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# Effectiveness of music therapy combining life review and songwriting in patients with terminal cancer: a pilot study based on a mixed methods investigation

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**Effectiveness of music therapy combining life review and songwriting in patients with terminal cancer: a pilot study based on a mixed methods investigation**

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## Abstract

**Background:** Spiritual well-being is a key protective factor against psychological distress in individuals receiving terminal cancer care, and several approaches have been proposed to enhance this aspect of care. In this study, we developed and evaluated the effectiveness of a novel intervention combining life review (a method known to improve spiritual well-being) with songwriting, a form of music therapy.

**Methods:** Eighteen adults with terminal cancer received the intervention in four sessions. During each session, participants discussed their life experiences guided by a brief life review questionnaire and collaboratively composed song lyrics with the researchers based on these narratives. Participants then selected their preferred melodies and chord progressions from five options provided by the researcher. Upon completion, they listened to their personalized songs and received a CD recording. The primary

outcome was spiritual well-being, assessed using the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale. Secondary outcomes included anxiety and depression, measured by the Hospital Anxiety and Depression Scale. Assessments were conducted at baseline, immediately post-intervention, and at 2 and 4 weeks post-intervention. Qualitative content analysis of participants' feedback was conducted to assess the acceptability and overall impressions of the therapy.

**Results:** Immediately following the intervention, participants demonstrated significant improvements in spiritual well-being ( $p=0.011$ ), depression ( $p=0.001$ ), and anxiety ( $p=0.022$ ). However, no sustained effect was observed for spiritual well-being. Depression scores remained significantly improved at the 4-week follow-up ( $p=0.022$ ). Anxiety levels stayed below the clinical cutoff at all assessment points, indicating a consistent absence of clinically significant anxiety. Qualitative analysis of participants' feedback yielded 77 codes, which were integrated into four major categories: 1. Positive feelings toward researchers or the music, 2. Recalling the past and realizing it was a good life, 3. Hope for the future, and 4. Sharing with others.

**Conclusion:** The intervention significantly improved spiritual well-being, depression, and anxiety in individuals with terminal cancer. These findings help address prior concerns regarding the applicability of life review and songwriting and suggest that this integrative approach may offer a beneficial therapeutic option for alleviating psychological distress in terminal cancer care.

**Trial registration:** Japan Registry of Clinical Trials (jRCT1032230494; November 30, 2023)

**Keywords:** palliative care, music therapy, life review, songwriting, terminal care

**Abbreviations:** FACIT-Sp, Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale; HADS, Hospital Anxiety and Depression Scale

## Introduction

The World Health Organization states that palliative care is an essential component of healthcare and that relieving serious health-related suffering, whether physical, psychological, social, or spiritual, is a global ethical responsibility [1]. Individuals with terminal cancer often experience profound psychological and spiritual distress due to the loss of interpersonal connections, autonomy (including independence, future control, and identity continuity), and temporality (a sense of future) [2]. Frost suggested that spiritual well-being is a key protective factor against psychological distress in individuals with terminal illness [3].

Paloutzian and Ellison defined spiritual well-being as “the affirmation of life in a relationship with God, self, community, and environment that nurtures and celebrates wholeness,” comprising both religious and existential dimensions [4]. Recently, support for spiritual well-being has received growing emphasis in psycho-oncological care, particularly through interventions such as meaning therapy, dignity therapy, positive psychotherapy, mindfulness-based approaches, life review, expressive writing, acceptance and commitment therapy, attention and interpretation therapy, compassion-based training, and spiritual therapy. However, the empirical foundation remains limited, and structured training for healthcare providers is still insufficient [5,6].

Life review is an approach wherein individuals reflect on their life experiences with a listener, while dignity therapy is a form of therapy where individuals narrate their life stories, which are in turn transcribed and shared with their loved ones. The

effectiveness of these approaches in the improvement of spiritual well-being and the alleviation of depression and anxiety in individuals in the terminal stage of illness has been reported [7-9]. However, these methods can be difficult to implement due to individuals' emotional vulnerability and reluctance to engage in self-disclosure [10].

Music therapy has also been reported to alleviate pain, anxiety, and depression and improve quality of life in individuals with terminal cancer, and it is often well-received, especially when incorporating therapeutic conversation [11,12]. Songwriting, a music therapy modality wherein individuals create lyrics and/or music collaboratively with a therapist, has shown effectiveness in reducing depressive symptoms, anxiety, and negative affect, while enhancing quality of life [13]. As it centers on therapeutic dialogue, it may be particularly acceptable to individuals with terminal illness [12]. However, unstructured music therapy has been noted to potentially increase anxiety, with songwriting posing a particular risk [14]. Various techniques have been explored to structure songwriting interventions, such as completing unfinished lyrics or modifying the lyrics of pre-existing songs, but further refinement of these methods remains necessary [15,16].

Although numerous strategies have been reported for enhancing spiritual well-being and reducing anxiety and depression in individuals with terminal cancer, it remains unclear whether any existing intervention is both consistently effective and readily accepted by individuals. Therefore, we hypothesized that co-writing personalized songs with participants guided by therapeutic conversations grounded in life review and followed by the provision of a CD recording could lead to long-term symptom alleviation. This study aimed to develop a music therapy intervention that integrates songwriting and life review for individuals with cancer receiving terminal care and evaluate its effectiveness

using standardized outcome measures. The research questions were as follows:

1. Can our novel music therapy intervention combining life review and songwriting result in short- or long-term improvement in spiritual well-being and alleviation of depression and anxiety in patients with cancer receiving terminal care?
2. What are the participants' impressions and acceptability of this therapy?

## Methods

### *Ethics approval and consent to participate*

This study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Ethics Committee of Tokai University Hospital (approval date: October 27, 2023; approval number: 23R073). The study's purpose and procedures, voluntary nature of participation, right to withdraw at any time, and protection of personal information were explained to all participants verbally and in writing. Written informed consent was obtained from each participant.

### *Participants*

Participants were individuals aged  $\geq 20$  years with terminal cancer who were receiving care at Tokai University Hospital, Tomei Atsugi Hospital, or Isehara Kyodo Hospital. Eligibility required that their attending physicians had determined they could benefit from psychological intervention, that participants had received a comprehensive explanation of the study, and had provided written informed consent freely. Individuals with dementia or hearing impairment that substantially hindered communication were excluded.

Based on a prior study demonstrating the efficacy of short-term life review, the

required sample size was calculated to be 18 participants (effect size = 0.70,  $\alpha$  = 0.05, power = 0.80). Accounting for possible attrition, the final recruitment target was set at 20 participants [8,17].

The definition of terminal care used in this study follows the “Guidelines for Terminal Care” issued by the Ministry of Health, Labor and Welfare:

1. The physician determines, based on objective evidence, that curative treatment is no longer expected to be effective.
2. Except in cases involving impaired consciousness or judgment, the patient, family, physician, nurse, and other stakeholders agree.
3. The patient, family, physician, nurse, and other stakeholders acknowledge the anticipation of death and engage in care planning accordingly [18].

### ***Intervention method***

Overall, four intervention sessions were conducted in private rooms, either at the participant's bedside or seated in a chair, depending on their physical condition. All interviews were audio-recorded after obtaining the participants' informed consent.

The first session focused primarily on a semi-structured interview. A verbatim transcript was generated from the recording, and keywords were extracted for thematic development. The second session followed a similar format. The previously extracted keywords were shared with the participant, who was invited to indicate if any words or episodes should be excluded. A summary of the second conversation was generated, and the participant was asked whether the identified themes could be included in the lyrics. Participants were also encouraged to share additional words or episodes they wished to add. Five pre-composed melody and chord progression sets were presented, from which participants selected their preferred version.

The third session repeated the dialogic structure of the previous sessions. Draft lyrics based on the earlier interviews were presented, and participants revised the lyrics until they felt satisfied. After the third intervention, the participants' memories became more organized, and additional episodes or words they wished to include in the lyrics could surface; these were accordingly added. A summary of this conversation was produced, and participants were asked again if the content could be included in the lyrics. The previously presented music options were revisited, and participants were asked if they wished to revise their selection. In the fourth session, participants listened to the music therapist perform the completed piece and received a CD containing a recording of the piece.

Music influences emotional states through features such as tempo, pitch, and volume [19]. Accordingly, Music Tracks 1 and 2 were selected as up-tempo compositions with a BPM of 100–120, whereas Music Tracks 3–5 were composed with a BPM of 60–80, which has been recommended for reducing pain and anxiety [20]. Although minor keys are often associated with sadness [19], all songs were composed in major keys, considering that participants might listen to the music alone following the intervention. Music Track 4 was composed in G major and featured a broad melodic range. The remaining tracks were composed in C major, excluding Music Track 5, which was written in a monotone style with a narrow melodic range and repeated phrases. Examples of songs are shown in Figure 1. The music therapist recorded original chord progressions and melodies created beforehand. The participants listened to five patterns and selected their favorite. The chosen chord progression was used, and the melody was fine-tuned to match the completed lyrics.

All interventions were conducted in Japanese by a single music therapist who was

certified by the Japan Music Therapy Association and had approximately 6 years of experience.

### ***Questions***

Based on the methodology of Short-term Life Review [8], participants engaged in dialogue guided by the following seven questions:

- a) What is the most important thing in your life and why?
- b) What are the most memorable experiences in your life?
- c) In your life, who or what has influenced you the most?
- d) What role in your life do you consider most meaningful?
- e) Which is your proudest moment?
- f) Is there anything your family should know about you, anything you would like them to tell you, or anything you would like them to remember?
- g) What message or advice would you like to pass on to those who are important to you or to the younger generation?

### ***Analysis***

The primary outcome measure was spiritual well-being, assessed using the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp; conducted under license from [facit.org](http://facit.org)). The FACIT-Sp was developed to evaluate quality of life and spiritual well-being in individuals with cancer, and its reliability and validity have been confirmed in Japanese populations [17]. In this study, 12 spirituality items were used to assess spiritual well-being. A total score (range: 0–48 points) was calculated, with higher scores reflecting greater spiritual well-being.

Anxiety and depression, assessed using the Hospital Anxiety and Depression Scale (HADS), served as secondary outcome measures. The HADS was designed to evaluate anxiety and depressive symptoms in individuals with physical illness [21,22]. It includes seven items, each for anxiety and depression, with higher scores reflecting more severe symptoms. Scores between 8 and 10 are considered borderline, whereas scores  $\geq 11$  indicate clinically significant anxiety or depression. The Japanese translation is licensed for research use [22].

Assessments were conducted at baseline, immediately after the fourth session, and at 2 and 4 weeks following the completion of the intervention. The Friedman test ( $p < 0.05$ ) was used to examine within-subject differences across time points. When significant differences were detected, Bonferroni-corrected post hoc comparisons were applied. All analyses were performed using SPSS Statistics Version 30 (IBM, Armonk, NY).

The analysis of participants' impressions employed Mayring's qualitative content analysis [23]. Qualitative content analysis enables the extraction of elements and domains rather than the processes of participants' thoughts or actions. The data consisted of open-ended written reflections. Descriptions were coded, and categories were created based on defined criteria. Data coding was performed, discrepancies were discussed, and the analysis was repeated. To enhance the credibility, transferability, reliability, and confirmability of the data analysis, triangulation was conducted involving a music therapist, a psychiatrist, a psychiatric researcher, a palliative care physician, and a musicology expert.

## Results

Overall, 20 participants were included in this study. One participant withdrew consent before the start of the intervention, and one participant died during the intervention. Thus, 18 participants were evaluated at T0 and T1, 11 at T2, and 10 at T3 (Figure 2). Participants' ages ranged from 51–86 years (mean  $71.7 \pm 10.6$  years). Participant profiles and the questions reflected in the lyrics are listed in Table 1.

Participants freely answered seven questions. Keywords were extracted, and lyrics were created based on the participants' opinions, and the lyrics were written according to the participants' wishes. After all interventions were completed, participants wrote their impressions on the T1, T2, and T3 questionnaires. A summary of the lyrics is shown in Table 2.

The average FACIT-Sp, HADS(D), and HADS(A) scores are shown in Table 3. In this study, Cronbach's alpha coefficients at T0 were 0.845 for FACIT-Sp, 0.552 for HADS(D), and 0.803 for HADS(A). In a reliability study of the Japanese version of the HADS, Hatta et al. reported that Cronbach's  $\alpha$  for the depression (D) scale was in the 0.5 range, consistent with the results of this study [24]. Furthermore, recent clinical research has also pointed out the weak internal consistency and construct validity of the D scale [25]. Therefore, rather than being a mere error, the lower reliability observed in this study may have stemmed from the scale's inherent characteristics and the small sample size.

### ***FACIT-Sp***

The Friedman test showed a significant difference across timepoints ( $n=9$ ,  $df=3$ ,  $\chi^2=10.395$ ,  $p=0.015$ , Kendall's  $W=0.385$ ). Post hoc comparisons revealed a significant increase in FACIT-Sp scores at T1 compared with those at T0 ( $n=18$ , test statistic =

1.556,  $p=0.011$ ,  $r=0.37$ ), indicating an improvement in the spiritual well-being of the participants. No significant differences were found between T0 and T2 ( $n=11$ , test statistic = 0.111,  $p=0.855$ ,  $r=0.03$ ) or between T0 and T3 ( $n=10$ , test statistic = 0.111,  $p=0.855$ ,  $r=0.04$ ); this finding indicated that the improvement in spiritual well-being was not sustained (Table 3, Figure 3).

### ***HADS (Depression)***

The number of participants with a score of  $\geq 8$ , indicative of suspected or clinically significant depression, was 10 of 18 (56%) at T0, 5 of 18 (28%) at T1, 3 of 11 (27%) at T2, and 1 of 10 (10%) at T3. The Friedman test revealed a significant difference across timepoints ( $n=9$ ,  $df=3$ ,  $\chi^2=14.037$ ,  $p=0.003$ , Kendall's  $W=0.520$ ). Post hoc comparisons showed a significant reduction in depression scores between T0 and T1 ( $n=18$ , test statistic = 1.944,  $p=0.001$ ,  $r=0.46$ ) and between T0 and T3 ( $n=10$ , test statistic = 1.389,  $p=0.022$ ,  $r=0.44$ ), indicating an improvement in depression. No significant change was observed between T0 and T2 ( $n=11$ , test statistic = 0.444,  $p=0.465$ ,  $r=0.13$ ), and no improvement in depression was noted (Table 3, Figure 4).

### ***HADS (Anxiety)***

The number of participants with a score of  $\geq 8$ , indicating borderline or clinical anxiety, was 4 of 18 (22%) at T0, 3 of 18 (17%) at T1, 2 of 11 (18%) at T2, and 1 of 10 (10%) at T3.

The Friedman test showed a significant difference across timepoints ( $n=9$ ,  $df=3$ ,  $\chi^2=10.607$ ,  $p=0.013$ , Kendall's  $W=0.396$ ). Post hoc comparisons revealed a significant reduction in anxiety scores between T0 and T1 ( $n=18$ , test statistic = 1.389,

$p=0.022$ ,  $r=0.33$ ), indicating an improvement in anxiety. No significant differences were observed between T0 and T2 ( $n=11$ , test statistic = 0.222,  $p=0.715$ ,  $r=0.07$ ) or between T0 and T3 ( $n=10$ , test statistic = 0.056,  $p=0.927$ ,  $r=0.02$ ), and no improvement in anxiety was noted (Table 3, Figure 5).

### ***Participants' impressions***

Seventy-seven codes were extracted from the written responses, leading to four major categories (Table 4):

1. Positive feelings toward researchers or the music
2. Recalling the past and realizing it was a good life
3. Hope for the future
4. Sharing with others

Participants recalled their past and realized that it had been a good life. For some participants, the realization that they had lived a good life directly led to hope for the future. Some participants expressed positive feelings toward the researchers or the music, such as gratitude to the researchers for providing the opportunity and favorable impressions of the completed music. Participants who expressed positive feelings toward the researchers also expressed hope for the future. Participants who were satisfied with the completed music went on to talk about sharing it with others (Figure 6).

Each category is explained below.

#### **1. Positive feelings toward the researcher and the music (15 participants)**

This category expresses sentiments such as liking the music, the joy of the

piece being completed, feeling it well represents one's life, and gratitude toward the researcher. Participants expressed liking the melody and high quality of the piece, the joy of completing a one-of-a-kind work, feeling the music was like a theme for their life, and gratitude toward the researcher.

“Thank you for your hard work. My life has come together, and I’m deeply moved.”

“I’m so happy to have a song made just for me, one of a kind in the world.”

## 2. Recalling the past and realizing it was a good life (12 participants)

This category expresses feelings such as reminiscing about oneself, recalling memories with family and positive experiences, reaffirming gratitude towards others, realizing one had a good life, and finding relief by talking about difficult experiences. Participants reflected on their childhood, youth, and episodes with family, reconsidering who they were and their relationships with others. Many stated they had a good life. Participants who spoke about unforgettable painful experiences also reported feeling relieved after sharing them.

“I’d been avoiding it because thinking deeply about it or talking to people about it was exhausting. This time, remembering it and talking it out helped me let it go. I realized so many good things had happened. The painful parts had seeped into my body no matter what, but I’m glad I was able to get it out.”

“Happy memories come flooding back, making my heart leap. Until now, it was life with my mother, her overbearing interference, the things she said to me during my student days, and my own lack of will. I could not see any reason to live. Now I feel that it is good I’m alive.”

### 3. Hope for the future (nine participants)

This category expresses thoughts about how one wishes to live going forward and the desire to live longer. Participants reflected on their relationships with themselves and others, expressing a desire to live the time remaining positively and joyfully. Some also stated that therapy made them feel their illness was cured and that they wanted to live longer.

“I feel a bit lonely, but I'm truly honored that you finished it with such high quality, and it makes me feel like my illness might just get better.”

“I'd much rather enjoy life with my kids than be pessimistic.”

“I'm so happy to have a song made just for me, the only one in the world, and it makes me want to live a little longer.”

### 4. Sharing with others (five participants)

This category represents sharing with friends, family, colleagues, and medical staff. Participants stated they shared or wished to share the music with family and those around them. One participant remarked, “With a little more time, this song will become a shared memory for my family.”

“I think if I listen to this song repeatedly and my family hears it too, it will become a topic of conversation and brighten up the family. I think it will be a good reference for the children too. After a little more time passes, I think this song will become a shared memory for the family.”

“I gave a CD to my coworkers. My coworkers all cried together. The power of music is incredible.”

Quantitatively, improvements in spiritual well-being and alleviation of depression and anxiety were most pronounced at T1. Qualitatively, participants frequently reflected on their past, stating that they felt they had “lived a good life,” followed by expressions of hope for the future and a desire to share the music with others.

Together, the qualitative findings illustrated how participants experienced and interpreted the short-term improvements in spiritual well-being and the alleviation of depression and anxiety observed in the quantitative results.

## Discussion

We developed a music therapy intervention technique, which combined life review with songwriting, that significantly improved spiritual well-being as measured by the FACIT-Sp and reduced depressive and anxiety symptoms as assessed by the HADS in individuals with cancer receiving terminal care. These findings align with previous research on reminiscence therapy, life review, dignity therapy, and songwriting interventions [8-10,13].

In this study, the baseline mean FACIT-Sp score was  $29.8 \pm 9.5$ , increasing to  $33.8 \pm 11.1$  following the intervention. Considering that the average FACIT-Sp score among the general Japanese population is 32 [17], participants whose baseline scores were below this benchmark showed an improvement that exceeded population norms post-intervention. However, no sustained long-term improvement in spiritual well-being was observed. In terminal care, preserving the psychological gains of meaning-centered therapies is often challenging due to progressive decline in somatic vitality and cognitive stamina [26]. Therefore, this intervention alone may be insufficient in the long

term, and it may be necessary to integrate it with broader palliative psychiatric care that includes continued existential support.

The baseline average HADS(D) score was  $8.6 \pm 4.9$ , falling within the “borderline” range suggestive of depressive symptoms. Immediately after the intervention, the mean score decreased to  $5.6 \pm 5.4$ , below the clinical cutoff, and remained in the non-depressed range thereafter. A significant reduction in depression scores was also observed between T0 and T3. Participants in this study exhibited no clinically significant anxiety at baseline, and anxiety scores remained below the diagnostic threshold at all subsequent time points (T1, T2, and T3). Although songwriting as a therapeutic modality is often unstructured and has been hypothesized to provoke anxiety [14], no such adverse effect was observed. In fact, anxiety levels declined post-intervention.

While systematic reviews and meta-analyses have shown that reminiscence-based psychosocial interventions are effective for reducing depression and anxiety in patients with cancer, they elicit distress due to emotionally intense recall or reluctance to share personal history [19,27]. Negative autobiographical memory recall has been associated with the onset or exacerbation of depression, raising implementation concerns in this population. Similarly, in music therapy, patients may become overwhelmed when asked to write lyrics without a structured framework, leading to confusion and anxiety [14,16]. However, with the method we used, participants were able to recall their songwriting experiences smoothly and had positive impressions of being able to look back on their lives. The structured psychotherapy developed in this study, which integrated life review with songwriting, appeared to mitigate these challenges. By providing scaffolding through guided reminiscence and supported lyric

development, the intervention was well tolerated and beneficial. This combined approach was effective in improving short-term spiritual well-being and reducing depressive and anxiety symptoms among individuals with cancer receiving terminal care.

Life reviews may recall not only positive but also negative experiences; however, re-experiencing negative emotions is recommended to integrate and accept past experiences. Positive experiences evoke calm emotions and have the effect of alleviating the unpleasant feelings associated with recalling negative experiences [28]. Participants in this study stated “Talking about it made me feel better” and “It was a good life,” indicating that recalling all experiences helped them recognize a sense of completion and meaning in life [29].

Participants expressed a desire to live their remaining time positively and joyfully. Cancer patients receiving palliative care often experience despair and a loss of meaning in life. “Hope” is considered crucial for coping with these emotions [30]. Through positive recollections about themselves and their relationships with others, they were possibly able to find hope for the remainder of their lives.

Additionally, many participants reported sharing the completed songs with family members, friends, and healthcare providers. Prior studies have shown that patients receiving palliative care who engage in songwriting often record their compositions with the intention of sharing them with others [31]. For individuals at the end of life, the opportunity to express emotions that are difficult to verbalize and to preserve personal memories in a tangible, lasting form is considered meaningful for both the patient and their family members [32]. Although it remains unclear whether the songs created in this study functioned as a form of grief support for bereaved families,

further investigation into their potential role in family-centered palliative care is warranted.

Intense flow experiences during songwriting are associated with increased hope, readiness for change, and self-concept, while life review is linked with a sense of life completion and recognition of meaning [13, 29]. We believe these factors influenced the positive outcomes of this study. A particularly significant contribution of this research was that it addressed the risk of increased anxiety during songwriting and the difficulty of life review.

### ***Limitations***

This study used a pre-post design within a single region, limiting generalizability. Future research should consider conducting a larger randomized controlled trial to validate these findings. Due to the clinical context involving participants receiving terminal care, follow-up was limited, and statistical power was insufficient to detect long-term effects.

This study did not evaluate the psychological state of bereaved family members as part of grief support, but such outcomes may warrant inclusion in future research. Although significant improvements in anxiety scores were observed, baseline anxiety levels were below the clinical threshold, limiting certainty regarding treatment effect.

Although minor keys are often associated with sadness [19], all songs were composed in major keys, considering the fact that participants might listen to the music alone following the intervention. However, some participants may have wanted to express feelings of sadness, and the decision to prepare only major-key pieces cannot necessarily be considered correct.

Finally, Cronbach's alpha coefficient for HADS(D) was low, consistent with the

findings in existing literature [24]. Future research may benefit from the assessment of patients' depressive symptoms using alternative measures.

#### ***Suggestions for future research and clinical practice***

This study examined the effectiveness of a novel music therapy intervention using a single-arm design, which limited the ability to draw comparative conclusions. Future research should include randomized controlled trials with a control group to verify and extend the findings. Furthermore, in clinical practice, interventions for individual subjects require a significant amount of time; therefore, depending on the setting, there may be a need to refine the techniques.

#### **Conclusions**

This study evaluated the effectiveness of a novel music therapy intervention that integrated songwriting and life review for individuals with cancer receiving terminal care. The findings demonstrated significant improvements in spiritual well-being, depressive symptoms, and anxiety. Notably, attrition unrelated to disease progression was minimal, indicating that the intervention was well tolerated. These results suggest that the approach may serve as a clinically viable option for patients experiencing diminished spiritual well-being and affective distress in end-of-life care. By addressing the previously reported challenge of unstructured music therapy, this method may reduce anxiety and enhance reproducibility in clinical settings. Future studies, including randomized controlled trials, are warranted to validate and extend these findings.

#### **DECLARATIONS**

**Ethics approval and consent to participate:** This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Tokai University Hospital (approval date: October 27, 2023; approval number: 23R073). The study's purpose and procedures, voluntary nature of participation, right to withdraw at any time, and protection of personal information were explained to all participants both in writing and verbally. Written informed consent was obtained from each participant.

**Consent for publication:** While the data does not contain personally identifiable information, we have obtained consent after explaining that data such as lyrics content will be published.

**Availability of data and materials:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing interests:** NN reports receiving grants from the 2024 Tokai University School of Medicine Research Aid and the 2023 Foundation for Promotion of Cancer Research in Japan. AY reports receiving grants from the 2021 and 2024 Grants-in-Aid for Scientific Research, outside the submitted work. MT reports receiving grants from the 2017 international cooperation research grant, and personal fees from Otsuka Pharmaceutical Factory, Inc.; Eisai Co., Ltd., and Specialist Doctors Inc., outside the submitted work. BT reports receiving personal compensation from Daiichi Sankyo Co., Ltd., MSD K.K., Shionogi & Co., Ltd., and Ono Pharmaceutical Co., Ltd., outside the submitted work. OM reports receiving personal fees from Daiichi Sankyo Co., Ltd., outside the submitted work. KY reports receiving grants and personal fees from Otsuka Pharmaceutical Co., Ltd.; Shionogi & Co., Ltd., and Eisai Co., Ltd., as well as personal fees from Mitsubishi Tanabe Pharma Corporation, Sumitomo Dainippon Pharma Co.,

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**Authors' contributions:** All authors contributed significantly to the conception and design of this study. NN, MT, BT, TI, OM, KH, and KY contributed to data collection. NN, MK, SO, and KY analyzed the data. NN, AY, and KY wrote the manuscript. KY supervised the study.

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**Tables**

Table 1. Participant profiles

Participants	Age	Marital status	Roommate	Education	Main illness	Religion	Sex	Music track	Questions used in lyrics*
1	51	Married	Yes	Technical school	Pancreatic	No	Female	3	a, b, c, f
2	70	Married	No	Technical school	Rectal	No	Male	2	a, b, e, f
3	68	Married	Yes	University	Lung	No	Male	3	a, b, e, f
4	59	Divorced	Yes	University	Breast	No	Female	1	a, b, c, f
5	73	Married	Yes	University	Lung	No	Male	1	a, b, e, f
6	69	Married	Yes	Technical school	Colorectal	No	Male	4	a, b, e, f
7	57	Married	Yes	Technical school	Sigmoid colon	No	Female	2	a, b, f
8	68	Divorced	No	High school	Sigmoid colon	No	Male	2	b, c, e
9	81	Widowed	Yes	Junior high school	Pancreatic	Yes	Female	3	a, b, c, f
10	86	Married	Yes	University	Rectal	No	Male	1	a, b, c, e, f
11	59	Unmarried	Yes	Junior college	Uterine	No	Female	3	a, b, c, e, f
12	85	Married	Yes	Junior high	Stomach	No	Male	3	a, b, e, f, g

				school					
13	71	Married	Yes	High school	Rectal	No	Female	3	b, d, f
14	82	Divorced	No	High school	Hepatocellular carcinoma	No	Male	1	a, b, e, f
15	85	Married	Yes	University	Intrahepatic cholangiocarcinoma	Yes	Female	3	b, e, f
16	82	Widowed	Yes	Junior high school	Pancreatic	No	Female	2	a, b, c, f
17	77	Married	Yes	High school	Liver	No	Male	2	a, b, e, f
18	68	Married	Yes	University	Renal cell carcinoma	No	Male	1	a, b, e, f

Table 2. Summary of lyrics

1	Spending time with my grandparents during my childhood inspired me to pursue a career in caregiving. My high school club activities with my friends and raising my children were the highlights of my youth. When I left my hometown to get married, my mother supported me, and I want to tell her how happy I am here. I love supporting my adorable children. My husband's proposal and our wedding in Karuizawa are my fondest memories.
2	When I was young, my family opposed my marriage to a woman with children, but I loved my children so much that I overcame their opposition. To protect my family, I purchased a truck and started my own company. There were difficult times, such as the deaths of my father and subordinates, but I was able to get through them because of my family. I am grateful to my children for making me their father.

3	<p>When I was at university, I studied engines and talked about my dreams with my friends. I remember how happy my parents were at my graduation ceremony. I am proud that I worked hard and was relied upon. I was happy when my children were born, but I regret that I was always working when I should have been spending time with them. I have fond memories of living in Paris with my wife after I was transferred there, and I hope she feels the same way. I am glad I mustered up the courage to call her before we got married.</p>
4	<p>My youth was filled with bike rides with friends and music we listened to together. My second son has a disability, but he is a cute child who is loved by everyone around him. I believe that having a unique personality is not a bad thing, but rather a wonderful thing. I have always relied on my eldest son, but when I think that he too had his own time, I feel sorry for him. My children are my treasures, and I live my life thinking of them.</p>

5	I worked diligently. When my children were born, I was happy to realize that they were my own. My eldest daughter worked too hard and passed away at a young age. I feel sorry for her. I want to see my grandchildren grow up. I was happy to meet my wife at the age of 22. I hope to be married again someday.
6	I have valued trust and made my dreams come true. I want to talk to my deceased parents. Although I am ill and cannot play much, I want my grandchildren to be happy. I think it is a miracle that I have two children. I am proud of my children. When I met my wife, I thought she was beautiful. Our wedding in Akasaka was a happy occasion. I think my wife is a wonderful person.
7	I reunited with my husband while going to live music shows with friends and working hard at a job I loved. On our 25th

	anniversary, we saw the beautiful ocean together. I didn't have a good relationship with my family in the past, so I have always cherished my husband and children. When our two children were born, I was truly happy and joyful. It has been fun to support my children.
8	I used to be poor and helped out at my parents' business, but I wasn't dissatisfied. My mother would occasionally take me to the movies. I didn't really understand the stories, but it was a special time. I couldn't support my family on a salaryman's salary, so I started my own company. There have been good times and bad, but I'm satisfied with everything.
9	My hometown is a town where it snows. As the eldest daughter, I worked hard not to make my parents cry. My father has passed away, but I still feel that he is watching over me. When I wanted to run away from my strict in-laws, I had a child, and my life got better. When I first met my husband, I thought he had kind eyes. We lived together for 57 years, and when he passed away, he gave me a peace sign. I want to apologize to my children for being strict with them and tell them that I will always be

	watching over them.
10	My father died in the war, and I was raised by my mother. I am proud that I started working at the age of seven to help my mother. When I was in university, I used to go to a singing café with my friends. I still remember the highballs I drank there and the songs we sang with our arms around each other's shoulders. I met my wife when I was working hard. I was too embarrassed to be present at the birth of my children, and I didn't play with them much. I regret that I was so young at the time. I want my family to continue to live happily.
11	On my mother's birthday, I bought flowers with my late father and we ate half a cake each. I remember well the round moon I saw from behind as my father carried me on his back. I wanted my beloved grandmother to be with me. I want to tell her that I love her. I spent my university days as a manager for the rugby club, and after graduating, I studied hard and made my dream come true. I cherish my family and my cute cats more than anything else, and I feel that I am a

	happy person.
12	I worked in a job that involved electricity, and I would rush to the scene whenever there was a problem, even during typhoons or thunderstorms. I brought light to a dark island, bringing joy to the residents. I taught my subordinates to never cut corners, no matter how difficult the job. I met my wife when I was 23. She looked so beautiful in her kimono that I was embarrassed to walk beside her. I feel very happy that my children always worry about me.
13	I grew up in downtown Tokyo. My father was kind, but my mother and I often fought. My older brother helped me practice riding a bicycle. I met my husband when I was 22. We agreed to meet at Yurakucho Station, but the station was so big that we couldn't find each other right away. I was truly happy when my children were born. Seeing my husband's baby crawl into his blanket at the hospital was so cute. I always worry about my children and nag them, but they are the

	most important people in my life. I hope their dreams come true.
14	My hometown had beautiful seas where I went fishing with my friends. I often played at my father's general store. My mother was a strong woman whom I loved. Although I was busy with work and had to leave early in the morning every day, I enjoyed my life. When my children were born, I looked at their faces and thought they were adorable. I cherish my ex-wife, the mother of my precious children, more than anything else. I hope she stays healthy and happy.
15	I spent my university days in the mountains with the mountaineering club. I was once stranded in the mountains. I actually wanted to become a doctor, but gave up to take over the family business. Still, I am proud that I worked so hard. I lived with my parents after getting married, but I regret leaving home because my husband and parents didn't get along, and I want to apologize to my parents. My youngest child died at an early age. It was the most difficult time of my life,

	but my daughter saved me. My children are as adorable now as they always have been. I love my family.
16	I left home at the age of 15 to make life easier for my mother and worked at a fish shop and as a babysitter. At work, I was taught that “you return what you receive when you are able to.” My children would fight with each other while making ramen for me, and their efforts brought tears to my eyes. Although my children did not like their father very much, I want them to know that he truly cherished them. Having my children made me happier than I could ever express in words.
17	I worked at a mountain lodge in the summer and at a ski resort in the winter. Since I was 18, I believed that this was the only thing for me. I am proud of changing the theory of skiing. I first met my wife 30 years ago, but we broke up once. She says it wasn't me fault, but I think I hurt her. I was really happy to be reunited with her. I had a happy life.

18	<p>I was a slacker in university, and the second floor of a soba restaurant in my neighborhood was our hangout. After graduation, I worked really hard. The pay wasn't great, but I enjoyed it. I met my wife through a friend, and we exchanged business cards at a coffee shop. We went out together to Yokohama and shrines. We got married 29 years ago. My wife called to tell me she was pregnant, and I rushed to catch the 5:32 AM train. My daughter was strong-willed and a source of pride, but she passed away two years ago. I believe I will see her again. My son was cute and grew up to be strong.</p>

Table 3. Mean scores for each measure

	T0	T1	p-value (T0×T1)	r (T0×T1)	T2	p-value (T0×T2)	r (T0×T2)	T3	p-value (T0×T3)	r (T0×T3)
FACIT- Sp	29.8 (SD=9.5)	33.8 (SD=11.1)*	0.011	0.37	31.2 (SD=7.0)	0.855	0.03	33.4 (SD=7.6)	0.855	0.04
HADS(D) )	8.6 (SD=4.9)	5.6 (SD=5.4)*	0.001	0.46	6.7 (SD=3.5)	0.465	0.13	4.5 (SD=3.1)*	0.022	0.44
HADS(A) )	4.4 (SD=4.0)	3.8 (SD=4.6)*	0.022	0.33	5.0 (SD=4.6)	0.715	0.07	4.0 (SD=2.7)	0.927	0.02

FACIT-Sp, Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale; HADS(D), Hospital Anxiety and Depression Scale (Depression); HADS(A), Hospital Depression and Anxiety Scale (Anxiety)

Table 4. Participants' impressions

Categories	Definition	Codes
Positive feelings toward researchers and the music	<p>Positive feelings toward the completed piece and the researcher</p> <ul style="list-style-type: none"> <li>- Enjoying the music</li> <li>- Joy at the piece's completion</li> <li>- Feeling it expresses one's own life well</li> <li>- Gratitude toward researchers</li> </ul>	<p>Gentle melody</p> <p>Feeling the power of music</p> <p>The song is well-crafted</p> <p>Moving</p> <p>The joy of completing a one-of-a-kind song</p> <p>Music pairs well with the lyrics</p> <p>The joy of leaving behind a CD about myself</p> <p>It energizes me</p> <p>The song beautifully expresses my confident life</p> <p>Healing</p> <p>Listening for mental care</p> <p>Gratitude for researchers hard work</p> <p>Gratitude for drawing out feelings in just a few sessions</p> <p>Gratitude for listening to my story</p>
Recalling the past and realizing it was a good life	Expressions for looking back on the past and the realization that it was a	I remembered things I had forgotten and gained a better understanding of myself.
		I felt nostalgic.

	good life	It became an opportunity to reflect on my own life.
	- Remembering oneself	I recall things about myself even outside of family's past intervention time.
	- Remembering the good things that have happened	I look back on the past. I remember when my children were young. I reflect on the happiness of having children.
	- Reaffirming gratitude towards those around you	I recall how my children's happiness was my joy.
	- Reaffirming that it was a good life	Sharing made the memories vivid. The joy of speaking honestly about myself.
	- Finding relief by talking about difficult experiences	There were many good and happy things. I realize I've had a blessed life. I realize how many people were involved in my life. Gratitude for being blessed with supportive people around me. I realize I was protected by my family and God, and feel that whatever happens from now on will be okay.
		Work and family memories were good things
		Recognizing anew how precious family is, and feeling gratitude
		I couldn't find meaning in life through my

		<p>relationship with my mother, but I felt it was okay to be alive</p> <p>After getting sick, I avoided interacting with people, but talking about it helped me let go</p> <p>It was good to vent those painful experiences</p> <p>I can't be detached about getting sick, but turning it into lyrics provided closure</p> <p>I felt lighter and happier</p>
Hope for the Future	<p>Expressions of Hope for the Future</p> <p>- How I Want to Live</p> <p>- The Desire to Live</p> <p>More</p>	<p>I want to live happily with my children without being pessimistic</p> <p>I want to live harmoniously with my family</p> <p>I want to live a little longer</p> <p>I feel like my illness might be cured</p> <p>I will keep on living</p> <p>I will live by listening to music to heal my pain</p> <p>I want to get well and go on a family trip</p> <p>Courage to live well up</p> <p>I want to strive forward positively</p>

Sharing with others	Expressions for sharing music with those around you	I want to share this with my friends I think my husband would enjoy hearing it I think my family would listen and feel uplifted
	- Sharing with friends	I think it could become a family reminiscence activity
	- Sharing with family	I think children would listen and find it helpful
	- Sharing with colleagues	We listened as a family and had a wonderful time
	- Sharing with medical staff	I distributed CDs to hospital staff I distributed CDs to my coworkers

**Figure Legends**

Figure 1. Representative sheet music of a song

Music Track 1 composed at BPM 100. The melody has been fine-tuned to match the completed lyrics.



Figure 2. Number of participants

Overall, 20 participants were included in this study.

One participant withdrew consent before the start of the intervention, and one participant died during the intervention. Thus, 18 participants were evaluated at T0 and T1. Subsequently, one participant developed consciousness disorder, five died, and one forgot to complete the questionnaire. Thus, 11 participants were evaluated at T2. Subsequently, two participants died, while the participant who forgot to complete the questionnaire at T2 responded. Thus, 10 participants were evaluated at T3.

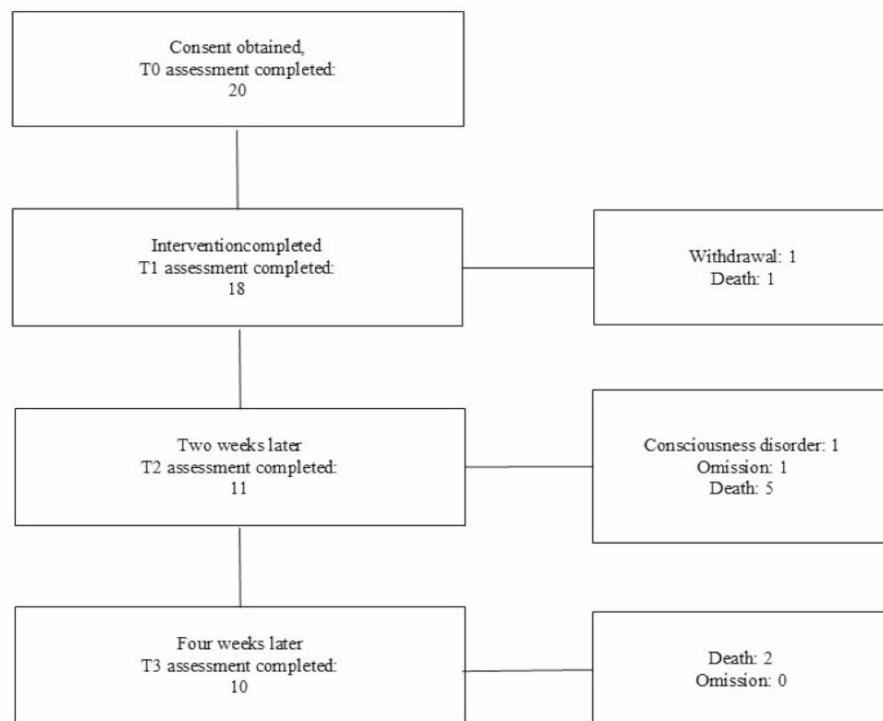


Figure 3. Results for FACIT-Sp

\*Items with significant differences

FACIT-Sp, Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale

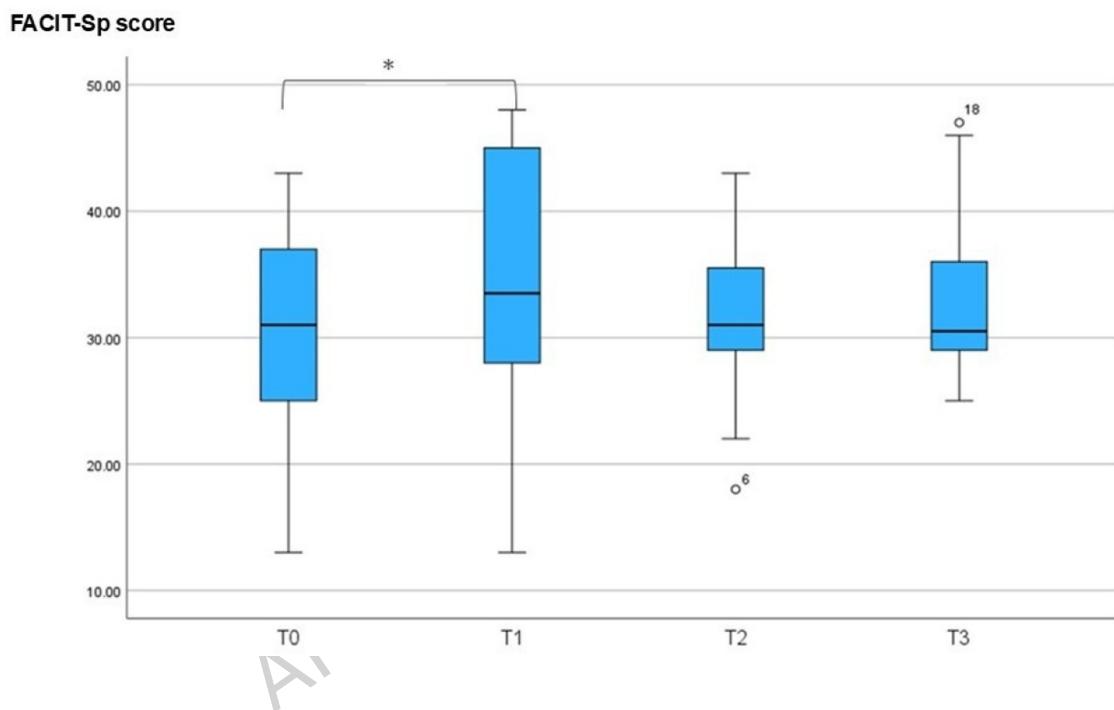


Figure 4. Results for HADS(D)

\*Items with significant differences

HADS(D), Hospital Anxiety and Depression Scale (Depression)

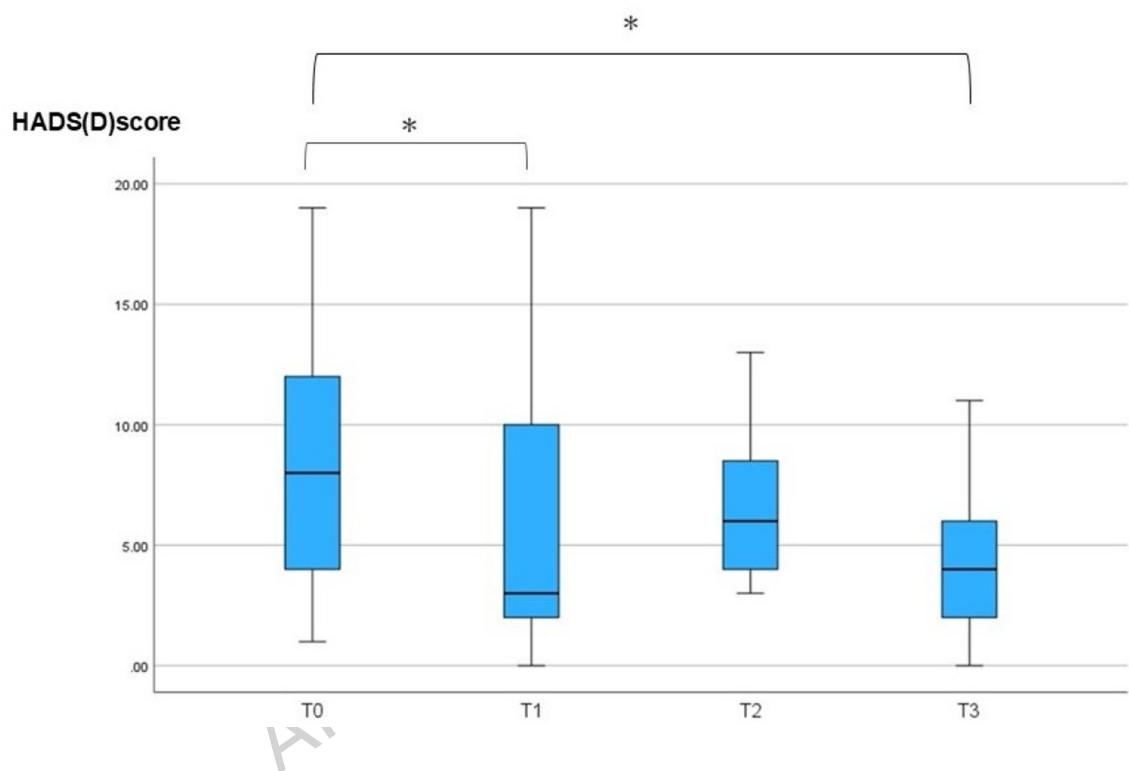


Figure 5. Results for HADS(A)

\*Items with significant differences.

HADS(A), Hospital Anxiety and Depression Scale (Anxiety)

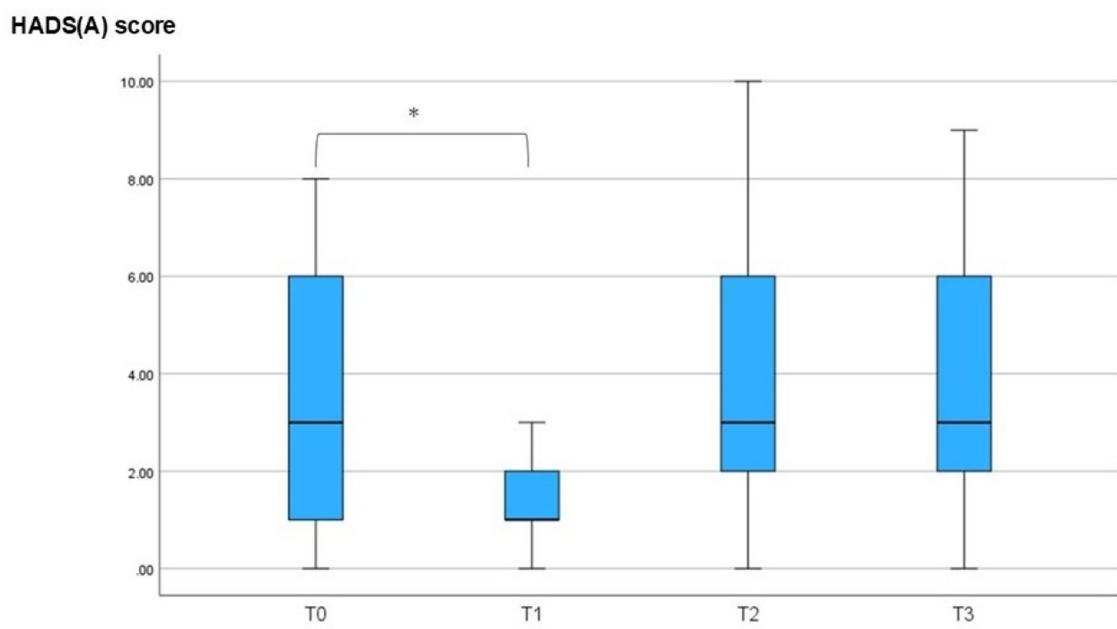


Figure 6. Diagram showing the participant feedback categories

Participants recalled their past and realized that it had been a good life. For some participants, the realization that they had lived a good life directly led to hope for the future. Some participants expressed positive feelings toward the researchers or the music, such as gratitude to the researchers for providing the opportunity and favorable impressions of the completed music. Participants who

expressed positive feelings toward the researchers also expressed hope for the future. Participants who were satisfied with the completed music went on to talk about sharing it with others.

