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ORIGINAL ARTICLE

Effects of music on depression in older people: a randomised controlled trial

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Aim. To determine the effect of music on depression levels in older adults.

Background. Depression is a common psychiatric disorder in older adults, and its impacts on this group of people, along with its conventional treatment, merit our attention. Conventional pharmacological methods might result in dependence and impairment in psychomotor and cognitive functioning. Listening to music, which is a non-pharmacological method, might reduce depression.

Design. A randomised controlled study.

Method. The study was conducted from July 2009–June 2010 at participants' home in Singapore. In total, 50 older adults (24 using music and 26 control) completed the study after being recruited. Participants listened to their choice of music for 30 minutes per week for eight weeks.

Outcome measures. Depression scores were collected once a week for eight weeks.

Results. Depression levels reduced weekly in the music group, indicating a cumulative dose effect, and a statistically significant reduction in depression levels was found over time in the music group compared with non-music group.

Conclusions. Listening to music can help older people to reduce their depression level.

Relevance to clinical practice. Music is a non-invasive, simple and inexpensive therapeutic method of improving life quality in community-dwelling older people.

Key words: depression, music intervention, older adults

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Introduction

Depression is a common psychiatric disorder with symptoms including low mood, low energy, poor concentration, loss of pleasure, poor self-care and low self-esteem (Moussavi *et al.* 2007, Maratos *et al.* 2008, WHO 2009). In Singapore, a survey reported that approximately 75% of the senior citizen retired after the age of 55 (Economic Characteristics 2005, http://www.singstat.gov.sg/pubn/popn/ghsr1/chap3.pdf), and another health survey in Singapore reported that the prevalence rate on depression of senior citizen is about 4·1% (Ministry of Community Development 2005). The pharmacological treatment of depression in old age is often associated with adverse reactions and drug interactions because of polypharmacy and age-related physiological changes (Spina & Scordo 2002). Therefore, safer alternatives to the treatment of depression in the older adults must be sought. In response to the challenge posed by pharmacological treatment in old age,

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music intervention has been identified by the researcher as an area of interest. The use of music as a healing intervention is common throughout history (Aldridge 1994). It has been used in specialised domains such as psychiatry, neurology and coronary care, as well as surgery and general geriatric care (Flaugher 2002, Rose 2004, Sung *et al.* 2006, Särkämö *et al.* 2008, Moradipanah *et al.* 2009). More specifically, studies have been conducted and have shown that music listening reduces depressive symptoms in the older age group (Lai & Good 2005, Choi *et al.* 2008, Särkämö *et al.* 2008, Chan *et al.* 2009, Cooke *et al.* 2009). However, studies of the effects of music on community-dwelling older adults were generally not explored (Chan *et al.* 2009). This study aims to investigate music listening as a form of intervention to alleviate symptoms of depression in the community-dwelling older adult group in Singapore.

One theory that attempts to explain how music might affect human psychological response is the theory of Music, Mood and Movement (MMM). It proposes that 'music produces the psychological response of altered mood leading to improved health outcomes' (Murrock & Higgins 2009 p. 2252). Elements of music such as the melody, pitch and harmony are shown to elicit a wide range of emotional responses in the listener (Murrock & Higgins 2009). As the elements pass through the auditory cortex of the brain, processing of the music occurs in the limbic system of the brain to elicit emotions (Tramo 2001). According to Jourdain (1997), music calls on memory of the past experiences that have emotions etched to them; this changes the emotional state of the listener. This indicates that if the right music is played, music listening has the potential to alter the emotional state of the listener, hence achieving a therapeutic outcome such as reduced symptoms of depression (Guzzetta 1991).

Although several empirical studies have provided support for this view on the effects of music on depression level for older people (Chan *et al.* 2009, Guetin *et al.* 2009, Moradipanah *et al.* 2009), there are also conflicting findings across the individual studies. For example, two studies have shown that there is no significant effect of music on reducing depression (Elliott 1994, Deshmukh *et al.* 2009). One of the explanations suggested by Elliott (1994) is that there may be not enough time or number of interventions for cumulative effects to occur. In a systematic review investigating the dose–response relationship in music therapy, it is noted that small effects are seen after 3–10 sessions; medium effects are achieved after 11 sessions and large effects after 16 sessions (Gold *et al.* 2009). This provides support for the view that the effect of music increases as the number of exposure to music increases. Currently, there is no study that has been carried out to investigate the effects of music listening on the older adult population in Singapore. In addition, to explore the cumulative effects of music on older people, an eight-week randomised controlled trail was conducted.

The aim of the study was to examine the effect of music on depression levels in community-dwelling older people in Singapore. The following two alternative hypotheses were tested:

1 There is a statistically significant lower depression levels on the older adults in the music group than those in a non-music group.
2 There is a statistically significant reduction in depression levels during the eight weeks study for the older adults in each group.

Methods

Sample size, study design and participants

This study was a randomised, controlled, repeated measures study (Fig. 1) conducted in subjects' home. A research nurse visited each subject weekly for eight weeks to measure their depression scores, and data were collected between July 2009–June 2010.

The power of this study was estimated based on the depression scores. A one-tailed repeated measure analysis of covariance (RM ANCOVA) was used to test for differences on between, within and interaction effects, and a medium effect size (0·61 for between effects, 0·72 for within effects and 0·60 for interaction effects) was chosen based on the findings from previous study (Chan *et al.* 2009). The required sample for each group was 28 (total = 56); this number could achieve 80% power at a 5% level of significance.

All subjects were aged 55 or more, who were alert and oriented, not hospitalised at the point of recruitment, able to hear, communicate verbally and give written consent. The subjects were recruited via the team members' social network using convenience sampling method. The music intervention took place in the participant's own home.

Sixty-one subjects were approached and 56 were eligible, four refused to participate, as they refused to allow the search nurse into their homes. The remaining 52 subjects were assigned randomly to either the music or non-music group. Each participant was given a number from 1–52, and we selected 26 unique numbers from the random digits table ranging from 1–52. Participants with numbers matched with the generated number were allocated to the music group, and those not matched were allocated to the control group. After the allocation, two participants in the music group refused to continue, because they did not like all the music that was

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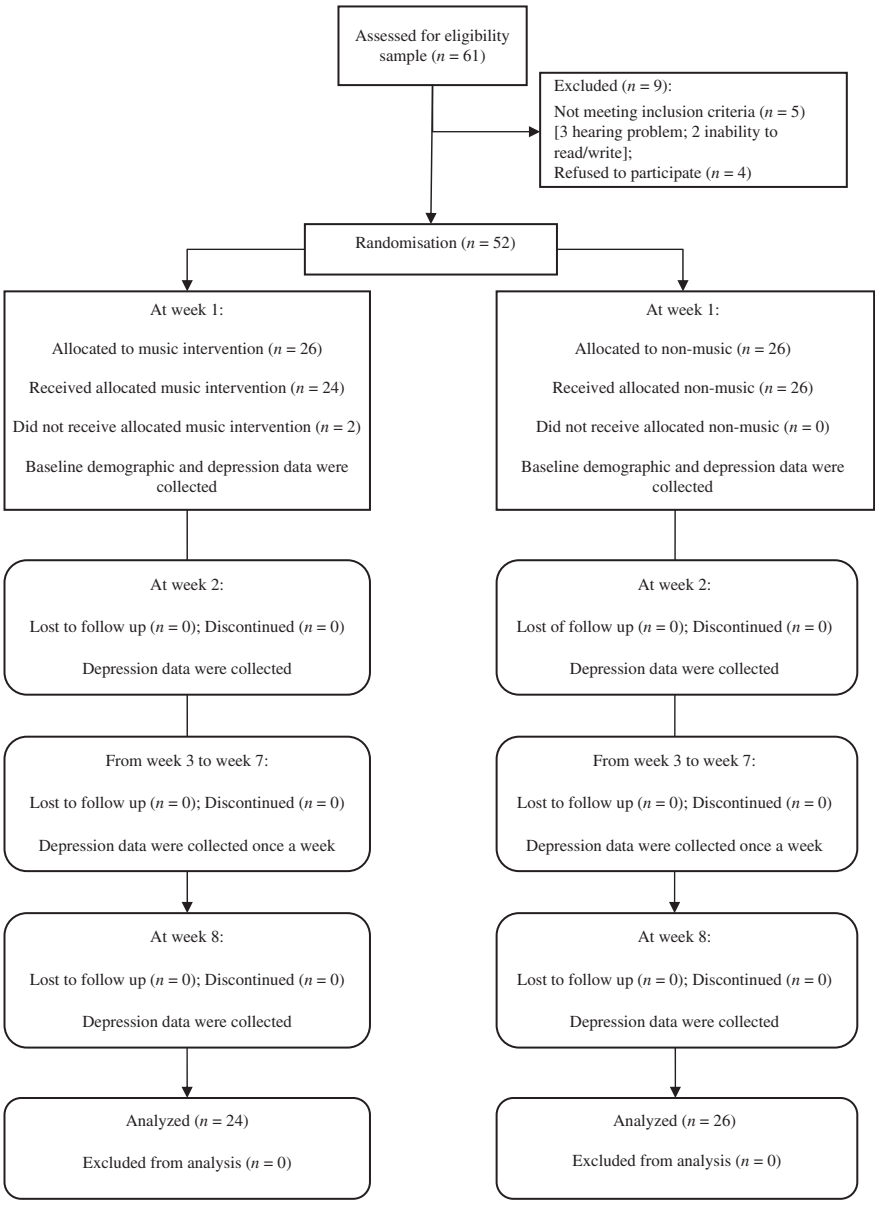

Figure 1 Subjects progress through the trial: CONSORT flowchart.

provided. In all, there were 24 participants in the music group and 26 participants in the non-music group at the start of the study. In the end, none of the remaining participants withdrew from the study with zero drop-out rate (Fig. 1).

Measures

The study instrument was bilingual with Mandarin and English consisted of two parts:

Part 1: Demographic and health variables. This included age, gender, religion, marital status, educational level, previous experience of listening to music and medical history. These data were commonly employed in previous studies using music as an intervention (Chan *et al.* 2009, Moradipanah *et al.* 2009).

Part 2: Depression variable. The Geriatric Depression Scale (GDS-15) was used to collect subjects' depression scores (Yesavage & Brink 1983, Spreen & Strauss 1998). It is a valid and reliable tool with cronbach's alpha values ranging from 0·88–0·91. It is one of the most popular tools used in clinical settings and is intended to assess depression in older people. It comprises 15 closed-ended questions and focuses on asking how the participants felt during the previous week. One point is assigned to each question, and a summary of all

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questions yields a total score from 0–15. Scores below three are considered normal, those between 4–7 as mild and those 8 or above are suggestive of depression (Lee *et al.* 1993, Chiu *et al.* 1994).

Types of music

The research nurse first introduced the four different selections of music, namely Chinese, Malay, Indian and Western slow rhythmic music. The participant then chose one type of music to be played during that session. Recent studies have shown that giving participants a choice of music lowered anxiety, promoted relaxation and led to effective treatment (Hsu & Lai 2004, Lee *et al.* 2005, Chang *et al.* 2008, Chan *et al.* 2009). Each session lasted for 30 minutes before data were taken. The four different types of music were carefully selected by the research team to have characteristic of 60–80 beats/minute without accented beats, percussive characteristics or syncopation. These characteristics were chosen based on several studies (Yung *et al.* 2002, Lai & Good 2005, Lee *et al.* 2005, Chan *et al.* 2009).

Data collection procedure

After random allocation of participants to groups, baseline data were collected by the research nurse. Prior to the music-listening session, the research nurse introduced the four types of music to the participants by reading the titles of the music and playing a one-minute sample tape from each selection for them to listen, before they decide which music to be played for that session. After deciding on their selection of music, the participant was asked to lie on bed or sofa for five minutes before the music intervention. Part 1 of the instrument was administered in the first week during baseline data collection for all subjects. For experimental group, Part 2 was administered as baseline after five minutes of rest period and before the 30 minutes of music intervention in week 1. Subsequently, for week 2 to week 8, it was administered after the 30-minute music intervention. For the non-music group, the instrument was administered weekly from week 1–8 after a 30-minute rest period (Chan *et al.* 2009).

During the study, a CD or MP3 player containing all the music was provided to the subjects in the music group to listen to at home. Participants in the music group were provided with earphones or speakers for listening to the music. They were able to adjust the volume to their preference. When the music started, the research nurse left the participant alone and stayed a short distance away, so that he or she would be available for any unexpected response to the music. After 30 minutes, the research nurse stopped the music and immediately measured the participants' depression data. Participants in the non-music group were given an uninterrupted rest period of 30 minutes, and their depression scores were collected after the rest period.

All data collection was carried out by the same research nurse, and the protocol was as follows:

1 Use of the MP3/CD player was demonstrated, and the participant was given an opportunity to return-demonstrate use of the MP3/CD to ensure its correct use.
2 Both non-music and music intervention were carried out in a quiet and restful environment without interruptions with comfortable bed/sofa/chair.
3 For participants in the music intervention group, they were asked to relax their body and mind before starting the music-listening intervention. For participants in the non-music group, they were asked to relax their body and mind 30 minutes before starting the interview.
4 The research nurse then left the participant alone and went a short distance away, close enough to be available in case of any unexpected response.
5 For participants in the music intervention, after the 30-minute music intervention, the research nurse stopped the music and collected participant's data immediately. For participants in the non-music, after the 30-minute rest period, the research nurse collected participant's data immediately.

Ethical considerations

Approval was obtained from the Institutional Review Board (IRB) of the university. The research nurse explained the study to potential participants and written informed consent was obtained beforehand. The subjects' personal information was identified only by case number, so that confidentiality was assured. Participants were told that they could withdraw from the study at any time. In addition, if the subjects experienced any untoward or unanticipated unpleasant effects from music, then the music intervention will stop immediately.

Data analysis

Descriptive statistics was used to describe the groups' characteristics. To test for homogeneity between groups for the demographic and health history data, chi-square or the Fisher's exact test was employed. The Shapiro–Wilk test was used to examine the normality of the GDS-15, and results showed that it was normally distributed, and thus parametric tests were used. ANCOVA was used to determine whether there was any statistically significant difference in depression levels

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between groups at each time point. Repeated measures (RM) ANCOVA was used to examine the within, between and interaction effects and adjusted by subjects' demographic data. If the assumption of sphericity was violated, the Greenhouse–Geisser correction was used, and the significance level of $p < 0{\cdot}05$ was adopted.

Results

Demographic and health history

A total of 50 participants took part in the study and continued to the end of eight weeks. There were 26 participants in the non-music group and 24 participants in the music group. Majority of the participants were 55–64 years old ($n = 32$, 64·0%; Table 1). There were more women ($n = 32$, 64%) than men in the study, and more than half of the participants' education level were secondary and above ($n = 27$, 54%). While most of the participants had religious beliefs, only 8% of the total sample did not have a religion. The majority of the participants had their children as a form of economical support (42%). Most of the participants (62·0%) did not have the habit of listening to music.

For the participants with some form of chronic illnesses (Table 1), 75·9% ($n = 22$) had hypertension, 24·1% ($n = 7$) suffered from diabetes, 24·1% ($n = 7$) suffered from other diseases such as hyperlipidaemia and systemic lupus erythematosus, 10·3% ($n = 3$) suffered from cardiovascular diseases and one participant has respiratory disease ($n = 1$). 31% of participants ($n = 9$) have more than one chronic illnesses. No significant differences were identified between groups for all demographic characteristics and health history.

Table 1 Comparison between groups

Demographic	Total ($n = 50$) n (%)	Non-music ($n = 26$) n (%)	Music ($n = 24$) n (%)
Age			
55–64	32 (64·0)	16 (61·5)	16 (66·7)
65–74	12 (23·0)	6 (23·1)	6 (25·0)
75+	6 (12·0)	4 (15·4)	2 (8·3)
Gender			
Male	18 (36·0)	9 (34·6)	9 (37·5)
Female	32 (64·0)	17 (65·4)	15 (62·5)
Marital status			
Married	43 (86·0)	23 (88·5)	20 (83·3)
Single	1 (2·0)	1 (3·8)	0 (0·0)
Widow/Widower	6 (12·0)	2 (7·7)	4 (16·7)
Educational level			
Primary School and below	23 (46·0)	13 (50·0)	10 (41·7)
Secondary School	23 (46·0)	10 (38·5)	13 (54·2)
College and above	4 (8·0)	3 (11·5)	1 (4·2)
Religious belief			
No	4 (8·0)	1 (3·8)	3 (12·5)
Yes	46 (92·0)	25 (96·2)	21 (87·5)
Catholic and Christian	14 (30·4)	7 (28·0)	7 (33·3)
Buddhist and Taoist	31 (67·4)	17 (68·0)	14 (66·7)
Others	1 (2·2)	1 (4·0)	0 (0·0)
Economic status			
Supported by children	21 (42·0)	12 (46·2)	9 (37·5)
Saving	11 (22·0)	6 (23·1)	5 (20·8)
Others	18 (36·0)	8 (30·8)	10 (41·7)
Perception of sleep quality			
Good and very good	25 (50·0)	10 (38·7)	15 (62·5)
Fair	17 (34·0)	12 (46·2)	5 (20·8)
Bad and very bad	8 (16·0)	4 (15·4)	4 (16·7)
Habit of music listening			
No	31 (62·0)	17 (65·4)	14 (58·3)
Yes	19 (38·0)	9 (34·6)	10 (41·7)
Chronic illnesses			
No	21 (42·0)	10 (38·5)	11 (45·8)
Yes	29 (58·0)	16 (61·5)	13 (54·2)
Hypertension (Yes)	22 (75·9)	12 (75·0)	10 (76·9)
Diabetes mellitus (Yes)	7 (24·1)	4 (25·0)	3 (23·1)
Cardiovascular (Yes)	3 (10·3)	3 (18·9)	0 (0·0)

Depression level

To address hypothesis 1, using RM ANCOVA, adjusted by baseline depression scores, gender, age, habit of music and region belief, to test for between-group difference in the depression score over eight weeks yielded significant difference ($p = 0{\cdot}016$; Table 2 and Fig. 2). In addition, ANCOVA, adjusted by baseline depression scores, gender, age, habit of music and religion belief, was used to determine any statistical significant difference in depression scores between the two groups at each week. As shown in Table 2, no significant differences were found between the two groups at week 2 ($p = 0{\cdot}639$), week 3 ($p = 0{\cdot}213$) and week 5 ($p = 0{\cdot}089$), but significant differences were found between groups at week 4 ($p = 0{\cdot}005$), week 6 ($p = 0{\cdot}012$), week 7 ($p = 0{\cdot}008$) and week 8 ($p = 0{\cdot}006$). To address hypothesis 2, RM ANCOVA was used to test for within-times factor (eight weeks) for each group. In the non-music group, results revealed that there was no significant reduction in the depression scores (Trend analysis, $F = 0{\cdot}18$, $p = 0{\cdot}677$) over the eight weeks. On the other hand, there was significant reduction in the depression scores over the eight week for the music group (Trend analysis, $F = 7{\cdot}05$, $p = 0{\cdot}016$).

Discussion

The findings contribute to knowledge about the effectiveness of music used as an intervention to relieve depression for older adults. From the results, there was a significant

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Table 2 Comparison of GDS-15 by groups again at eight weeks

	Non-music (n = 26)	Music (n = 24)	
Depression	Mean (SD)	Mean (SD)	F (p-value)
GDS-15			
Week 1	4·23 (2·89)	4·17 (3·14)	1·10 (0·427)†
Week 2	3·96 (2·66)	3·63 (2·95)	0·22 (0·639)‡
Week 3	3·77 (3·37)	2·96 (2·39)	1·60 (0·213)‡
Week 4	4·31 (3·12)	1·88 (2·29)	8·57 (0·005**)‡
Week 5	4·04 (3·45)	1·92 (2·32)	3·02 (0·089)‡
Week 6	4·15 (3·74)	1·46 (1·79)	6·96 (0·012*)‡
Week 7	4·00 (3·29)	1·46 (1·84)	7·65 (0·008**)‡
Week 8	4·15 (3·53)	1·38 (1·84)	8·51 (0·006**)‡
Between-group effect, F (p-value)	6·31 (0·016*)§		
Within-time effect, F (p-value)	1·00 (0·418)§		
Interaction effect, F (p-value)	4·01 (0·001**)§		

GDS-15, Geriatric Depression Scale.
Significant at *$p < 0·05$, **$p < 0·01$.
†ANCOVA adjusted by age, gender, religious belief and habit.
‡ANCOVA at week 2 to week 8 adjusted by week 1 (baseline), age, gender, habit, religious belief.
§Repeated measures ANCOVA adjusted by week 1 (baseline), gender, religious belief and habit.

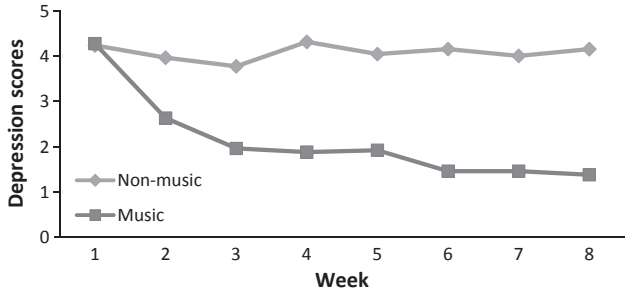

Figure 2 Comparison of depression between groups.

difference between the two groups at weeks 4, 6, 7 and 8. The music group had consistently reduced depression scores compared with the control group during the eight-week study. In Murrock and Higgins (2009) study, they pointed out that music would evoke a psychological response by altering mood and leading to improved health outcomes. In this study, the subjects experiencing lesser depression implied that music stimuli had been processed in the mood. The fact that perception of music leads to stirring emotional experiences is an indicator that the limbic system is engaged in processing music stimuli and that this system is influenced by musical pitch and rhythm (Guzzetta 1991, Jourdain 1997, Guetin *et al.* 2009). Thus, people's emotional reaction to music may occur because the limbic system is the neurophysiological location of emotional states, feelings and sensations. Therefore, our findings support the MMM model that music stimuli exert an emotionally meaningful effect on human health by engaging specific brain functions.

The length of this study was extended to eight weeks mainly because we wanted to address the accumulative effect of music listening for older people on depression levels. The results from this study pointed towards that music has a dose–response relationship in GDS when significant difference was found after week 6. A systematic review was conducted by Gold *et al.* (2009) on the dose–response of music on psychiatric patients, and they suggested that there was a significant dose–effect relationship in music therapy for depression levels on psychiatric patients. From our result, the time taken for depression scores in the music group to reach a consistent statistically significant reduction level was six weeks.

Strengths, limitations and future directions

This research had several methodological strengths. Drop-out and lost on follow-up rates were zero, with 100% of the subjects in both groups providing data during two months. Despite this strength, the research also had limitations that affected its outcome. First, the sample was depended on the researcher's social network via snowballing sampling technique. This could have created bias in the selection of the sample, even though the sample was randomised after being selected. Second, blinding of the participant to the intervention was not possible as the participants were aware that they were listening to music, and Hawthorne effect could not be avoided, even though the researcher remained a distance away from the participants during the intervention. Third, length between the interventions was one week apart, and thus, confounding variables could have set in during the week and cause a change in the outcome variables. For example, this study did not control the number of times the participant can listen to music at home other than the intervention session. They were only encouraged to listen to music at home after the intervention session, but it was not made compulsory. Therefore, the participant may listen to more music on a particular week, which may result in a significant difference from the baseline. Fourth, although results shown that listening to music may act as an effective intervention to allay depression levels in a group of older people, because of small sample sizes, we could consider it as a preliminary

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study and further study should proceed by recruiting more subjects. Last but not the least, to be aware of the emotional side effects that may occur in some of the older people after listening to music, having a psychologist work with the research nurse to handle this issue is suggested for future studies.

Relevance to clinical practice

From this randomised controlled study, it is shown that listening to music may act as an effective intervention to reduce depression levels for a group of older adults. Accumulative effects were confirmed on this two months design; however, because of small sample sizes, we would consider it as a pilot study. In practice, health-care professionals can encourage older people to listen to music as a self-care therapy that could enable them to reduce their depression levels and develop a healing process in their daily lives.

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Contributions

Study design: MFC, HO, NVT; data collection and analysis: ZYW, MFC and manuscript preparation: MFC, ZYW, HO, NVT.

Conflict of interest

The author(s) declare that they have no conflict of interests.

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