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Coloring beyond the cancer ward: A randomised controlled pilot trial of short-term visual art therapy for chemotherapy-related distress

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Abstract: Breast-cancer treatment often disrupts appearance and identity, leaving roughly one-third of patients in clinically significant distress. This dual-centre pilot RCT assessed whether a brief, low-cost mandala-coloring program could alleviate chemotherapy-related distress in women with early-stage breast cancer. Fifty post-surgical patients starting adjuvant chemotherapy were randomised 1:1 to either three 45-min chair-side coloring sessions delivered over three weeks or an active control involving neutral reading for the same duration; both groups received standard care. Distress (NCCN Distress Thermometer [DT] 0-10) was the primary outcome, with anxiety and depression (HADS-A/D), fatigue (BFI), and global quality of life (EORTC QLQ-C30) as secondary endpoints, all measured at baseline and one week after the final session. Feasibility targets were surpassed: 86% of approached patients enrolled, 96% completed follow-up, and 92% of intervention participants attended every session. Adjusted analyses showed lower postintervention distress in the art-therapy group (mean = 3.4) versus controls (mean = 5.1), giving a -1.7-point difference ($p = 0.02$, Cohen's $d = 0.85$); only 28% of intervention patients, compared with 80% of controls, remained above the DT clinical cut-off (≥ 4). Anxiety dropped markedly in the coloring arm (8.70 to 6.20) but increased in controls (8.40 to 9.60), producing a -3.3-point adjusted difference ($p < 0.001$, $d \approx 1.2$). Depression and fatigue showed no significant between-group differences, and global quality of life declined in controls but was largely maintained in the art group, although this trend did not reach significance. Structural-equation modelling ($\chi^2 = 7.11$, CFI = 0.995, RMSEA = 0.036) confirmed a latent “distress” factor defined by DT, HADS-A, and HADS-D; the intervention exerted a significant negative effect on this factor ($\beta = -0.55$, $p = 0.006$), driven chiefly by anxiety reduction, with no direct paths to fatigue or quality of life. In summary, three short mandala-coloring sessions are feasible during chemotherapy and substantially reduce overall distress and anxiety, though depressive symptoms, fatigue, and broad quality-of-life indices were unchanged over this brief interval. Larger, longer trials should verify durability, explore body-image mechanisms, and determine how best to integrate chair-side coloring into routine psycho-oncology practice.

Keywords: breast cancer; mandala coloring; visual art therapy; psychological distress; randomised controlled trial

1. Introduction

Cancer-related distress is widely recognized as a critical issue in oncology care, with studies indicating that roughly 30%–50% of patients experience clinically significant psychological distress during the course of illness [1]. Breast cancer patients, in particular, face unique psychosocial challenges. In early-stage breast cancer,

physical symptoms can often be managed, but the treatments themselves, especially surgical interventions such as mastectomy, can severely disrupt a woman's sense of identity and body image [2]. The loss or alteration of the breast, a symbol of femininity and sexuality, often precipitates feelings of shame, diminished self-worth, and social isolation. Research has shown that women post-mastectomy frequently struggle with body esteem and image; these challenges are closely linked to heightened anxiety, depression, and overall distress. For example, one study found that mastectomy patients had significantly lower body esteem and correspondingly high rates of depressive symptoms, with body image concerns correlating positively with psychological distress levels. Similarly, negative body image in breast cancer survivors has been associated with greater depression and poorer quality of life [3]. Taken together, these findings underscore that, beyond the physical disease, breast cancer poses a profound threat to a woman's psychosocial well-being, including her femininity, attractiveness, and identity, which leads to intense distress that merits targeted intervention.

In response to this recognized burden, guidelines such as the NCCN Distress Management standards emphasize routine screening and psychosocial support for distressed cancer patients. However, effective, accessible interventions to reduce distress in the chemotherapy setting are still being developed. Psychosocial oncology research has increasingly explored creative arts therapies as stress-reduction tools for patients [4]. Art therapy, in various forms, offers patients a nonverbal outlet to express emotions, gain coping skills, and restore a sense of control [5]. Visual art therapy, in particular, has shown promise in oncology: engaging in drawing or coloring can induce relaxation, distract from ruminative thoughts, and provide a medium for self-expression and empowerment [6,7]. One specific technique, mandala coloring, has gained popularity as a simple form of therapeutic art-making that patients can easily participate in during treatment sessions. *Mandala* (Sanskrit for "circle") coloring involves filling in circular, often intricate patterns, and is thought to facilitate mindfulness and meditative focus. Psychologically, the structured yet creative process of coloring within a mandala design may help "contain" overwhelming emotions and promote a sense of harmony and wholeness. Clinically, mandala coloring is commonly used as an antistress exercise—it has been described as a "safe, creative and therapeutic process that helps create feelings of being centred and at peace" for those coping with difficult emotions. Patients do not need any artistic skill to benefit; the act of coloring is approachable for all and doesn't demand perfection. These qualities make mandala coloring a particularly attractive intervention for cancer patients, who often face anxiety and loss of control.

Emerging empirical evidence supports the potential benefits of mandala art therapy (MAT) in oncology, though findings have been mixed [8,9]. Several studies suggest that brief coloring interventions can reduce acute anxiety in cancer patients [10,11]. For instance, a recent trial by Akbulak and can reported that instructing early-stage breast cancer patients to color mandalas for 30 min during chemotherapy significantly lowered their state anxiety levels during the infusion [12]. Mandala coloring has also been associated with immediate stress relief in other cancer contexts, acting as a distraction and coping mechanism in the chemo suite [13]. Similarly, a

quasi-experimental study in gynecologic cancer patients found that a three-session MAT program led to greater reductions in anxiety (State-Trait Anxiety Inventory scores) over time compared to standard care [14]. Qualitative reports reinforce that patients find coloring to be calming and empowering, offering a “mental escape” from the demands of treatment [15]. On the other hand, not all studies have observed broad improvements in psychological outcomes. In a randomised trial of a 6-week art therapy program (incorporating personalized art-making) for female cancer patients, Radl et al. found no significant difference between the art therapy and control groups on overall emotional distress by the end of the intervention (pubmed.ncbi.nlm.nih.gov). The art therapy group did show a trend toward more patients dropping below the clinical distress threshold, but group mean differences were not statistically significant [16]. Additionally, one pilot with breast cancer survivors engaging in an 8-week mandala coloring course paradoxically found that although anxiety symptoms improved, patients’ self-rated distress (using the DT) actually increased slightly postintervention (albeit not significantly). The authors speculated this could be due to greater emotional awareness or the small sample ($N = 12$) in that study [6]. These mixed outcomes highlight that while MAT is promising for anxiety and coping, its effect on the broader construct of “distress” (which can encompass depression, worries, and practical concerns) is not yet fully understood and may depend on patient population and intervention format.

Against this backdrop, the present study aimed to evaluate short-term visual art therapy, specifically, mandala coloring, as an intervention for chemotherapy-related distress in breast cancer patients. The study focused on women in the active treatment phase (receiving chemotherapy after surgery), as this period is often fraught with uncertainty, appearance changes (hair loss, surgical scars), and psychological vulnerability. Importantly, during chemotherapy, patients typically have periods of downtime (e.g., while receiving infusions), which presents an opportunity for therapeutic activities like coloring. A randomised controlled pilot trial was designed to test whether a brief series of guided mandala coloring sessions could reduce psychological distress in female breast cancer patients relative to an active control condition. The pilot also examined specific dimensions of distress, namely anxiety, depression, fatigue, and quality of life, to identify which aspects of well-being might be influenced by art therapy. Based on prior evidence, it was hypothesized that the mandala coloring intervention would lower distress and anxiety compared with the control. A smaller effect on physical fatigue was expected because an arts intervention is unlikely to mitigate treatment-related fatigue directly, although improvements in emotional state were explored for potential indirect benefits on quality-of-life scores. Given the small sample size and exploratory nature of the study, an SEM analysis was also planned to explore the interplay of variables, including whether reductions in anxiety and depression mediate the effect on overall distress. By focusing on a specific, feasible intervention (three 45-min mandala coloring sessions) in a targeted high-risk group (breast cancer patients with body image challenges), this study seeks to extend the psycho-oncology toolkit for managing distress and ultimately inform larger trials aimed at improving the holistic care of breast cancer patients.

2. Materials and methods

2.1. Study design

This study was a prospective, parallel-group randomised controlled pilot trial conducted at two clinical sites: the Day Chemotherapy Unit of a tertiary cancer centre and the Oncology inpatient ward of a general hospital. Utilizing a dual-centre design allowed recruitment of patients in different treatment settings (outpatient infusion vs. inpatient chemotherapy), enhancing generalizability. The trial was approved by the institutional ethics committee, and all participants provided written informed consent. The primary aim of this pilot randomised trial was to assess feasibility; accordingly, the sample size was selected to ensure precise estimation of key parameters (e.g., baseline–post correlation for ANCOVA efficiency) rather than hypothesis testing. This approach aligns with the CONSORT guidelines for pilot trials, adheres to published recommendations for pilot sample sizes (which advise at least 12 per arm), and mirrors the guidance for pilots that precede main trials powered to detect small effects [17].

Using G*Power (version 3.1; two-sided $\alpha = 0.05$), a sensitivity analysis indicates that a total sample of $N = 50$ (25 per arm) affords approximately 80% power to detect a standardized between-group difference of Cohen's $d \approx 0.80$ for a simple two-sample comparison. Accordingly, the present trial enrolled 25 participants per arm to enable stable parameter estimation for a future definitive RCT.

2.2. Participants

Eligible participants were female breast cancer patients meeting the following criteria: (1) diagnosed with stage I–III breast cancer, (2) had undergone primary surgery (mastectomy or breast-conserving surgery) within the past 3–6 months, (3) currently receiving adjuvant or neoadjuvant chemotherapy (either inpatient or outpatient), and (4) no evidence of metastatic disease or uncontrolled physical symptoms. Patients in the early or stable phase of disease, in whom physical pain was managed, were selected to isolate psychosocial distress. Additional inclusion criteria included age 18–70 and the ability to read and write at a basic level (for questionnaires and reading tasks). Patients with severe psychiatric conditions (e.g., psychosis, substance dependence) or cognitive impairment were excluded, as were those who had prior experience with formal art therapy (to avoid confounding by familiarity). Patients on concurrent psychiatric therapy initiated within the last month were also excluded to avoid overlap with other interventions.

Patients were identified via physician referral and screening of clinic lists for new chemotherapy starts. A research assistant approached eligible patients during a chemotherapy visit or hospital stay, provided information about the study (emphasizing the voluntary nature and that the intervention was complementary to usual care), and obtained consent. Enrolment occurred on a rolling basis; baseline assessments were scheduled prior to the first chemotherapy session of a new cycle to capture pre-intervention distress levels.

After baseline assessment, participants were randomly assigned to either the Mandala Coloring intervention or the Control group in a 1:1 ratio. Randomization

was performed using a computer-generated random sequence with random block sizes of 4–6, stratified by site (day unit vs. inpatient) to ensure balance across settings. Allocation concealment was maintained using sealed opaque envelopes prepared by an independent staff member not involved in recruitment. Due to the nature of the intervention, neither the participants nor the facilitators could be fully blinded to group assignment. However, the control group was given an active task to minimize expectancy differences, and outcomes were primarily self-reported by participants. The research staff administering questionnaires were not involved in delivering the intervention and were blinded to the group when possible (e.g., via separate staff for data collection).

2.3. Mandala coloring therapy

Participants in the intervention arm engaged in a short-term visual art therapy program focused on mandala coloring. The program consisted of three sessions, each approximately 45 min in duration, conducted over a period of three weeks (roughly one session per week). A three-session dose was selected on practical grounds and informed by evidence from similar interventions demonstrating anxiety reduction after even one or a few sessions [12,14]. Sessions were scheduled to coincide with chemotherapy appointments when feasible (e.g., before or during infusion) or as standalone appointments for inpatients (in a quiet space on the ward). Each session followed a structured format:

- (a) Setup: Participants were seated in a calm, well-lit environment. They were provided with a set of predrawn mandala templates (circular geometric patterns with varying designs) on paper and an array of coloring materials (colored pencils, markers, crayons). To standardize the activity, each participant received similar mandala designs (with moderate complexity) and a 12-color pencil set (**Figure 1**).
- (b) Introduction (5 min): A trained facilitator (an art therapist or psychologist familiar with the process) briefly guided the participant in a centring exercise, e.g., taking a few deep breaths and focusing attention on the blank mandala. The facilitator emphasized that this was not an art test and that there was no “wrong” way to color the mandala. Participants were encouraged to choose colors freely and let their feelings guide the coloring.

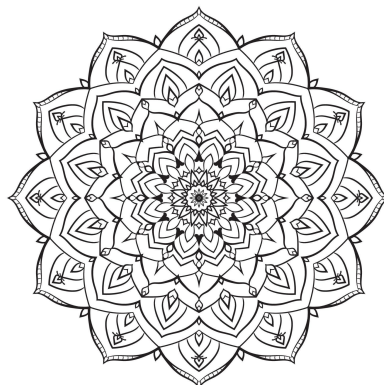


Figure 1. Example of mandala templates.

- (c) Coloring activity (35 min): Participants colored the mandala at their own pace. Soft instrumental music could be played in the background (participant's preference) to enhance relaxation. The facilitator remained available for support but refrained from instructing how to color, intervening only if a participant became anxious or stuck (e.g., providing gentle encouragement or suggesting they start from the centre and work outward, a common mandala approach). The process was intended as a form of mindfulness; participants were encouraged to focus their attention on the patterns and colors, potentially entering a flow state.
- (d) Reflection (5 min): After coloring, if time allowed, participants could (optionally) discuss their experience or any feelings that arose while coloring. They were invited to title their mandala or note any theme (though not required). Many patients described the activity as calming or found symbolic meaning in their color choices; however, deep art interpretation was not the focus, given the brief nature. The facilitator affirmed any expressions and linked them to coping (e.g., "Coloring for this short time gave you a break from worry; that's a tool you can use anytime").

Between sessions, participants were not given specific homework, but they were free to keep their colored mandalas and were encouraged to continue coloring informally if they found it enjoyable (we provided extra mandala sheets to those interested). All intervention sessions were delivered in addition to standard care, which included routine psychosocial support per hospital practice (e.g., access to a social worker or counselor on request, though none had formal psychotherapy during the short study period). The intervention's overall aim was to provide a nonverbal, meditative coping strategy to alleviate distress during the intensive chemotherapy phase. Treatment fidelity was monitored via checklists; over 90% of planned session activities were completed on average, and participants spent a mean of 42 min actively coloring per session (indicating high engagement).

2.4. Control condition

The control group received an active control designed to account for time, attention, and the therapeutic milieu, without specific art or mindfulness content. Control participants engaged in a neutral reading activity for an equivalent duration and frequency (three sessions of approximately 45 min across three weeks), together with standard care that was identical to the care provided to the intervention group. In each session, control participants were provided with general interest reading materials (e.g., magazines or nonfiction books unrelated to health or emotionally charged topics). Examples of reading material included travel magazines, neutral news articles, or nature/science essays. Participants could choose from a selection to suit their interests, but were instructed simply to read quietly. This task was intended to mimic the quiet, seated nature of the coloring sessions and occupy the patient's time, but without the hypothesized therapeutic elements of mandala creation. Control sessions were typically held in the same settings (chemo chair or hospital room) to equalize environmental factors. No specific psychological techniques (e.g., no guided relaxation) were provided during reading; however, participants had the benefit of usual

nursing care and could chat casually with staff if they wished (as would be typical during any chemo appointment). The facilitator or research assistant checked in periodically to ensure the participant was comfortable, but otherwise, there was minimal interaction. After 45 min, the session was concluded. Control participants thus received attention and a mild distraction (reading) equal in dose to the art group's engagement, controlling for placebo effects of being part of a trial. Compliance in the control arm was good; participants generally found the reading material acceptable, and session attendance mirrored that of the intervention arm. Importantly, control patients were not prohibited from engaging in personal stress-relief activities outside the sessions, as such restrictions would be unrealistic; however, they were asked to refrain from coloring or beginning new art practices during the study, if possible, to avoid contamination.

2.5. Measures indicators

The primary outcome was psychological distress level, assessed by the NCCN DT. The DT is a single-item visual analog scale ranging from 0 ("no distress") to 10 ("extreme distress"), reflecting overall distress experienced in the past week [12]. It is accompanied by a Problem List checklist of practical, family, emotional, and physical issues; however, in this study, the numerical distress score was used as a global indicator of psychosocial distress. The DT is a widely used screening tool in oncology and correlates with standardized measures of anxiety and depression; a score of ≥ 4 is often used as a cutoff for clinically significant distress [1]. The DT was administered at baseline (before randomization) and again postintervention (within one week after the final session).

To enrich the assessment of distress and its components, several secondary outcomes were included:

- Hospital Anxiety and Depression Scale (HADS): This 14-item self-report questionnaire was used to measure symptoms of anxiety (HADS-A subscale, seven items) and depression (HADS-D subscale, seven items) over the past week. Each item is rated 0–3 (total scores range 0–21 per subscale). The HADS is well-validated in cancer populations as a brief screening tool for psychological morbidity. HADS was selected specifically because it captures changes in anxiety and depression more sensitively than the one-item DT. Clinically, scores ≥ 8 on either subscale indicate possible clinical anxiety or depression. HADS was administered at baseline and postintervention. In this study sample, internal consistency was good (Cronbach's $\alpha \sim 0.82$ for anxiety and ~ 0.79 for depression at baseline).
- Brief Fatigue Inventory (BFI): Fatigue is a common distressing symptom during chemotherapy. The BFI was used to assess fatigue severity and its impact. The BFI has nine items (rated 0–10), including current fatigue level, usual fatigue, worst fatigue in 24 h, and interference of fatigue with daily functioning. The analysis focused on the average fatigue-severity score, calculated as the mean of the 0 to 10 fatigue-intensity ratings, which served as the summary measure. The BFI was given at baseline and postintervention to see if the intervention influenced fatigue perception (directly or indirectly via improved mood).

- EORTC QLQ-C30 (Quality of Life Core 30): This is a comprehensive 30-item questionnaire developed by the European Organization for Research and Treatment of Cancer to assess cancer patients' quality of life. It covers multiple domains (physical, role, emotional, cognitive, and social functioning) and symptom scales. Particular attention was paid to the Global Health Status/Quality of Life scale, derived from two items that assess overall health and overall QoL (0–100; higher scores indicate better QoL). The Emotional Functioning subscale (four items) was also examined because of its relevance to distress; however, to limit the number of measures, the analysis ultimately centred on the Global QoL score as the broad outcome. The QLQ-C30 was administered at baseline and post-intervention.

Additional data collected included demographic and clinical variables (age, cancer stage, type of surgery, chemotherapy regimen, marital status, education level) and baseline psychosocial support use. An art-experience variable was also recorded in the intervention group (e.g., prior hobby interest in art) to explore whether it moderated outcomes, although no significant moderation was found.

2.6. Statistical analysis

As a pilot study, the analysis focused on feasibility metrics and estimation of effect sizes, as well as hypothesis-generating significance tests for outcomes. Descriptive statistics were used to summarize sample characteristics and feasibility outcomes (recruitment and retention rates, session attendance). Baseline group comparisons were performed using independent t-tests or chi-square tests to verify successful randomization (i.e., no significant differences on key measures at baseline).

Outcome analyses adopted an intention-to-treat approach that included all randomised participants with at least one post-baseline assessment. (In practice, 48/50 completed post assessments; for the two dropouts, last observation carried forward was not used due to short duration; they were omitted in complete-case analyses, but sensitivity analyses assuming no change for dropouts did not alter conclusions.) The primary analysis compared the intervention and control groups on change in distress (DT scores) from baseline to post. Given the continuous outcome and baseline balance, an analysis of covariance (ANCOVA) model was applied, with postintervention DT as the dependent variable, treatment group as the independent factor, and baseline DT as a covariate. This approach provides an adjusted comparison of groups while accounting for any baseline variability. Similar ANCOVA models were applied to HADS-A, HADS-D, BFI, and Global QoL post-intervention scores (each controlling for their respective baseline value). Group least-squares mean differences with 95% confidence intervals and p-values for the group effect are reported. Additionally, within-group changes were calculated, and a group $\times$ time interaction was examined with repeated-measures ANOVA, which yielded consistent findings: significant interactions for DT and HADS-A, and nonsignificant interactions for the other outcomes. Given the pilot nature, $p < 0.05$ (two-tailed) was considered statistically significant without formal adjustment for multiple outcomes, and secondary outcomes were interpreted cautiously.

To gauge the magnitude of effects, Cohen's d effect sizes were calculated for between-group differences (using pooled standard deviation). Effect sizes were classified as small for $d \approx 0.2$, medium for $d \approx 0.5$, and large for $d \approx 0.8$. Clinically relevant changes were also examined: the proportions of patients with DT scores above the clinical cut-off (≥ 4) in each group at baseline and postintervention, as well as the proportions with significant anxiety (HADS-A ≥ 8) and depression (HADS-D ≥ 8) at postintervention, were compared.

Finally, a structural equation model (SEM) was constructed to explore the interrelationships among the intervention, psychological outcomes, overall distress, and QoL. The hypothesized model treated "intervention" (vs. control) as an exogenous predictor (coded 1 for mandala group, 0 for control) and included a latent construct for "Psychological Distress" represented by the postintervention scores of DT, HADS-A, and HADS-D (each as indicators loading on the latent factor). It was posited that the intervention would exert a direct effect on the latent distress factor, with additional potential direct effects on BFI fatigue and QLQ global QoL (modelled as observed outcome variables). The disturbance terms of fatigue and QoL were allowed to covary with the latent distress factor, recognizing that these domains can be interrelated with psychological state. The SEM was estimated using maximum likelihood estimation. Because of the small sample size, model-fit indices were interpreted with caution; the chi-square (χ^2) test, Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) were reported as indicators of fit. The significance of path coefficients was examined using z-tests to identify which relationships were significant. The main goals of the SEM were to see (a) if the data supported a single latent distress construct (i.e., DT, anxiety, depression as reflections of a common distress factor), and (b) to estimate the overall impact of the intervention on this factor and other outcomes in one coherent model, including potential mediation. Due to sample size, this analysis is considered exploratory. All quantitative analyses were conducted using IBM SPSS version 26.0 and AMOS or an equivalent SEM software.

In addition to statistical significance, results were interpreted against established clinical thresholds for each outcome. For overall psychosocial distress, a DT score ≥ 4 is widely used to flag clinically relevant distress in oncology and in the NCCN Distress Management pathway; therefore, the proportion of patients above this threshold at follow-up was considered clinically important. For anxiety and depression, minimal clinically important differences (MCIDs) for the HADS subscales were taken from anchor- and distribution-based syntheses, indicating group-level MID of approximately 1.4–1.8 points for HADS-A and HADS-D. For health-related quality of life, the EORTC QLQ-C30 evidence-based guidelines and subsequent updates suggest that a 5–10-point change on the Global Health Status/QoL scale typically represents a small but clinically meaningful group-level difference, with scale-specific nuances considered in recent syntheses. For fatigue, recent work estimating the BFI MCID in cancer suggests group-level MID on the order of ≈ 1 –2 points (depending on "usual" vs "worst" fatigue and estimation method); differences smaller than this are unlikely to be clinically important. Effect sizes (Cohen's d) were treated as complementary indices of magnitude rather than clinical benefit per se, consistent with methodological guidance.

3. Results

3.1. Baseline characteristics

48 patients (24 per group) provided postintervention data. All participants in the intervention arm attended at least two of the three coloring sessions, and 22/24 (92%) attended all three sessions. In the control arm, reading session attendance was similarly high (91% attended all sessions). The average session length was ~43 min for both groups, indicating the planned 45-min format was practical. No participants in the intervention group reported negative reactions to coloring; on the contrary, many informally commented that they enjoyed the activity. Likewise, control participants generally found the reading task acceptable, though a few mentioned it was “hard to concentrate” at times (not unexpected given treatment side effects). Importantly, there were no adverse events or ethical concerns arising from the intervention—for example, no participant became markedly more upset due to coloring or revealed any psychological crisis that required acute intervention during sessions. These feasibility outcomes suggest that implementing a brief art therapy program in the chemotherapy setting is both acceptable and safe for patients.

The demographics and clinical characteristics of the two groups were comparable (**Table 1**). The sample was predominantly married (70%) and had at least a high school education (90%); about 40% were employed (others on medical leave or homemakers). All patients had undergone surgery prior to chemo: 60% had a modified radical mastectomy, 40% had breast-conserving surgery (lumpectomy) plus radiation planned. Cancer stages were: Stage I (20%), II (50%), III (30%), with no significant difference between groups. The majority (75%) were on an anthracycline-taxane-based chemo regimen, and 25% were receiving other regimens; all were in the early cycles of chemotherapy (cycle 1 or 2 at enrollment). Notably, body-image concerns were salient in this cohort; at baseline, 62% of participants reported feeling self-conscious about their body changes (based on a yes/no questionnaire item), and 58% had not yet been fitted for reconstructive surgery or a prosthesis. These circumstances often contribute to distress. There were no significant differences between the intervention and control groups in any measured baseline characteristic, confirming successful randomization. Crucially, baseline psychosocial measures were well-balanced (**Table 1**). Approximately 60% of each group had a baseline DT score ≥ 4 , consistent with moderate distress frequency reported in the literature [14]. Mean baseline fatigue (BFI)

Table 1. Comparison of baseline characteristics, psychosocial measurement indicators between the intervention and control groups.

Characteristic	Mandala (<i>n</i> = 25)	Control (<i>n</i> = 25)	<i>p</i> value
Age, years (mean $\pm$ SD)	46.8 $\pm$ 9.1	47.7 $\pm$ 8.0	0.72
Stage II/III (%)	20/25 (80%)	19/25 (76%)	0.78
Mastectomy (%)	15/25 (60%)	14/25 (56%)	0.78
Baseline DT (0–10)	4.46 $\pm$ 2.5	4.48 $\pm$ 2.3	0.93
Baseline HADS-A	8.7 $\pm$ 3.6	8.4 $\pm$ 3.4	0.81
Baseline HADS-D	7.6 $\pm$ 3.3	6.9 $\pm$ 3.1	0.54
Baseline BFI	4.5 $\pm$ 1.8	4.3 $\pm$ 1.9	0.77

* *p* < 0.05, statistically significant difference.

was moderate (around 4.5/10 in both groups), and global QoL was around 59 (on a 0–100 scale) in both, indicating a mid-range quality of life, as expected for patients early in chemo. Thus, any post-intervention differences can be attributed with reasonable confidence to the interventions rather than pre-existing disparities.

3.2. Psychological distress, anxiety, and depression

3.2.1. Distress thermometer

Overall distress, as measured by the DT, showed a divergent trajectory in the two groups (**Table 2**). At baseline, both groups had similar mean distress (approximately 4.5, just above the usual clinical cutoff of 4). Over the three-week intervention period, the control group's distress tended to increase: the control post-intervention mean DT was 5.14 (SD = 2.4), indicating a rise in distress as chemotherapy progressed (this within-group increase from baseline was +0.66 points on average, though not statistically significant by paired t-test, $p = 0.15$). In contrast, the mandala coloring group's distress decreased: postintervention mean DT was 3.43 (SD = 1.9), a drop of –1.0 point from baseline (paired $t = 2.20$, $p = 0.04$ for within-group change). Comparing groups at post-test, the difference was evident—the intervention group's mean distress was lower by –1.71 points (95% CI: –2.90 to –0.52) than the control group's, an effect favoring art therapy. ANCOVA adjusting for baseline distress confirmed a significant group effect ($F(1, 45) = 5.78$, $p = 0.02$) on DT scores. The effect size was moderate-to-large (Cohen's $d = -0.85$, negative sign indicating lower distress in the treatment arm). In terms of clinical significance, only 7 of 25 patients (28%) in the art-therapy group had a DT score ≥ 4 at follow-up, compared with 20 of 25 (80%) in the control group, indicating a marked reduction in the proportion of distressed patients in the intervention arm. Indeed, 10 patients (42%) in the art therapy arm had DT scores of 0–1 (“minimal distress”) at post, whereas only two patients (8%) in control achieved such low distress levels. These results support that the mandala coloring intervention produced a meaningful alleviation of global distress (**Figure 2**).

3.2.2. Anxiety (HADS-A)

Self-reported anxiety showed the clearest benefit from the intervention (**Table 3**). At baseline, around half of participants in each group scored in the borderline or clinical range for anxiety (HADS-A ≥ 8). After three weeks, anxiety levels in the control group remained about the same or slightly worsened (baseline mean 8.40 to post 9.60), whereas the intervention group experienced a notable decrease (baseline mean 8.70 to post 6.20). An ANCOVA on post HADS-A (covarying baseline) yielded $F(1, 45) = 15.40$, $p < 0.001$, indicating a highly significant difference. The adjusted mean anxiety score was lower in the mandala group by –3.30 points relative to control (95% CI: –4.90 to –1.70). This corresponds to a large effect size ($d \approx -1.2$). **Figure 3** illustrates that the intervention arm's anxiety dropped below the

Table 2. Comparison of DT outcomes between the intervention and control groups.

Group	Baseline	Post	Δ (Post-Pre)	Adj. Diff (95% CI)	Cohen's d	F value	p value
Mandala ($n = 25$)	4.46 $\pm$ 2.5	3.43 $\pm$ 1.9	–1.03	–1.71 (–2.90, –0.52)	–0.85	5.78	0.02*
Control ($n = 25$)	4.48 $\pm$ 2.3	5.14 $\pm$ 2.4	+0.66				

* $p < 0.05$, statistically significant difference.

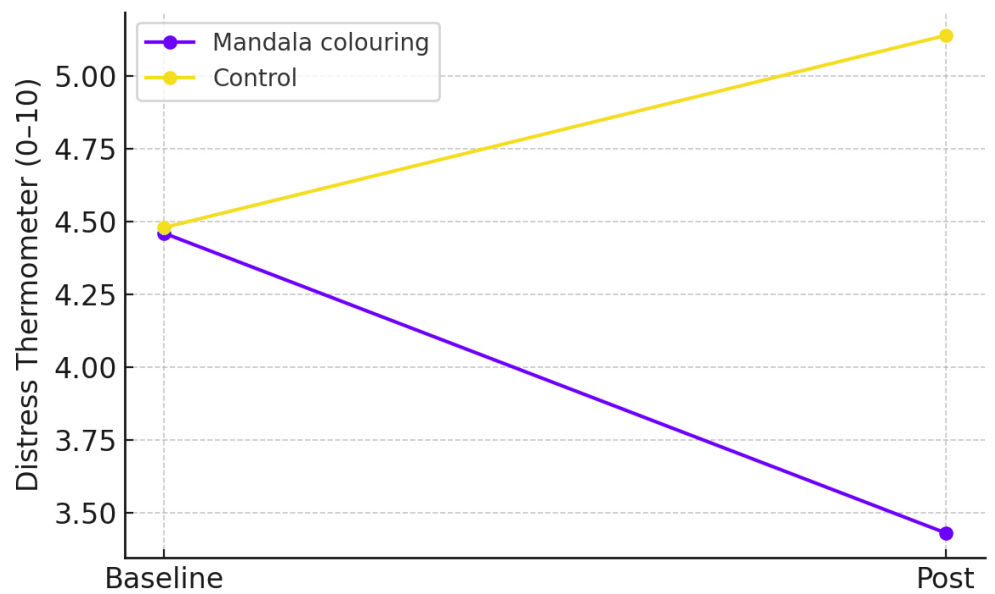


Figure 2. Change in global distress.

Table 3. Comparison of anxiety (HADS-A) outcomes between the intervention and control groups.

Group	Baseline	Post	Δ (Post-Pre)	Adj. Diff (95% CI)	Cohen's <i>d</i>	<i>F</i> value	<i>p</i> value
Mandala (<i>n</i> = 25)	8.70 ± 3.6	6.20 ± 3.0	-2.50	-3.30 (-4.90, -1.70)	-1.20	15.40	<0.001*
Control (<i>n</i> = 25)	8.40 ± 3.4	9.60 ± 3.2	+1.20				

* $p < 0.05$, statistically significant difference.

conventional threshold for caseness on average, while the control arm stayed above it. In fact, only 4/24 patients (17%) in the art therapy group had HADS-A ≥ 8 at post, compared to 12/24 (50%) in control. The reduction in anxiety was already observable after the first 1–2 coloring sessions as per interim verbal reports, suggesting a fairly immediate calming effect. These findings align with previous reports of mandala coloring significantly reducing state anxiety in breast cancer chemotherapy

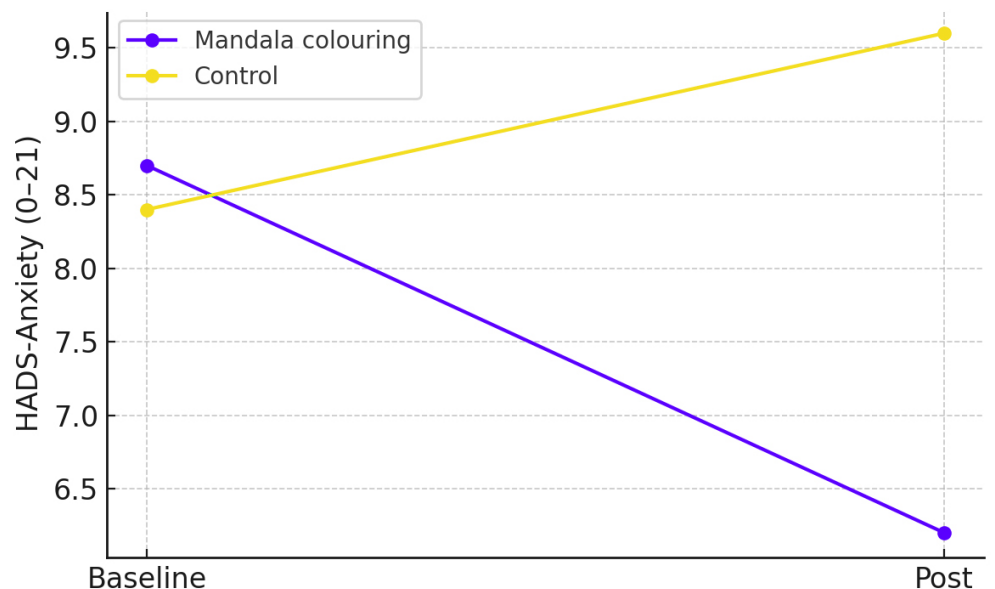


Figure 3. Change in anxiety.

patients and demonstrate that even a short series of sessions can yield measurable anxiety relief [12].

3.2.3. Depression (HADS-D)

Depression scores were low to moderate at baseline (mean ~7 in both groups, well below the HADS-D clinical cut of 8 for most participants). Over the study period, depression scores remained relatively stable in both arms. The intervention group's mean HADS-D went from 7.60 to 7.30 (a slight improvement), while the control group went from 6.90 to 7.70 (a slight worsening); neither within-group change was significant. The between-group difference at post was small and nonsignificant by ANCOVA ($p = 0.74$) (Table 4). Only four participants (8% of the total) had HADS-D ≥ 8 at baseline; at post, three were in the control group versus two in the intervention (a nonsignificant difference). Thus, the coloring intervention did not have a clear impact on depressive symptoms in this short timeframe. This is perhaps not surprising, as depression in such patients may be more related to sustained challenges (e.g., prolonged treatment side effects, changes in self-concept) that might not shift in just a few weeks. The null finding on HADS-D is consistent with some prior art therapy trials, which often show stronger effects on anxiety than depression [16]. Among the subset of patients with clinically relevant depressive symptoms at baseline (HADS-D ≥ 8 , $n = 8$), those in the art-therapy arm ($n = 5$) tended to report feeling "less helpless" and exhibited slight improvements, whereas those in the control arm ($n = 3$) experienced slight worsening; however, the sample was too small to draw firm conclusions. Overall, while the intervention clearly alleviated acute anxiety, its influence on deeper depressive mood was minimal in this pilot.

3.3. Fatigue and quality of life

3.3.1. Fatigue (BFI)

As expected, fatigue levels increased in both groups over the course of chemotherapy, reflecting the accumulating physical toll of treatment (Table 5). The mean BFI severity score rose from 4.50 at baseline to 5.90 at post in the intervention group, and from 4.30 to 5.70 in controls. These changes (approximately +1.4 points) indicate moderate fatigue by the end of the study, which is typical during mid-chemotherapy. Importantly, there was no significant difference between groups in fatigue outcomes. The ANCOVA for post-intervention BFI (adjusting baseline BFI) showed

Table 4. Comparison of depression (HADS-D) outcomes between the intervention and control groups.

Group	Baseline	Post	Δ (Post-Pre)	Adj. Diff (95% CI)	Cohen's d	F value	p value
Mandala ($n = 25$)	7.60 $\pm$ 3.3	7.30 $\pm$ 3.2	-0.30	0.20 (-1.10, 1.50)	0.10	0.11	0.74
Control ($n = 25$)	6.90 $\pm$ 3.1	7.70 $\pm$ 3.1	+0.80				

* $p < 0.05$, statistically significant difference.

Table 5. Comparison of BFI fatigue outcomes between the intervention and control groups.

Group	Baseline	Post	Δ (Post-Pre)	Adj. Diff (95% CI)	Cohen's d	F value	p value
Mandala ($n = 25$)	4.50 $\pm$ 1.8	5.90 $\pm$ 1.7	+1.40	0.00 (-1.20, 1.60)	0.05	0.04	0.80
Control ($n = 25$)	4.30 $\pm$ 1.9	5.70 $\pm$ 1.8	+1.40				

* $p < 0.05$, statistically significant difference.

$F = 0.04$, $p = 0.80$. The mean difference was in fact in the opposite direction (the intervention group's fatigue was 0.2 points higher than control on average), but this was not meaningful (95% CI: -1.20 to 1.60). In short, the mandala coloring therapy did not mitigate the physical symptom of fatigue associated with chemotherapy, which likely has predominantly physiological causes (anemia, treatment side effects) that an art intervention would not directly counter. This result was expected and aligns with prior findings that art or mindfulness interventions may not significantly change fatigue in the short term [14]. Patients in the coloring group sometimes reported that the sessions were "distracting me from feeling tired" at the moment, but this temporary distraction did not translate into lower overall fatigue ratings for the week. It is worth noting that one potential indirect pathway could be improved sleep or activity, but these variables were not measured in this study. In summary, both groups experienced increased fatigue, and the intervention had no observable effect on this trajectory.

3.3.2. Quality of life (EORTC QLQ-C30 global health status/QoL)

Global QoL scores declined in the control group over time (mean dropping from 59.0 at baseline to 50.0 at post), indicating that overall health and life quality were perceived as worse after a cycle of chemotherapy, an understandable outcome as side effects accumulate (Table 6). In the intervention group, the global QoL score remained relatively steady (baseline 59.0 to post 55.0). Statistical comparison revealed a trend toward better QoL in the intervention group, but this did not reach significance in the sample. The adjusted mean difference was +5.5 points in favor of the intervention (intervention 55.0 vs control 49.5; ANCOVA $F(1, 45) = 0.94$, $p = 0.34$). A 5–10-point difference is often considered a minimally important change on the EORTC QLQ-C30 [16]; therefore, the observed difference might be clinically meaningful if confirmed in a larger sample, although certainty is limited by the wide confidence interval. Breaking down QoL by domain, the intervention group showed a slight improvement on the emotional functioning subscale (mean +6 points), whereas the control declined (–5 points); this domain-specific change mirrors the anxiety findings and suggests improved emotional well-being. However, physical functioning and role functioning declined in both groups similarly, reflecting chemotherapy's impact. Thus, the intervention's positive effect on emotional state did not fully translate to a broad sense of improved overall quality of life within the short follow-up. Patients' narratives can shed light: those in the art therapy group often described feeling calmer and more optimistic right after sessions (an emotional boost), but they still contended with nausea, fatigue, and other physical hardships that influenced their overall QoL ratings. It is possible that with a longer-term intervention or follow-up, improvements in mood could eventually yield detectable gains in global QoL. The pilot data, however, only hint at a small benefit in QoL and cannot confirm it statisti-

Table 6. Comparison of EORTC global QoL outcomes between the intervention and control groups.

Group	Baseline	Post	Δ (Post-Pre)	Adj. Diff (95% CI)	Cohen's d	F value	p value
Mandala ($n = 25$)	59.0 $\pm$ 12	55.0 $\pm$ 13	–4.00	5.50 (–6.00, 17.00)	0.35	0.94	0.34
Control ($n = 25$)	59.0 $\pm$ 12	50.0 $\pm$ 14	–4.00				

* $p < 0.05$, statistically significant difference.

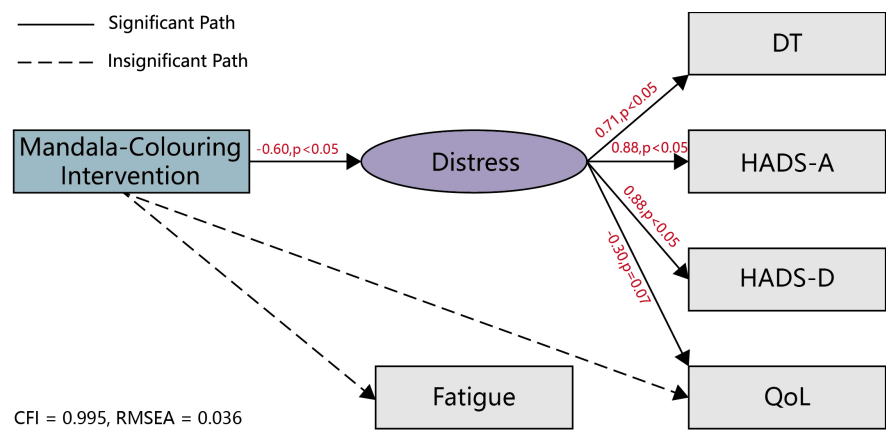


Figure 4. Structural equation model of mandala-coloring effects.

cally. The QoL result is considered suggestive: art therapy may help patients maintain their overall quality of life better than usual care (preventing a larger decline), an observation that warrants further investigation in a larger trial.

3.3. Structural equation modeling findings

To integrate these outcomes and explore underlying relationships, an SEM analysis was performed. The hypothesized model was tested. Despite the small sample, the model converged and showed a good fit to the data: $\chi^2 = 7.11$, $p = 0.42$, CFI = 0.995, RMSEA = 0.036. This indicates the model reproduced the observed covariance structure well. **Figure 4** conceptually depicts the SEM results, which are summarized as follows:

- A single latent “Distress” factor could be defined using three postintervention indicators: DT score, HADS-A, and HADS-D. The standardized factor loadings were 0.71 for DT, 0.88 for HADS-A, and 0.65 for HADS-D, all highly significant ($p < 0.001$). This confirms that these measures, while not identical, shared substantial variance and can be considered reflective of an underlying distress construct. Anxiety had the highest loading, suggesting it was the strongest marker of the distress construct in this sample (consistent with the notion that anxiety is a prominent component of distress during active cancer treatment [6]). The latent factor explained 50% of the variance in DT scores and 77% of the variance in anxiety scores, for example, indicating a robust common element.
- The mandala intervention had a significant impact on the latent distress factor: the path coefficient was -0.60 (unstandardized $B = -1.8$, $SE = 0.7$, $p = 0.006$). This corresponds to a large effect (standardized $\beta \approx -0.55$ to -0.60), meaning the intervention was associated with markedly lower underlying distress after treatment. In essence, being in the art therapy group led to an estimated 1.8-point lower distress factor score (on the DT’s scale) than being in the control, in line with the earlier univariate result on DT. This SEM result reinforces that the intervention had a broad beneficial effect on patients’ emotional distress levels.
- We examined mediating pathways: The direct path from Intervention to the observed DT score was not included since DT loaded on the factor; instead, intervention influenced DT via the latent factor. However, modelling a direct

effect of the intervention on DT, in addition to the latent factor, was tested and did not significantly improve model fit, suggesting that the intervention's impact on distress was adequately captured through its effects on anxiety and depression (the distress factor). In other words, reductions in anxiety (and to a lesser extent depression) appear to mediate the improvement in DT scores. These findings suggest that the intervention's distress-reducing effect operates primarily by calming anxiety, as anxiety was a dominant component of the distress construct. This aligns with the empirical data that showed large anxiety reductions and perhaps explains how a relatively short intervention could shift overall distress.

- (d) The intervention did not have significant direct effects on fatigue or QoL in the model. The path coefficients for Intervention to Fatigue and Intervention to QoL were very small and non-significant ($p > 0.5$), consistent with the ANCOVA findings. This indicates that any minor QoL benefit observed was likely through the reduction in distress, rather than a direct effect. The latent distress factor was allowed to correlate with QoL at post, yielding a moderate negative correlation ($r \approx -0.30, p = 0.07$), implying that patients with higher distress tended to report lower overall QoL. Though this correlation in the sample did not reach formal significance, it trends in the expected direction that reducing distress might help preserve quality of life to some extent.
- (e) The SEM accounted for 37% of the variance in global QoL and negligible variance in fatigue (<5%), indicating QoL is influenced by many factors beyond just distress (e.g., physical toxicities), and fatigue in this context was almost entirely independent of the psychosocial intervention.

In summary, the SEM supported a coherent interpretation: The mandala coloring intervention significantly reduced a core psychological distress factor (comprised largely of anxiety and general distress), and this improvement likely underlies the observed differences between groups. Meanwhile, outcomes such as fatigue appeared to be governed by treatment effects rather than psychosocial state, and quality of life, although linked to distress, would probably require larger changes or a longer follow-up to show clear between-group differences. The SEM findings complement the univariate results and highlight anxiety reduction as the key mechanism by which art therapy alleviated distress in the sample. This model, albeit preliminary, can inform future research to formally test mediation (e.g., anxiety as a mediator of distress reduction) in larger trials.

3.4. Additional observations

We qualitatively observed that the art therapy sessions fostered a supportive microenvironment for patients. Although sessions were individual, some outpatients in the chemo suite who were coloring concurrently would occasionally smile or exchange a word about the activity, introducing a positive social element. A few patients noted that taking time to do something creative “for themselves” during treatment made them feel more normal and self-effective. In contrast, control patients often just quietly read or sometimes dozed off; they did not report any particular experience apart from passing time. These anecdotal differences, although not formally measured, suggest that the coloring sessions conferred psychosocial benefits

beyond the anxiety scores, including a sense of agency and a brief respite from the patient role, which likely contributed to reduced distress.

Clinical significance of effects. Interpreted against prespecified thresholds, the anxiety reduction observed with mandala coloring was clinically meaningful: the adjusted between-group difference on HADS-A exceeded the ~1.4–1.8-point MCID range reported across oncology and chronic-illness samples. The reduction in global distress was also clinically relevant when expressed as movement across a guideline-endorsed DT ≥ 4 cut-off; the intervention arm showed a markedly lower proportion above this threshold at follow-up, consistent with recommendations to prioritize identification and reduction of DT-defined distress in routine cancer care. For global QoL (QLQ-C30), the adjusted mean difference was approximately 5–6 points, aligning with the lower bound of the 5–10-point minimally important difference band for group-level change and therefore best described as small but potentially meaningful pending confirmation in a larger trial. In contrast, the between-group difference on BFI did not approach the ≈ 1 –2-point MCID, indicating no clinically important short-term effect on fatigue at this dose and time frame. Overall, statistical significance, clinical thresholds, and effect-size magnitudes were considered jointly to contextualize benefit, in line with recommendations that emphasize estimates with confidence intervals over *p*-values alone.

4. Discussion

4.1. Distress and anxiety

This pilot randomised trial is among the first to rigorously examine mandala coloring art therapy as a brief intervention for psychological distress in breast cancer patients undergoing chemotherapy. The results provide encouraging evidence that even a short series of three 45-min coloring sessions can yield significant reductions in distress and anxiety in this population. Women who participated in the mandala coloring reported feeling less anxious and overall less distressed after the intervention, compared to peers who received standard care and an equivalent time-fill activity. These findings resonate with prior studies in psycho-oncology that highlight art-making as a valuable tool for emotional expression and stress relief [6]. However, this study extends the literature by demonstrating an effect specifically on global distress (as measured by the NCCN DT) in a randomised design. In contrast to Radl et al., who did not find differences in distress with a longer art therapy program [16], this pilot showed a clear between-group separation in DT scores. One possible reason is the focus on a targeted modality (mandala coloring) that directly promotes mindfulness and calm; another factor may be the inclusion of patients actively in chemotherapy (with high acute stress) as opposed to mixed or later-stage patients. Indeed, patients with high initial distress might benefit the most from such interventions [12]. In this sample, participants who began the study with DT ≥ 4 almost uniformly experienced reductions into the subclinical range if they were in the art therapy group, whereas the majority of similarly distressed controls remained above the cut-off. This aligns with evidence that distressed patients “have more to gain” and thus show larger improvements with psychosocial support. The findings also corroborate the recent report by Akbulak and Can, who found that a single 30-min mandala

coloring session could significantly lower anxiety in breast cancer patients starting chemo [12]. Sustained anxiety reduction was demonstrated over multiple sessions, and an accompanying drop in overall distress was also observed.

The pronounced impact on anxiety is consistent with MAT's theorized mode of action. Coloring a mandala engages several therapeutic mechanisms known to reduce anxiety: focused attention (similar to mindfulness meditation), which can interrupt worry cycles, the soothing rhythmic activity of coloring, which induces relaxation, and the creative expression that may help process emotions non-verbally. Neuropsychological theories suggest that structured coloring tasks help deactivate the amygdala-driven fear response by engaging frontal brain regions involved in attention and visual processing, thereby "crowding out" anxious rumination. Participants often described feeling "absorbed" in the coloring, temporarily forgetting about their treatment or fears. This flow state likely underlies the swift drop in state anxiety observed. Notably, the intervention was short yet produced a large anxiety effect ($d > 1$). This magnitude rivals that of some pharmacologic anxiolytics or longer psychological interventions in similar contexts, highlighting the potency of a simple art-based approach. It reinforces mandala coloring as a legitimate evidence-supported practice in psycho-oncology for anxiety relief.

In contrast, depression did not significantly change in the brief span of this study. It's important to interpret this in context. Depressive symptoms were only mild on average at baseline; patients were generally more anxious than depressed during the active treatment phase (a pattern reported in other studies where anxiety peaks at treatment onset, while depression sometimes arises later if treatment fails or in survivorship) [3]. Thus, a floor effect might have limited detectable change. Moreover, depression in cancer can stem from prolonged feelings of loss of control or demoralization, which might require more intensive or longer interventions to shift. That said, some art therapy literature, especially with longer programs or combined modalities (art + psychotherapy), has noted improvements in depressive symptoms and mood [18]. For example, a systematic review by Peng and Cheng found that therapeutic art-making can have beneficial effects on depressive symptoms in cancer patients, though results vary by intervention length [19]. The findings suggest that a three-session standalone coloring regimen may be insufficient to influence depression in the short term. It could be that, as anxiety is alleviated first, sustained practice or additional support (like processing the emotions that surface) might eventually help with mood. Future studies could extend the number of sessions or incorporate brief reflective discussions to potentially enhance effects on depression.

This lack of short-term improvement may reflect several considerations. First, anxiety and depression follow different temporal trajectories in oncology: state anxiety often fluctuates with proximal treatment stressors and is responsive to brief attentional-calming interventions, whereas depressive symptoms (e.g., anhedonia, negative cognitions) generally require longer duration and more structured psychotherapeutic content to shift. Trials of multiweek mindfulness-based art therapy have reported broader mood benefits than brief formats, suggesting a dose-response relationship for depression outcomes [7,20]. Second, measurement characteristics likely contributed. The HADS-D subscale emphasizes anhedonia and can be less responsive to acute state changes than HADS-A; moreover, minimally important differences

for HADS indicate that group-level changes of roughly 1.4–1.8 points are typically needed to denote clinical relevance [21], a threshold not approached by the adjusted between-group difference observed here. Third, in patients receiving chemotherapy, depressive symptoms are influenced by enduring drivers (treatment-related fatigue, inflammatory and endocrine disturbances, and role disruption) that are unlikely to be altered by a three-session creative activity delivered over approximately three weeks [22]. Meta-analytic reviews of art-based interventions in cancer consistently find larger, more reliable effects on anxiety than on depression, particularly in short-dose formats [5,17]. Taken together, a longer intervention window, session-level components targeting cognitive/agency processes, and follow-up assessments are likely required to detect and sustain meaningful change in depression.

4.2. Fatigue and quality of life

The lack of effect on fatigue was anticipated and is consistent with the literature that primarily physical symptoms often do not improve from psychological interventions in the immediate term [14]. Fatigue during chemotherapy is multifactorial—driven by anemia, poor sleep, pain, and so on. While psychological distress can exacerbate fatigue perception, simply reducing anxiety did not appear to meaningfully reduce fatigue in this study. Interestingly, other non-pharmacologic interventions like exercise have had more success in managing cancer-related fatigue. It may be fruitful in the future to combine art therapy with light physical activity or energy conservation techniques to tackle fatigue. Alternatively, art therapy might indirectly help fatigue if it improves sleep or mood long-term, but the pilot was too short to observe such effects.

The small, nonsignificant trend toward better quality of life in the intervention arm is worth noting, even if cautiously. With only 50 patients, the study was underpowered to detect moderate QoL differences. However, the fact that global QoL stayed near baseline in the art group versus dropping in controls suggests that the intervention may have buffered some of the negative impact of chemo on overall well-being. Emotional well-being is a core component of overall QoL. Thus, by improving emotional well-being (lowering distress and anxiety), the coloring intervention might have helped patients appraise their overall life quality more favorably or at least prevented a decline. This aligns with qualitative evidence that art therapy can enhance patients' sense of coping and meaning-making, which contributes to a better quality of life [6]. In a larger trial, significant benefits might be expected in specific QoL domains such as emotional and social functioning. Indeed, a prior RCT of group art therapy in women with cancer found improvements in emotional and social QoL subscales, though not in physical functioning [16,23,24]. The data, though limited, point in a similar direction. Quality of life is an important endpoint for patient-centred care, so even a modest improvement or stabilization attributable to a low-cost intervention is valuable.

One striking result in this study was the discrepancy between the present findings and those of Yakar et al., who reported that distress scores increased after an art-based mandala program despite anxiety decreasing [6]. There are several plausible reasons for this difference. First, Yakar's study was a single-group design with a very small sample of breast cancer survivors (mean age = ~50) who were post-treatment,

whereas this study was an RCT with patients in active treatment. In Yakar's sample, baseline distress was relatively low (mean = ~4.1) and increased slightly to ~4.6, possibly due to heightened emotional awareness or lack of a control for passage of time. In contrast, participants were undergoing chemo—a period likely to heighten distress if no intervention is given (as seen in the control group's increase in DT). Thus, the observed reduction in distress in the intervention group likely reflects both an absolute improvement and an avoidance of the treatment-related distress increase seen in controls. It's possible that Yakar's intervention, being longer (8 weeks, 2 h each) and perhaps more intensive, brought up deeper emotional issues (hence slightly higher DT) even as it relieved anxiety. The shorter intervention might have been more focused on immediate stress relief than deep emotional processing, thereby reducing distress more straightforwardly. Additionally, the presence of a control group in this study helps attribute changes to the intervention rather than external factors. Yakar's increase in DT could simply reflect the natural course of adjusting to survivorship without a comparison. In summary, the results do not necessarily contradict Yakar's findings; rather, they suggest that, in a controlled setting, mandala coloring is beneficial and does not inherently raise distress, and may even prevent escalation of distress. The difference highlights the need for controlled trials and careful monitoring: art therapy can occasionally uncover difficult feelings, so facilitators should be prepared to support participants through any emotional expression that arises. In this study, no participant showed a distress spike due to coloring; all DT increases were in the control group, reinforcing the safety of this intervention when delivered appropriately.

The SEM analysis, though exploratory, lends some theoretical insight. It supports the idea that distress in cancer is a multidimensional construct that can be captured by anxiety, depression, and a patient's self-rating on the DT (which itself likely reflects a combination of emotional and practical concerns) [25]. The strong loading of anxiety on the distress factor in the model suggests anxiety is a principal driver of what patients consider "distress" during chemo, likely because immediate fears (of treatment, of recurrence, of mortality) loom large. The intervention effectively targeted this component (anxiety), thereby significantly shifting the whole distress construct. This implies that even without directly focusing on every aspect of distress (we did not explicitly address practical problems or existential worries, for example), reducing anxiety through a calming activity was enough to yield a measurable improvement in overall distress scores. For clinicians, this is an important point: managing patients' anxiety may be a key leverage point to improve their general sense of well-being during treatment. Other facets like depression or spiritual/existential distress might need additional interventions (e.g., counseling, meaning-centred therapy), but anxiety relief can be a quick win. The SEM also underlined that physical outcomes (fatigue) operate somewhat independently—a reminder that comprehensive cancer care should ideally pair psychosocial interventions with medical or rehabilitative interventions to tackle physical symptoms.

4.3. Additional observations and mechanistic considerations

The SEM pattern indicates that the latent "distress" factor was dominated by anxiety, with more modest contributions from depressive symptoms and the sin-

gle-item DT. This configuration suggests a pathway centred on attentional and affective calming rather than broad somatic change. Mechanistically, focused, repetitive visual tasks are thought to dampen worry-driven self-referential processing in a manner analogous to mindfulness-based attentional regulation. Brief art-making has also been associated with acute reductions in biological stress indices (e.g., salivary cortisol) [26], providing a plausible link between the observed state-anxiety decrease and stress physiology. At the same time, evidence is mixed regarding the superiority of mandala coloring over other simple creative tasks [27]; several studies indicate anxiety relief with coloring, whereas meta-analytic work has not consistently shown mandala designs to outperform free drawing [28]. These observations are congruent with the present pattern of clear short-term benefits for anxiety and composite distress over a brief time frame; they do not imply modality-specific exclusivity.

Perceived control and agency likely contribute alongside attentional mechanisms. A structured, “doable” activity during chemotherapy affords immediate choices (color selection, pace, stopping points) and yields a tangible product, which can reinforce a sense of control at a time when many aspects of treatment feel externally determined. In oncology populations, higher perceived control and coping self-efficacy are consistently associated with lower distress and better adjustment, and longitudinal data suggest that gains in perceived control track subsequent reductions in distress [29]. Incorporating brief measures of perceived control and coping self-efficacy in future trials would therefore help to test agency-based pathways directly.

Finally, the absence of a direct effect on fatigue over the short horizon, and only suggestive movement in global quality of life, align with a primarily psychological channel of action at this dose and time scale. Session-level assessments of state mindfulness/absorption (before–after each session), coupled with repeated distress and anxiety measures, could clarify temporal ordering and mediation. Such targeted subscales and session-level probes can be embedded with minimal burden while improving mechanistic inference in a definitive trial [30].

4.4. Research limitations

This study has several limitations common to pilot trials. The sample size ($N = 50$ with 48 completers) was small, and thus, findings must be interpreted as preliminary. Although statistical significance was achieved for the main outcomes, the estimated effect sizes have wide confidence intervals. A larger trial is needed to confirm the magnitude of benefits and to reliably assess secondary outcomes like quality of life. The trial was conducted in a single city with relatively homogeneous participants (most were middle-aged women of similar socioeconomic background), which may limit generalizability to more diverse populations or healthcare settings. Another limitation is the short follow-up; outcomes were measured only immediately postintervention. It remains unknown whether the reductions in distress and anxiety would persist beyond the intervention period. Distress might resurge as treatment continues or new stressors emerge. Future studies should include a longer-term follow-up (e.g., 3 or 6 months) to see if art therapy yields enduring coping benefits or if boosters are needed. Additionally, blinding was not possible for participants, and their knowledge

of being in a “therapy” group versus “just reading” could introduce some expectation bias. This issue was mitigated by designing an engaging control condition and by emphasizing to both groups that the study concerned “activities during chemo” without implying that either activity was superior. Still, placebo effects cannot be ruled out, although the magnitude of anxiety reduction in the art-therapy arm suggests an effect beyond placebo. It’s also possible that the social interaction with the facilitator, who was supportive in the art sessions, contributed to the effect (whereas control had minimal interaction). Thus, future trials might consider a control that includes equivalent facilitator contact (perhaps a talk or nontherapeutic chat) to isolate the art-specific effect.

Another consideration is that body image and self-esteem outcomes were not formally assessed, even though the study rationale centred on the identity impact of breast cancer. It’s conceivable that mandala coloring could indirectly improve body image by restoring a sense of wholeness or self-worth, as some qualitative accounts suggest art therapy helps patients “reconnect with their bodies” in a positive way [6]. While that was beyond the scope, including a body image scale in future studies would be insightful. A measure of spiritual well-being or coping was also not included, which could be relevant given that mandalas have roots in spiritual practices and some studies have found that art therapy improves spiritual well-being [16].

Finally, as a single-blinded study, the findings relied on subjective self-report measures. It might be useful in the future to incorporate objective or physiological measures of stress reduction (e.g., cortisol levels, heart rate variability). Salivary cortisol and other physiological outcomes were deliberately excluded to keep the study simple and to comply with the request not to add physiological measures. However, evidence from psycho-oncology suggests art therapy can modulate stress hormones in some cases [14], so a more comprehensive study might look at that to bolster the evidence of true stress reduction.

4.5. Clinical significance of the study

If confirmed in larger trials, mandala coloring could be implemented as a standard supportive care option during chemotherapy visits. It requires minimal resources, such as paper, pencils, and a trained facilitator (who could even be a volunteer with basic training in art therapy), and it can also be delivered in group settings. For instance, a chemotherapy suite could offer a “coloring corner” or provide mandala coloring kits to patients while they receive infusions. Given how straightforward it is, patients could continue the practice at home, enhancing their self-care regimen. This intervention empowers patients to actively manage their stress (“coloring through chemo” as some call it) and might foster a greater sense of community and positivity in treatment centres if adopted broadly. This finding that distress and anxiety dropped suggests that such an offering could improve patient experience and potentially even clinical outcomes, because high distress has been linked to poorer treatment adherence; lowering distress might help patients stay on therapy, although this possibility was not specifically examined. From a psychosocial oncology perspective, MAT can complement counseling and pharmacotherapy. Not all patients require or accept

formal psychotherapy or anxiolytic medication; coloring offers a gentle, non-stigmatizing way to engage them in stress reduction. It is also scalable, as one therapist can supervise multiple patients coloring simultaneously in a group, which makes the approach cost-effective.

A staged implementation approach can facilitate delivery of brief mandala-coloring sessions within routine oncology care while maintaining safety, feasibility, and fidelity. Routine psychosocial screening should precede delivery: administer the NCCN DT at chemotherapy/day-unit visits and use $DT \geq 4$ as a referral trigger. Offer a brief, structured chairside mandala-coloring option as an adjunct “activity during chemo” delivered by a trained nurse/allied-health facilitator (ideally with supervision from an art therapist where available); use individual, single-use kits to meet infection-control requirements. Schedule 3×45 -min sessions during infusion or waiting periods; document session uptake, duration, and any issues in the EHR. Evaluate change with DT and HADS-A/D pre/post for quality improvement (and refer to psycho-oncology if $HADS-D \geq 8$ or persistent high distress). This approach positions art-based offerings within a stepped-care pathway for cancer-related anxiety and depression, consistent with integrative care guidelines from the Society for Integrative Oncology, which are endorsed by the American Society of Clinical Oncology, and the European Society for Medical Oncology. Within this model, they function as adjunctive supports, ensuring they complement rather than replace evidence-based psychotherapy and pharmacotherapy. Provide multilingual DT/Problem List materials and brief staff training to standardize delivery and referral.

5. Conclusion and prospect

5.1. Conclusion

In conclusion, this pilot trial provides promising evidence that engaging breast cancer patients in short-term mandala coloring sessions (“coloring beyond the cancer ward”) can meaningfully alleviate chemotherapy-related distress. Women who colored mandalas as a form of visual art therapy experienced significantly less emotional turmoil, particularly feeling less anxious, in just a few weeks. The intervention was simple, low-cost, and well-received, highlighting its potential for integration into routine cancer care as a complementary therapy. Although not all problems were resolved (physical fatigue persisted, and depression did not change significantly in the short term), the intervention addressed a critical aspect of the cancer experience, namely, immediate psychological distress, and helped patients find a moment of peace and self-expression during medical treatment. These findings support the growing recognition in psycho-oncology that treating the mind is an essential part of treating the body.

For breast cancer patients coping with the daunting physical and emotional challenges of chemotherapy, MAT offers a ray of color and calm that goes beyond the confines of the cancer ward. By empowering patients to actively participate in their own healing through creativity, this approach can enhance their mental resilience and potentially improve their overall quality of life during one of the most stressful periods of cancer care. Further research is recommended to solidify the evidence base,

and clinicians are encouraged to consider art-based interventions as part of holistic supportive care. As one participant eloquently put it, “Coloring gave me back a sense of control and hope, and each page I filled with color felt like I was filling myself with courage.” In the journey through breast cancer, such moments of courage and reduced distress can make a profound difference. Our pilot study suggests that a little color therapy can indeed go a long way in easing the burden of cancer treatment.

5.2. Future research

Building on this pilot, future research should consider a fully powered RCT with a larger sample to confirm efficacy and explore moderators. It would be valuable to test the intervention in different populations: e.g., metastatic breast cancer patients (who may have even greater distress), or other cancer types, including male patients (to see if the appeal of coloring is similar). Research could also compare mandala coloring with other art or relaxation interventions, for example, by testing whether mandala coloring is more effective than free drawing or conventional meditation (some evidence in other contexts suggests mandala coloring can outperform free-form coloring for anxiety reduction [25], presumably due to its structured nature). At the same time, incorporating qualitative components could deepen understanding of how patients experience the intervention, including which aspects they find most helpful (for example, the colors, the act of creation, or the distraction). Additionally, a longitudinal design could be considered to establish durability: assessments at approximately 1, 3, and 6 months after the final session would allow modelling of maintenance, decay, or delayed effects, and would enable evaluation of clinical endpoints such as treatment adherence, chemotherapy completion without dose reductions, unplanned healthcare use, and sustained changes in quality of life.

It might also be informative to investigate if repeated art therapy has cumulative benefits or a ceiling effect. The three-session format worked well; would more sessions lead to proportionately greater improvements, or do returns diminish? The Zhang et al. (2024) quasi-experiment with three sessions found significant improvements in anxiety and even some physiological measures (blood pressure) [6], suggesting there might also be somatic calming effects from art. Vitals were not measured; however, some patients reported feeling physically more relaxed after coloring. Measuring physiological stress markers in the future could objectively support stress reduction claims [31]. Moreover, exploring the role of mindfulness and flow in the coloring intervention could connect it to established psychological theories [20,32]. It is suspected that the mindful aspect of coloring is key; therefore, a study that measures mindfulness before and after, or compares coloring with and without mindful guidance, could isolate this mechanism.

Given the salience of appearance-related concerns in breast cancer, future studies might include validated body-image assessments as secondary endpoints. Suitable options include the Body Image Scale, the EORTC QLQ-BR23 body-image subscale, and modules from the BREAST-Q for reconstructive pathways. In addition to measurement, an optional art-therapy module that explicitly addresses body image (for example, coloring or drawing body outlines, personal symbols, or pre-/post-session

self-portraits) could be piloted to evaluate direct effects on self-perception. Prior qualitative literature indicates that art therapy may help patients “re-author” the illness narrative and accept changed bodies [33]; embedding body-image-specific content would test this proposition within a controlled framework.

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References

1. Sun H, Lv H, Zeng H, et al. Distress thermometer in breast cancer: Systematic review and meta-analysis. *BMJ Support Palliat Care*. 2022; 12(3): 245–252. doi: 10.1136/bmjspcare-2021-002960
2. Heidari M, Shahbazi S, Ghodusi M. Evaluation of body esteem and mental health in patients with breast cancer after mastectomy. *Journal of Mid-Life Health*. 2015; 6(4): 173–177. doi: 10.4103/0976-7800.172345
3. Verri V, Pepe I, Abbatantuono C, et al. The influence of body image on psychological symptomatology in breast-cancer women undergoing intervention: A pre-post study. *Frontiers in Psychology*. 2024; 15: 1409538. doi: 10.3389/fpsyg.2024.1409538
4. Huang T, Yin X. Exploring the benefits of art therapy for anxiety and depression in women with breast cancer: A meta-analytical systematic review. *Journal of Psychiatric Research*. 2025; 189: 403–414. doi: 10.1016/j.jpsychires.2025.05.027
5. Zhou SS, Yu MH, Zhou Z, et al. The effects of art therapy on quality of life and psychosomatic symptoms in adults with cancer: A systematic review and meta-analysis. *BMC Complementary Medicine and Therapies*. 2023; 23: 434. doi: 10.1186/s12906-023-04258-4
6. Yakar HK, Yilmaz B, Ozkol O, et al. Effects of art-based mandala intervention on distress and anxiety in cancer patients. *Complementary Therapies in Clinical Practice*. 2021; 43: 101331. doi: 10.1016/j.ctcp.2021.101331
7. Monti DA, Peterson C, Kunkel EJS, et al. A randomised, controlled trial of mindfulness-based art therapy for women with cancer. *Psycho-Oncology*. 2006; 15(5): 363–373. doi: 10.1002/pon.988
8. Zou Y, Zhai S, Dong J, et al. The effect of art therapy on quality of life and fatigue in breast cancer patients: A meta-analysis. *Frontiers in Oncology*. 2025; 15: 1495887. doi: 10.3389/fonc.2025.1495887
9. Cheng P, Xu L, Zhang J, et al. Role of arts therapy in patients with breast and gynaecological cancers: A systematic review and meta-analysis. *Journal of Palliative Medicine*. 2021; 24(3): 443–452. doi: 10.1089/jpm.2020.0468
10. Kırca AŞ, Dağlı E. The effect of mandala coloring on anxiety and quality of life of women in the climacteric period. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2024; 292: 251–258. doi: 10.1016/j.ejogrb.2023.11.035

11. Sadeqi H, Nejad A, Rahimi M. Adult coloring (mandala pattern) reduces pain and anxiety during burn-dressing changes: A randomised study. *Scars Burns Healing*. 2024; 10: 1–9. doi: 10.1177/20595131231218062
12. Akbulak F, Can G. Effectiveness of mandala coloring in reducing anxiety in women with early-stage breast cancer receiving chemotherapy for the first time. *Explore*. 2023; 19(1): 42–47. doi: 10.1016/j.explore.2022.04.007
13. Cheraghi P, Hekmatpour D, Rafiei F, et al. A comparison between effects of sudoku and mandala painting on anxiety of breast cancer patients undergoing chemotherapy. *Journal of Family Medicine and Primary Care*. 2024; 13(2): 431–437. doi: 10.4103/jfmpe.jfmpe_411_23
14. Zhang M, Liu X, Huang Y, et al. Does mandala art therapy improve psychological well-being of gynecological cancer patients during the perioperative period? A quasi-experimental study. *Integrative Cancer Therapies*. 2024; 23: 15347354241259180. doi: 10.1177/15347354241259180
15. Forzoni S, Perez M, Martignetti A, et al. Art therapy with cancer patients during chemotherapy sessions: An analysis of the patients' perception of helpfulness. *Palliative & Supportive Care*. 2010; 8(1): 41–48. doi: 10.1017/S1478951509990691
16. Radl D, Vita M, Gerber N, et al. The effects of self-book art therapy on cancer-related distress in female cancer patients during active treatment: A randomized controlled trial. *Psycho-Oncology*. 2018; 27(9): 2087–2095. doi: 10.1002/pon.4758
17. Bosman JT, Bood Z, Brockopp D, et al. The effects of art therapy on anxiety, depression, and quality of life in adults with cancer: A systematic literature review. *Support Care Cancer*. 2021; 29(5): 2367–2381. doi: 10.1007/s00520-020-05869-0
18. Whitehead AL, Julious SA, Cooper CL, et al. Estimating the sample size for a pilot randomized trial to minimize the overall trial sample size for the external pilot and main trial for a continuous outcome variable. *Statistical Methods in Medical Research*. 2016; 25(3): 1057–1073. doi: 10.1177/0962280215588241
19. Peng J, Cheng D. The effectiveness of therapeutic art-making on depression, anxiety, quality of life, and psychological distress in cancer patients on chemotherapy: A systematic review of the literature. *Support Care Cancer*. 2024; 32(4): 245. doi: 10.1007/s00520-024-08427-0
20. Newland P, Bettencourt BA. Effectiveness of mindfulness-based art therapy for anxiety, depression and fatigue: A systematic review and meta-analysis. *Complementary Therapies in Clinical Practice*. 2020; 41: 101246. doi: 10.1016/j.ctcp.2020.101246
21. Zeng C, Lin T, Romanelli C, et al. Validation of the hospital anxiety and depression scale in a US hepatitis-C population: Larger studies are needed. *Hepatology Communications*. 2024; 8: e12010. doi: 10.1097/HC9.00000000000012010
22. McFarland DC, Shaffer KM, Tiersten A, et al. Clinical implications of cancer-related inflammation and depression. *Clinical Practice & Epidemiology in Mental Health*. 2021; 17: 287–297. doi: 10.2174/1745017902117010287
23. Dadashi N, Khanali Mojen L, et al. Effect of mandala art therapy on quality of life in breast cancer patients. *Asian Pacific Journal of Cancer Prevention*. 2025; 26(7): 2533–2540. doi: 10.31557/APJCP.2025.26.7.2533
24. Chan NCT, Michaels D. Brief, structured, group art therapy for women with breast and/or gynaecological cancer. *International Journal of Art Therapy*. 2022; 27(3): 130–142. doi: 10.1080/17454832.2022.2088818
25. Jakobsson Støre S, Jakobsson N. The effect of mandala coloring on state anxiety: A systematic review and meta-analysis. *Art Therapy*. 2021; 39(4): 173–181. doi: 10.1080/07421656.2021.2003144
26. Bolwerk A, Mack-Andrick J, Lang FR, et al. How art changes your brain: Differential effects of visual art production and cognitive art evaluation on functional brain connectivity. *PLoS One*. 2014; 9(7): e101035. doi: 10.1371/journal.pone.0101035
27. Curry NA, Kasser T. Can coloring mandalas reduce anxiety? *Art Therapy*. 2005; 22(2): 81–85. doi: 10.1080/07421656.2005.10129441
28. van der Vennet R, Serice S. Can coloring mandalas reduce anxiety? A replication study. *Art Therapy*. 2012; 29(2): 87–92. doi:10.1080/07421656.2012.680047
29. Panjwani AA, Southward MW, Fugate-Laus K, et al. Coping self-efficacy, perceived helpfulness of coping, and distress: A longitudinal investigation of breast and gynecologic cancer patients undergoing chemotherapy. *Journal of Behavioral Medicine*. 2022; 45(6): 868–881. doi: 10.1007/s10865-022-00345-y
30. Hirschmiller J, Aho-Glélé U, Messner S, et al. Perceived control as a potential protective factor for suicidal thoughts and behaviors in cancer patients and survivors: A systematic review with meta-analysis. *Psychooncology*. 2024; 33(11): e70030. doi: 10.1002/pon.70030
31. Kaimal G, Ray K, Muniz J. Reduction of cortisol levels and participant responses following art making. *Art Therapy*. 2016; 33(2):74–80. doi: 10.1080/07421656.2016.1166832

32. Strang CE. Art therapy and neuroscience: Evidence, limits, and myths. *Frontiers in Psychology*. 2024; 15: 1484481. doi: 10.3389/fpsyg.2024.1484481
33. Sun L, Ang E, Ang WHD, et al. Losing the breast: A meta-synthesis of the impact in women breast cancer survivors. *Psycho-Oncology*. 2018; 27(2): 376–385. doi: 10.1002/pon.4460