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Title: Comparison of group vs. self-directed music interventions to reduce chemotherapy-related distress and cognitive appraisal: An exploratory study

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Title: Comparison of group vs. self-directed music interventions to reduce chemotherapy-related distress and cognitive appraisal: An exploratory study

Background

Breast cancer is a major hazard to women's health worldwide, affecting physical function and psychological burden. Even at an early stage, women become distressed upon receiving a breast cancer diagnosis [1], manifesting 15% to 55% of known psychological distress including anxiety and depression [2-4]. Worsening symptoms of distress occurred over the cyclic course of chemotherapy until mid-completion and then stabilized until the end in African American women with breast cancer [5].

Neurotoxic effects of chemotherapy may affect cognitive changes including problems in attention, concentration, learning, memory, and mental speed during the course of cancer treatment [6]. Women with breast cancer (WBC) experience stress or threat related to chemotherapy, and cognitive appraisal occurs consciously or unconsciously throughout the illness trajectory. Cancer cognitive appraisal, how an individual views a situation, is associated with the anxiety, harm or loss [7]. When patients' reaction to treatment includes harm or loss, the stressors can increase their vulnerabilities which contribute to depression and influences how coping resources are utilized [8].

Chinese patients tend to view cancer as taboo, feel stigmatized by the illness, and believe that death is inevitable. Fatalism can be regarded as a cognitive appraisal of stressors associated with cancer and is thought to influence how individuals cope with illness, such as avoidant behaviors [9] or poor adjustment [10]. Higher levels of depression can be predicted by factors such as higher utilization of escape-avoidance coping and greater appraisal of harm or loss [8]. Exploring coping strategies may facilitate understanding about their influences and could lead to intervention to alleviate chemotherapy-related distress. As WBC experience ongoing cyclic chemotherapy and have special needs for psychological support, evolving alternative therapies are utilized as part of their treatment regimen [11,12].

For decades music has been used to help individuals achieve a change in behavior, feeling, or physiology. It uses the processing of associative memory network [13] to alleviate negative emotions by occupying the brain's attention channels with meaningful, relaxing stimuli [14]. A study of healthy individuals reported that listening to self-selected joyful or peaceful music reduced anxiety and depression [15]. Ten to fifteen minutes of listening to energizing or sedative music elevates the regulation of the autonomic nerve system evidenced by changes in heart rate variability [16].

For oncology patients, music-based interventions have been used to relieve mind-body discomforts [17-19]. Effective music interventions incorporate passively listening to recorded music or participating in an interaction as guided imagery and music therapy led by a therapist [20]. Evidence of music therapy for WBC undergoing chemotherapy includes prompt lessening of anxiety [2,21,22], decreased levels of tension, depression, and anger [2,17]. A meta-analysis indicated that therapist-provided music intervention could immediately reduce the severity of anxiety and depression with moderate to large effects on cancer patients [23]. Similar findings have been supported by the Chinese WBC population

[22,24] and suggested that an individualized one-hour music-listening session using earphones had a positive effect on chemotherapy-induced anxiety [25].

Providing music interventions in a group setting with peer support, motivation, and social interaction may have added effects above and beyond the intervention itself [26]. Results of group stress management interventions have shown promising improvement in distress and psychological adjustment among WBC undergoing therapy [27,28]. A group-based approach may be beneficial for cancer patients who have insufficient social support [29,30], as group music interventions have resulted in significant effects on mood and psychosocial well-being among WBC [31].

While research using music-based interventions ranges from individual to groups, the unit of delivery is not always explicitly stated or described [26]. The majority of prior music intervention studies have focused on immediate effects when delivered to individuals. Few studies have examined the longer impact of music interventions delivered to a group of WBC. Therefore, this current study employs both group approach and music interventional techniques as a framework to facilitate the interaction, interpersonal learning, and experiences for coping with breast cancer [20,29]. A group-based approach can create mutual support by participants and plays a pivotal role in cognitive restructuring for cancer patients contributing to “vicarious learning” [29]. Music-listening interventions can initially reduce mind-body distress through relaxing the body’s rigidity, enhancing the consciousness and connecting to the current situation [14].

Based on the aforementioned, participants received a 3-stage GMI that applied the principles of guided imagery and music in order to generate a period of dynamic inner experience for altering emotion and cognition. Therefore, the aims of the present study were to compare the effects of group music interventions (GMI), self-directed music interventions (SMI), and the control on chemotherapy-related distress and cognitive appraisal for women with breast cancer undergoing chemotherapy. Three hypotheses were proposed that GMI will have greater effects at post-intervention and 3-month follow-up (1) in decreasing anxiety and depression; (2) reducing negative emotion and cognitive avoidance; and (3) increasing positive attitudes for WBC compared to SMI and the control.

Methods

Study Design

A 3-arm, quasi-experimental design with repeated measurement was applied. Participants were randomly assigned to one of the following approaches: GMI, SMI, or control.

Participants and Sample Size

After obtaining Institutional Review Board approval (Registration: B-ER-102-004), adult women over 20 years old able to speak and understand spoken and written Chinese or Taiwanese and undergoing a 6-dose chemotherapy cycle for breast cancer were referred by case managers of oncology clinics in a medical center in southern Taiwan. Women were excluded if they reported any auditory or visual deficits, mental illness or cognitive impairments. Data collection were from January through December 2013.

A sample size of 45 was determined based on ANOVA repeated measurement to achieve a power of 0.9, effect size = 0.25 (G-power v.3.1.5). Based on an estimated 20% dropout rate, a sample size of 54, was required. Of the 68 women referred to the study, 60 women with breast cancer were willing to participate and provided written informed consent. Subjects were sequentially assigned to GMI, SMI or control group based on study enrollment.

Interventions

Group music intervention (GMI)

The GMI was provided on the chemotherapy day which was the first or the second dose scheduled in an interval of 3 weeks within the total 6-dose cycle. Participants received 8 weekly sessions. The sessions were led by 2 trained group therapists certified by the Chinese Group Therapy Association. Each 60-minute session of 6–7 subjects contained 3 stages: relaxation, music-listening, and experience-sharing. The recorded music was delivered via speakers in a meditation room where participants can lay on the floor with a blanket and yoga mat.

In the relaxation stage, the group therapist (GT) guided participants to perform a 10-minute self-love session—hand and foot massage with music in the background to achieve physical relaxation. Four to five pieces of music, provided by the GT according to participants' preferences obtained during the intake evaluation, and a music intervention protocol to alleviate chemotherapy-induced anxiety were provided [25].

In the music-listening stage, 7–8 pieces of music were given. The first 2–3 tracks chosen according to participants' music preference aimed to act as a prelude to embarking on a musical journey. A connection with GMI was established through light music and nature songs with wind, birds, and piano (*Songs of the Pacific, Forest Piano, Violin Rain, Aroma Lavender*). The remaining pieces of music were selected by the GT from the repertoire in the collections of “*Music for the Imagination*” [32]; for example, Beethoven's Violin concerto (Imaginative), Bach's Suite #3 – Air (Explorative) and Hayden's Cello Concerto in C (Supportive).

Finally, during a 10-minute experience-sharing stage, the GT encouraged participants to express their personal experiences, incorporating emotion, sensory images, body sensations, memories and thoughts to group members. A weekly story of “how a woman thrives in coping with the breast cancer” was shared by the GT at the end of each session to foster cognitive changes through individual or interpersonal learning.

Self-directed Music Intervention (SMI)

The SMI was performed by each subject in her home upon beginning the 6-dose chemotherapy cycle. Subjects of SMI were given the same and identical CD collection provided for the GMI. The music used in each session, a total of eight pieces, was compressed on a disc. Each subject was asked to individually listen to the music according to her current mood and physical condition for at least 8 weekly 60-minute sessions. For the fidelity of research, a research assistant contacted subjects weekly via telephone interview to determine their individual progress and listening time. As SMI intervention control, if the

subject had not yet completed the 60-minute listening session before evaluation, she would be reminded to do so.

Control Group

The control group received no music materials but were provided with standard care such as wound assessment, illness information, and consultation in the outpatient clinic.

Measurements

In addition to demographic data obtained at baseline, outcome measurements were obtained 3 times: a week before the intervention (T0), immediately 8-week post-intervention (T1), and 3-month follow-up (T2). Demographics and two questionnaires were completed in a private area during the clinic visit. Demographic data that included age, education, employment, marital status, and disease-related information such as years of being diagnosed and having other chronic disease were collected from the participants and their medical charts at baseline.

Chemotherapy-related Distress

The Hospital Anxiety and Depression Scale (HADS) is a self-assessment scale for detecting states of depression and anxiety in people with medical illness [33]. The full 14-item rating scale contains 7 items each for anxiety (HADS-A) and depression (HADS-D) subscales. Each item is rated by the respondent from 0 to 3, with 0 being not at all and 3 being most of the time with 6 items reverse coded. Scores range from 0–21 for each subscale and are reported as normal (0–7); mild (8–10); moderate (11–14), or severe (15–21) anxiety and depression [34]. The internal consistency of HADS-A and HADS-D was previously reported for Taiwanese cancer patients with Cronbach's alphas of .84 and .76 [35]. In the current study, the Cronbach's alphas were .85 and .78.

Cognitive Appraisal

The Mini-Mental Adjustment to Cancer scale (Mini-MAC), used to determine cognitive appraisal, includes 29 items on a 4-point Likert-type scale assessing psychological responses to cancer [36,37]. The Mini-MAC is associated with adaptive coping and psychological outcome in cancer patients and includes five dimensions: Helplessness/Hopelessness (HH), Anxious Preoccupation (AP), Fighting Spirit (FS), Fatalism (FA), and Cognitive Avoidance (CA). The HH and AP are positively correlated to the psychosocial outcomes of stress, anxiety, and depression. Conversely, higher scores of FS and FA indicate lesser psychological distress, whereas a higher CA relates to poor mental health [38]. The internal consistency of the Mini-MAC ranged from .67 to .88 among Chinese subjects [38,39] and .84 in the current study. Ho et al. [39] explored a 3-factor model of mini-MAC, i.e. negative emotion (HH and AP), positive attitude (FS and FA), and cognitive avoidance (CA). We employed this model to evaluate the efficacy of the music intervention in this present study.

Data Analysis

Data analyses were performed using SPSS Statistics software package, version 22 for Windows. Descriptive statistics were used to evaluate the demographic data and disease-related information at baseline. Comparisons were performed with Kruskal–Wallis nonparametric analysis of variance tests

followed by post hoc Dunn tests for 3 groups. An effect size (ES) was computed for sufficient information when the differences were significant. The significance level was determined as $p < 0.05$.

Results

A 13.3% drop-out rate among the 60 women who consented to participate resulted in 52 WBC completing the study. Four women in control and four women in the SMI group were lost due to reported symptoms, lack of time or disinterest. The majority of women were married, living with family, had been diagnosed with breast cancer in the past 2 years, and were without a co-morbid chronic disease. No significant demographic and disease-related differences were identified among the groups (Table 1 & Fig. 1).

Hypothesis 1

Hypothesis 1 was partially supported. There was no difference in anxiety and depression scores of the HADS at T0 and T1 among the 3 groups. However, at T2, there were significant differences in mean ranks for anxiety ($p < .001$) and depression ($p = .007$) having a moderate positive anxiety effect and small depression effects, respectively ($ES = 0.34; 0.19$). By post-hoc comparison, GMI had significantly lower anxiety and depression levels than SMI and the control (Table 2). A greater reduction trend of anxiety and depression in GMI than the other 2 groups over time was reflected in Figure 2 and 3. This finding indicates that positive effects of GMI in the reduction of anxiety and depression were identified at 3-month follow-up but not at post-intervention.

Hypothesis 2

Hypothesis 2 was partially supported. The mean rank of mini-MAC among the 3 groups revealed no significant differences at T0 across the five dimensions (Table 3). By comparison of the mean rank among 3 groups, GMI showed significant differences in HH with a small effect (0.21) at T1 ($p = .005$) and with moderate effects (0.42) at T2 ($p < .001$). The reduction of HH in GMI was significantly greater than that of the SMI and the control at T1 and T2 by post-hoc. There was a significant difference of AP at T1 ($p = .013$) with a small effect (0.17), but no significance at T2. GMI had a significant difference in the lower level of AP than the control group at T1 by post-hoc. CA was significant ($p < .001$) with moderate effect (0.39) at T2 indicating that GMI had a significantly lower CA score than SMI and the control group by post-hoc. This finding supports that GMI has significant effects in negative emotion (HH, AP) at post-intervention and also positive effects in HH and cognitive avoidance (CA) at 3-month follow-up.

Hypothesis 3

Hypothesis 3 was rejected. For the FA and FS, a significant difference of the mean rank in FA among the 3 groups with the small effects at T1 and T2 ($ES = 0.26$ to 0.15) demonstrated that GMI had significantly lower FA mean rank compared to SMI and control group by post-hoc. A significant difference of the mean rank in FS at T2 among 3 groups indicated that GMI had a lower effect than SMI and control group by post-hoc (Table 3). This finding rejects that GMI has effects in increasing positive attitudes (FA, FS) at both post-intervention and follow-up.

Discussion

Effects on Chemotherapy-related Distress

This study aimed to explore the positive effects on anxiety and depression of group (GMI) and individual (SMI) music interventions among women with breast cancer during chemotherapy at post-intervention and 3-month follow-up. For hypothesis 1, results indicated no immediate effects but did support that GMI had small to moderate effects at follow-up.

While there were no immediate effects on anxiety and depression, GMI had a small to moderate effect on chemotherapy-related distress at 3 months. These findings are contrary to previous studies which have suggested that music-based interventions have an immediate effect in anxiety reduction [2,22,24]. The difference may be related to the timing of the GMI sessions. Subjects underwent blood tests at 7 a.m. followed by the GMI session at 8 a.m. The stress may have narrowed perceptions of the music and increased immediate anxiety. The context and, in particular, the timing are confounding issues for intervention sessions and require further study. However, GMI appears to have had a moderate effect in reducing anxiety for WBC after 3-month follow-up.

The findings showed no immediate effects in reducing depression across the 3 groups. Subjects had lower scores of depression at baseline, similar to those in previous music interventional studies [40,41]. Findings may be related to the floor effect which limits the range of potential change. In addition, patients have positive expectations concerning the participation in the MI [40] which may affect baseline scores. Alternatively, the subject may have experienced a sense of loss or lack of social support when the GMI was completed which may have led to a change in depression score. However, the GMI demonstrated significant but small effects on depression compared with the SMI and control groups at follow-up, indicating that participants need longer to show alleviation of depression through GMI, and this was consistent with the study of Robb et al. [42]. Nevertheless, this result should be interpreted with caution due to the small effect size and sample size. Changes in anxiety should be further thoroughly examined with a rigorous design of RCT and a larger sample.

Effects on Cognitive Appraisal

In hypothesis 2, findings support the immediate effects of GMI on negative emotions (HH and AP) at post-intervention and significant effects on helplessness and hopelessness (HH) and cognitive avoidance (CA) at follow-up. The significant changes in these negative emotions echoed Bigatti et al.'s [8] finding that depression could be predicted by a greater appraisal of harm or loss. The cognitive modification may initiate a small effect on negative emotion after group closure and manifest a moderate effect on HH and CA as late as 3 months after the end of GMI. Helping women reduce the feelings of forsaken hope and pessimistic attitude influenced by the illness may require a longer adaptation time.

There was a significant difference in anxious preoccupation between GMI and the control at T1, indicating that GMI had immediate effects. The music with group interaction may have distracted subjects' preoccupation with cancer and feelings of devastation, fear, and apprehension. The role of AP, identified as an indicator of poor adjustment [38], has a significant association with higher levels of

internal control over the cause of cancer [43]. This important turning point of change indicated that AP reduction might be learned and reinforced by the experience-sharing within the GMI sessions. Consequently, we posit that GMI may serve as an effective strategy to alleviate helplessness, hopelessness and anxious preoccupation for WBC.

Cognitive avoidance showed a significant and moderate effect change in the GMI group, suggesting that at least 3 months are required for integration of cognitive changes into a newly learned mindset, readjustment of personal viewpoints toward cancer, and modification of one's attitude about life and death. This finding echoes the notion proposed by Kerr et al. [44] that music stimulates emotion schemas integrating affect and cognition by the conscious awareness of new experiences and understandings of the anxiety-provoking situation. The awareness, in turn, may lead to decreased anxiety and positive mood changes.

The findings established that GMI was not significant in increasing positive attitudes (fighting spirit [FS] and fatalism [FA]). These findings did not support our hypothesis 3, as higher scores of FA and FS indicate better health status and a lower level of psychological distress [38]. Contrary to expectations, the study results indicated that SMI demonstrated a mild effect in both FS and FA compared to GMI. It is possible that women in the SMI group, allowing flexibility in arranging their time of music listening and chosen repertoire, implemented the intervention according to their current mood. However, due to the small effect size and low mean scores among the 3 groups, qualitative in-depth interviews are needed to further explore these findings.

The use of cognitive reappraisal coping strategies controls higher levels of cognitive functions which may lead to improving psychosocial functioning in cancer survivors [6]. Patients have an ability to cope with stress serving to adjust the psychological impacts of stress and chemotherapy and thus longer outcomes were reflected in the current study, suggesting that group music intervention nested cognitive appraisal likely plays a crucial role in reducing the existing vulnerability and preventing cancer-related cognitive decline.

Strengths and limitations

This study is strengthened by using GMI led by group therapists to alleviate chemotherapy-related distress and cognitive appraisal with using a 3-arm design for WBC. GMI can be utilized as an alternative strategy for cancer supportive care in the course of patients' illness, and as a facilitation tactic to foster participants' engagement in the group interaction and emotional sharing. This validated evidence is suitable for boosting women's mental health and extending it to other cancer patients might be considered.

Limitations to the study findings include a sample derived from a single setting, not achieving sample size per power analysis, and the floor effect of the anxiety and depression scores. These may limit the generalizability of the results to all WBC. It is also not known if women in the control group exposed themselves to music in the home environment. Social support could be undertaken independently to further understand how supports impacting on the change of emotions and cognition.

Conclusion

A more beneficial effect for reducing chemotherapy-related distress, negative emotions and cognitive avoidance was experienced by women with breast cancer participating in a group music intervention than women provided with music for home use or women without music. Therefore, group music intervention can be considered a valuable intervention to ameliorate the impact of anxiety, depression and distorted cognition during chemotherapy and beyond. Further studies are required to explore the effects of the music-based intervention on positive attitudes and the role that cognitive appraisal plays in the illness trajectory for women with breast cancer.

Conflicts of Interest:

The authors declare that there is no conflict of interest. We have full control of all primary data and agree to allow the journal to review our data.

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent:

Informed consent was obtained from all individual participants included in the study.

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