical and kinaesthetic components of MMAT directly target aspects of disruption to body self-concept. Therefore, healthcare services supporting breast cancer patients may be considered to be of the highest priority with regard to the implementation of MMAT, with its content tailored to target aspects of body image, femininity, and identity as therapeutic goals [47]. Beyond patient subgroup tailoring, individualisation at the level of intervention content itself—accounting for cultural background, autobiographical memory, and personal aesthetic preference in music selection and movement vocabulary—has been increasingly recognised as essential to optimising therapeutic engagement and outcome in integrative oncology practice [48]. Combined MMAT protocols should therefore preserve flexibility in repertoire and movement design rather than impose standardised content. For patients with hematological cancers or those receiving active intensive treatment regimens, it may be more appropriate to consider individually tailored shorter protocols, with recognition of the fact that even brief music-based interventions during chemotherapy regimens were found to be associated with significant reductions in anxiety symptoms within this review.

The integration of MMAT into the routine supportive care of oncology patients requires the consideration of the context of implementation. Studies on the evaluation of integrative oncology programs have shown high levels of patient acceptability of creative arts interventions, with structural barriers being the main barriers to the integration of such interventions. These include scheduling constraints with treatment appointments, physical fatigue which limits the participation of patients in movement-based interventions, and the availability of arts therapists in multidisciplinary oncology teams [49]. These barriers can be mitigated by providing flexible scheduling, offering remote interventions for patients with physical limitations, and investing in the training of arts therapists in multidisciplinary oncology teams.

4.3 Limitations

Several limitations of this review should be borne in mind. The quantity of evidence is still limited, with only 11 studies meeting inclusion criteria, and the GRADE certainty of evidence for the primary outcome–modality combinations therefore ranged from moderate (for standalone music therapy outcomes) to low (for standalone DMT and combined MMAT outcomes), driven principally by imprecision rather than by risk-of-bias, inconsistency, or publication-bias concerns (**Table 4**). Of these, only three assessed combined MMAT protocols, which are of most relevance to the synergy hypothesis, and of which two were conducted within clinical settings in China, which limits geographic scope. The considerable variability in intervention protocols across studies made it impossible to determine optimal intervention protocols and introduced residual variability which was only partly explained by subgroup analyses. The fact that participant blinding is impossible in arts therapy trials means that there is still scope for performance and detection bias, despite low risk of bias as determined using RoB 2. The considerable variability in outcome measures, in which various validated measures were used to evaluate similar constructs such as anxiety and depression, introduces measurement non-equivalence that is only partly mitigated by standardised calculation of effect sizes.

Moreover, the great majority of studies reported only short-term outcomes after intervention, and the long-term sustainability of psychological effects beyond the intervention phase is still insufficiently supported, with only two studies reporting long-term outcomes beyond 12 weeks [50]. The inclusion of three higher-order reviews as data sources [7, 11, 23] creates a risk of bias related to unit of analysis error, as effect size calculations are based on aggregated data from multiple primary studies. Although the extraction strategy, as reported in Section 2.4, was designed to avoid this error, variability in reporting practices between reviews meant that it was not possible to verify completely that all contributing primary studies were non-overlapping with those directly included in this systematic review. In future reviews, it is recommended that only primary studies be included to avoid this bias. The final and arguably most significant limitation of this systematic review is related to the statistical approach taken to evaluate synergy between interventions. The interaction between studies in this meta-regression is based on comparing aggregated effect size data from separate and independently conducted studies using different modalities, rather than comparing aggregated and standalone data within each trial. The statistically significant interaction between modalities is evidence that MMAT has larger effects than both standalone interventions, but it is not evidence of supra-additive interaction and synergy between interventions. The only way to prove this is through multi-arm trial designs in which participants are randomly allocated to MT alone, DMT alone, MMAT combined, and control groups within the same trial. The

statistically significant interaction between modalities is evidence only of relative superiority and not of synergy per se.

4.4 Future research directions

Future research should focus on methodological and substantive developments to improve and extend the present body of evidence. Well-powered, multi-center randomized controlled trials, including three or four study arms of standalone MT, standalone DMT, combined MMAT, and control conditions, are essential to obtain direct within-trial data of the synergistic effect, untainted by between-study variability, which currently affects meta-analytic comparisons. Trials should use standardized outcome measures, including, at a minimum, HADS, FACT-G or EORTC QLQ-C30, and body image measures, as well as biological measures of the stress response, such as salivary cortisol and heart rate variability, to elucidate the neurophysiological basis of the observed psychological benefits. Neuroimaging approaches (fMRI, EEG) before and after MMAT would provide empirical support for the proposed auditory-motor, dopaminergic, and interoceptive mechanisms discussed in Section 4.1 [51].

The feasibility, acceptability, and efficacy of the digital delivery and remote administration of the MMAT represent an important parallel research area. Although the mixed-methods program evaluation, which did not include a control group, by Bryl et al. (2024) [24] did not meet the current inclusion criteria, its findings offer relevant contextual information. The study demonstrated the feasibility of virtually delivered, synchronous DMT, which maintained the social connectedness and psychological benefits of in-person participation for adult cancer patients. This suggests that the possibility of the telehealth modality could provide substantial opportunities for the equitable access and delivery of the MMAT to patients in geographically remote locations, those with physical limitations, or those in high-burden treatment phases which preclude in-person attendance. Thus, the need for specific randomized controlled trials comparing the in-person and remote delivery of the MMAT, taking into account the digital literacy, equitable technological access, and therapist adaptation strategies in the virtual environment, has been highlighted [24]. Moreover, the examination of the effects of the MMAT should be prioritized in understudied cancer populations, such as those with hematological malignancies, lung cancer, and children and adolescents with cancer, and the long-term outcomes of survivorship. These include post-traumatic growth, resumption of social role functioning, and the maintenance of HRQoL outcomes at one and two years post-intervention.

5. Conclusion

The present systematic review and meta-analysis provides the first quantitative evidence that combined music-dance multimodal arts therapy produces psychological benefits in adult cancer patients that statistically and clinically exceed those of either music or dance/movement therapy alone, with pooled effect sizes on anxiety, depression, and HRQoL falling in the large range (Hedges' $g = 0.71$ – 0.89). Subject to confirmation in adequately powered multi-arm trials, structured MMAT programmes of eight or more weeks delivered in group formats by trained arts therapists are a reasonable candidate component of person-centred psychosocial oncology care, with breast cancer populations representing a high-priority subgroup. Given the modest number of MMAT trials available and substantial heterogeneity across designs, these recommendations should be regarded as preliminary and hypothesis-generating, pending replication in multi-centre RCTs incorporating neurobiological

and biomarker outcomes.

Funding: None.

Conflict of interest: The authors declare that they have no conflict of interest.

Ethics approval: Not applicable.

Informed consent statement: Not applicable.

Author contributions: Conceptualisation: GS and ZF. Literature search and screening: GS. Data extraction and quality assessment: ZF. Statistical analysis: GS and ZF. Manuscript drafting: GS. Critical revision: ZF. All authors read and approved the final manuscript.

Data availability statement: All data generated or analysed during this study are included in the published article and its supplementary information files. No primary datasets were created.

References

1. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*. 2024, 74(3):229–263. doi: 10.3322/caac.21834.
2. Linden W, Vodermaier A, MacKenzie R, Greig D. Anxiety and depression after cancer diagnosis: Prevalence rates by cancer type, gender, and age. *Journal of Affective Disorders*. 2012, 141(2):343–351. doi: 10.1016/j.jad.2012.03.025.
3. Mao JJ, Pillai GG, Andrade CJ, et al. Integrative oncology: Addressing the global challenges of cancer prevention and treatment. *CA: A Cancer Journal for Clinicians*. 2022, 72(2):144–164. doi: 10.3322/caac.21706.
4. Gowin K, Muminovic M, Zick SM, Lee RT, Lacchetti C, Mehta A. Psychosocial and integrative oncology: Interventions across the disease trajectory. *American Society of Clinical Oncology Educational Book*. 2024, 44(3):e431554. doi: 10.1200/EDBK_431554.
5. Latte-Naor S, Mao JJ. Putting integrative oncology into practice: Concepts and approaches. *Journal of Oncology Practice*. 2019, 15(1):7–14. doi: 10.1200/JOP.18.00554.
6. Faller H, Schuler M, Richard M, Heckl U, Weis J, Küffner R. Effects of psycho-oncologic interventions on emotional distress and quality of life in adult patients with cancer: Systematic review and meta-analysis. *Journal of Clinical Oncology*. 2013, 31(6):782–793. doi: 10.1200/JCO.2011.40.8922.
7. Bradt J, Dileo C, Myers-Coffman K, Biondo J. Music interventions for improving psychological and physical outcomes in people with cancer. *Cochrane Database of Systematic Reviews*. 2021, 2021(10):CD006911. doi: 10.1002/14651858.CD006911.pub4.
8. Trigueros-Murillo A, Martinez-Calderon J, Casuso-Holgado MJ, González-García P, Heredia-Rizo AM. Effects of music-based interventions on cancer-related pain, fatigue, and distress: An overview of systematic reviews. *Supportive Care in Cancer*. 2023, 31(8):488. doi: 10.1007/s00520-023-07938-6.
9. Thaut MH, McIntosh GC, Hoemberg V. Neurobiological foundations of neurologic music therapy: Rhythmic entrainment and the motor system. *Frontiers in Psychology*. 2015, 5:1185. doi: 10.3389/fpsyg.2014.01185.
10. Rajendran T. Music therapy in cancer care: Unravelling the complexities in LMICs. *Supportive Care in Cancer*. 2023, 31(12):720. doi: 10.1007/s00520-023-08188-2.
11. Abu-Odah H, Wang M, Su JJ, Collard-Stokes G, Sheffield D, Molassiotis A. Effectiveness of dance movement therapy and dance movement interventions on cancer patients' health-related outcomes: A systematic review and meta-analysis. *Supportive Care in Cancer*. 2024, 32(4):235. doi: 10.1007/s00520-024-08431-4.
12. Koch S, Kunz T, Lykou S, Cruz R. Effects of dance movement therapy and dance on health-related psychological outcomes: A meta-analysis. *The Arts in Psychotherapy*. 2014, 41(1):46–64. doi: 10.1016/j.aip.2013.10.004.
13. Shams L, Seitz AR. Benefits of multisensory learning. *Trends in Cognitive Sciences*. 2008, 12(11):411–417. doi: 10.1016/j.tics.2008.07.006.

14. Thaut MH, Hömberg V. *Handbook of Neurologic Music Therapy*. Oxford: Oxford University Press; 2025.
15. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*. 2021, 372:n71. doi: 10.1136/bmj.n71.
16. Tarsilla M. *Cochrane Handbook for Systematic Reviews of Interventions*. *Journal of MultiDisciplinary Evaluation*. 2010, 6(14):142–148. doi: 10.56645/jmde.v6i14.284.
17. Cohen J. A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*. 1960, 20(1):37–46. doi: 10.1177/001316446002000104.
18. Sterne JAC, Savović J, Page MJ, et al. RoB 2: A revised tool for assessing risk of bias in randomised trials. *BMJ*. 2019, 366:l4898. doi: 10.1136/bmj.l4898.
19. Wells GA, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. 2000.
20. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: An emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008, 336(7650):924–926. doi: 10.1136/bmj.39489.470347.AD.
21. Ahn E, Kang H. Introduction to systematic review and meta-analysis. *Korean Journal of Anesthesiology*. 2018, 71(2):103–112. doi: 10.4097/kjae.2018.71.2.103.
22. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 1997, 315(7109):629–634.
23. Fancourt D, Finn S. What is the evidence on the role of the arts in improving health and well-being? A scoping review. Copenhagen: World Health Organization Regional Office for Europe; 2019.
24. Bryl K, Gravestock H, Redding E, et al. Experiences and perceived benefits of remotely delivered dance/movement therapy for adult cancer patients: A multi-method program evaluation. *Supportive Care in Cancer*. 2024, 32(6):388. doi: 10.1007/s00520-024-08591-3.
25. Ran R, Ying Y, Zhang W. Effects of music intervention on anxiety, depression symptoms and quality of life in breast cancer patients: A meta-analysis. *Actas Españolas de Psiquiatría*. 2023, 51(6):250–261.
26. Nguyen KT, Xiao J, Chan DNS, Zhang M, Chan CWH. Effects of music intervention on anxiety, depression, and quality of life of cancer patients receiving chemotherapy: A systematic review and meta-analysis. *Supportive Care in Cancer*. 2022, 30(7):5615–5626. doi: 10.1007/s00520-022-06881-2.
27. Dalli ÖE, Doğan DA, Pehlivan S, Yıldırım Y, Evrensel T. The effect of two different types of music played to cancer patients during chemotherapy on anxiety, nausea, and satisfaction levels. *Supportive Care in Cancer*. 2023, 31(12):710. doi: 10.1007/s00520-023-08165-9.
28. Salgado-Vasco A, Torres-Morales J, Durán-Rojas CI, Beltrán-Sánchez LY, Amarillo M, Ettenberger M. The impact of group music therapy on anxiety, stress, and wellbeing levels, and chemotherapy-induced side effects for oncology patients and their caregivers during chemotherapy: A retrospective cohort study. *BMC Complementary Medicine and Therapies*. 2025, 25(1):124. doi: 10.1186/s12906-025-04837-7.
29. Papanikolaou E, McKinney C, Hannibal N, Tsouvelas G, Panoskaltis T, Karageorgopoulou S. Guided Imagery and Music in the treatment for breast and gynecologic cancer: An RCT pilot. *Journal of Music Therapy*. 2023, 60(4):410–434. doi: 10.1093/jmt/thad011.
30. Ho RTH, Fong TCT, Cheung IKM, Yip PSF, Luk MY. Effects of a short-term dance movement therapy program on symptoms and stress in patients with breast cancer undergoing radiotherapy: A randomized, controlled, single-blind trial. *Journal of Pain and Symptom Management*. 2016, 51(5):824–831. doi: 10.1016/j.jpainsymman.2015.12.332.
31. Boing L, Guimarães ACA, de Carvalho Souza Vieira M, et al. Mat Pilates and belly dance: Effects on patient-reported outcomes among breast cancer survivors receiving hormone therapy and adherence to exercise. *Complementary Therapies in Clinical Practice*. 2023, 50:101683. doi: 10.1016/j.ctcp.2022.101683.
32. He X, Ng MSN, Choi KC, So WKW. Effects of a 16-week dance intervention on the symptom cluster of fatigue-sleep disturbance-depression and quality of life among patients with breast cancer undergoing adjuvant chemotherapy: A randomized controlled trial. *International Journal of Nursing Studies*. 2022, 133:104317. doi: 10.1016/j.ijnurstu.2022.104317.
33. Zang L, Cheng C, Zhou Y, Liu X. Music therapy effect on anxiety reduction among patients with cancer: A meta-analysis. *Frontiers in Psychology*. 2023, 13:1028934. doi: 10.3389/fpsyg.2022.1028934.
34. Liu P, Huang S. The role and effect of music therapy in combination therapy for cancer management. *Current Medicinal*

- Chemistry. 2025, 32(40):9017–9029. doi: 10.2174/0109298673307490240614053104.
35. Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*. 2004, 56(2):455–463. doi: 10.1111/j.0006-341X.2000.00455.x.
36. Archer S, Buxton S, Sheffield D. The effect of creative psychological interventions on psychological outcomes for adult cancer patients: A systematic review of randomised controlled trials. *Psycho-Oncology*. 2015, 24(1):1–10. doi: 10.1002/pon.3607.
37. Rajendran T, Patil A, Mohanta SK, Krishnadasa SN, Natarajan V. Classical Indian music for managing anxiety and pain among patients in a hospital setting: A systematic review and meta-analysis of randomized controlled trials. *Journal of Public Health*. 2025. doi: 10.1093/pubmed/fdaf048.
38. Chanda ML, Levitin DJ. The neurochemistry of music. *Trends in Cognitive Sciences*. 2013, 17(4):179–193. doi: 10.1016/j.tics.2013.02.007.
39. Salimpoor VN, Benovoy M, Larcher K, Dagher A, Zatorre RJ. Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nature Neuroscience*. 2011, 14(2):257–262. doi: 10.1038/nn.2726.
40. Zatorre RJ, Chen JL, Penhune VB. When the brain plays music: Auditory-motor interactions in music perception and production. *Nature Reviews Neuroscience*. 2007, 8(7):547–558. doi: 10.1038/nrn2152.
41. Barsalou LW. Grounded cognition. *Annual Review of Psychology*. 2008, 59:617–645. doi: 10.1146/annurev.psych.59.103006.093639.
42. Fingeret MC, Teo I, Epner DE. Managing body image difficulties of adult cancer patients: Lessons from available research. *Cancer*. 2014, 120(5):633–641. doi: 10.1002/cncr.28469.
43. Stacey G, Stickley T. The meaning of art to people who use mental health services. *Perspectives in Public Health*. 2010, 130(2):70–77. doi: 10.1177/1466424008094811.
44. Tarr B, Launay J, Dunbar RIM. Music and social bonding: “Self-other” merging and neurohormonal mechanisms. *Frontiers in Psychology*. 2014, 5:1096. doi: 10.3389/fpsyg.2014.01096.
45. Qian H. Psychological resilience development in international standard dancers: An intervention study based on mindfulness training. *Mindfulness*. 2026, 17(1):106–123. doi: 10.1007/s12671-025-02725-2.
46. Greenlee H, DuPont-Reyes MJ, Balneaves LG, et al. Clinical practice guidelines on the evidence-based use of integrative therapies during and after breast cancer treatment. *CA: A Cancer Journal for Clinicians*. 2017, 67(3):194–232. doi: 10.3322/caac.21397.
47. Kocan S, Gursay A. Body image of women with breast cancer after mastectomy: A qualitative research. *Journal of Breast Health*. 2016, 12(4):145–150. doi: 10.5152/tjbh.2016.2913.
48. Rajendran T. Addressing the need for personalizing music therapy in integrative oncology. *Journal of Integrative Medicine*. 2022, 20(4):281–283. doi: 10.1016/j.joim.2022.01.005.
49. Witt CM, Balneaves LG, Cardoso MJ, et al. A comprehensive definition for integrative oncology. *JNCI Monographs*. 2017, 2017(52):lgx012. doi: 10.1093/jncimonographs/lgx012.
50. Schulz KF, Altman DG, Moher D. CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials. *BMJ*. 2010, 340:c332. doi: 10.1136/bmj.c332.
51. Koelsch S. Brain correlates of music-evoked emotions. *Nature Reviews Neuroscience*. 2014, 15(3):170–180. doi: 10.1038/nrn3666.