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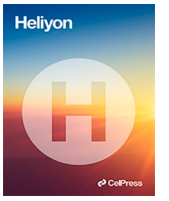

Research article

An online supportive music and imagery intervention to promote ICU nurses' stress management: Preliminary study

Aimee Jeehae Kim [a], Sungwon Na [b], Jung Yeon Kim [c], Soo Ji Kim [d,**,1], Jeongmin Kim [b,*,1]

[a] Department of Musicology and Culture, Music Therapy Major, Graduate School, Dong-A University, Busan, 49315, Republic of Korea
[b] Department of Anesthesiology and Pain Medicine, Anesthesia and Pain Research Institute, Yonsei University College of Medicine, Seoul, 03722, Republic of Korea
[c] Severance Hospital Nursing Department, Yonseiro 50-1, Seodaemungu, Seoul, 03722, Republic of Korea
[d] Music Therapy Education, Graduate School of Education, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul, 03760, Republic of Korea

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ABSTRACT

Nurses in intensive care units are subjected to high levels of work-related stress and must cope with psychological distress. This preliminary study explored the effects of an online supportive music and imagery intervention on these nurses' perceived stress, psychological distress, and sleep quality. A prospective pre–post design was employed to investigate the effectiveness of online supportive music and imagery interventions. The intervention comprised five weekly sessions, each lasting 50–60 min, which included verbal interactions and listening to music, and were facilitated by trained music therapists. Perceived stress and psychological distress were measured before and after the five-week program to investigate its effectiveness, and the current stress level and emotional state were measured before and after each session to explore changes over the intervention period. Sleep quality was measured weekly. In total, 29 participants completed the program. The results showed a significant decrease in perceived stress ($d = 0.45$, $p = .045$) and psychological distress ($d = 0.53$, $p = .045$) after the intervention. Regarding changes over the intervention period, the findings demonstrated a significant main effect of the number of sessions on perceived stress ($p = 0.001$), energy ($p = 0.001$), and tension ($p = 0.023$), whereas the effects on perceived valence and scores on the Korean version of the Insomnia Severity Index were not significant. Moreover, a significant post-session main effect was observed for all perceived stress and emotion ratings ($p < 0.001$). Online supportive music and imagery interventions may help reduce stress levels and enhance positive emotional states among nurses in intensive care units. Integrating self-work into supportive music imagery interventions may increase adherence to the intervention and extend its effect.

* Corresponding author. Department of Anesthesiology and Pain Medicine, Yonsei University College of Medicine, 50-1, Yonsei-ro, Seodaemun-gu, Seoul, 03722, Republic of Korea.
** Corresponding author. Music Therapy Education, Graduate School of Education, Ewha Womans University, 209 Case Hall, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul, 03760, Republic of Korea.
E-mail addresses: specare@ewha.ac.kr (S.J. Kim), anesjeongmin@yuhs.ac (J. Kim).
[1] They equally contributed as corresponding authors

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1. Introduction

Intensive care units (ICUs) are a highly stressful work environment for nurses [1,2]. High levels of work stress can cause physical problems, such as high blood pressure, digestive issues, and sleep disorders, and psychological issues, such as anxiety, depression, and post-traumatic stress disorder [3–6]. Additionally, ICU nurses commonly face sleep difficulties resulting from work schedules based on shift work [7]. Significant work stress and insufficient sleep can affect their professional performance, along with their physical and mental well-being and social life [8–10]. The prevalence of high burnout levels among ICU nurses has been extensively documented [11].

The coronavirus disease 2019 (COVID-19) pandemic has exacerbated workplace stress for ICU nurses, who deal with massive influxes of patients, ICU beds, supply shortages, numerous end-of-life decisions, and fear of getting infected or infecting others with diseases, including their families [12,13]. During the pandemic, their workload and healthcare roles expanded, adding additional pressure to the workplace [14,15]. Given the tremendous strain placed on ICU nurses, it is critical to develop interventions that support them in effectively dealing with work-related stress.

Previous studies have addressed the benefits of music for stress management [16–19]. Both active music production and passive music listening have been successfully used to reduce stress. Regarding stress reduction among ICU nurses, research found that physiological and subjective levels of stress were significantly lowered after listening to their preferred musical selections [18,20]. Considering the highly intense work stress experienced by ICU nurses during the COVID-19 pandemic, it is crucial to identify and integrate efficient research-based coping strategies into the interventions that support ICU nurses at their workplace [21,22].

Music and imagery (MI) is a music-centered psychotherapy approach derived from the Bonny method of Guided Music and Imagery (BMGIM). Supportive music and imagery (SMI) facilitates the development of positive psychological resources through deep music listening [23]. Psychological resources (i.e., self-efficacy and self-acceptance) are positive dispositions that contribute to personal well-being and resilience, further enhancing individual adaptation [24,25].

Unlike simply listening to music, SMI uses music listening to actively induce positive emotional experiences and physical relaxation, using this connection to experience and develop adaptive and positive psychological resources [23,26]. In SMI, the therapist tailors music-based experiences and imagery to meet each participant's specific needs [27], and verbally guides the participants through the SMI process [28]. Focusing on positive resources rather than issues can help participants develop the internal resources and resilience required to cope with psychological distress.

Studies on SMI and MI have revealed significant improvements in psychological well-being among clinical populations with chronic pain or stress [27,29,30]; however, no published research has addressed the application of SMI to healthcare professionals. Given the need to help ICU nurses deal with workplace stress, we modified the SMI process to offer it to them as an online intervention. This preliminary study aimed to examine the effects of a five-week online SMI therapy intervention on perceived stress, psychological distress, emotions, and sleep quality among ICU nurses. Specifically, we investigated the changes in perceived stress and psychological distress after completing the program. Perceived stress ratings, emotion ratings, and sleep quality were measured in each session to explore changes over the intervention period.

2. Materials and methods

2.1. Ethical approval

The study procedure was reviewed and approved by the Institutional Review Board of Severance Hospital (4-2019-0207), Seoul, Korea. Participants provided written consent after meeting with the researchers personally.

2.2. Study design and participants

A prospective pre-post design was used to examine the effectiveness of the five-week online SMI intervention. ICU nurses who volunteered to participate in the study, did not have any difficulty listening to music, and were not currently participating in other stress management programs were eligible for inclusion. Participants diagnosed with mental disorders, such as anxiety or major

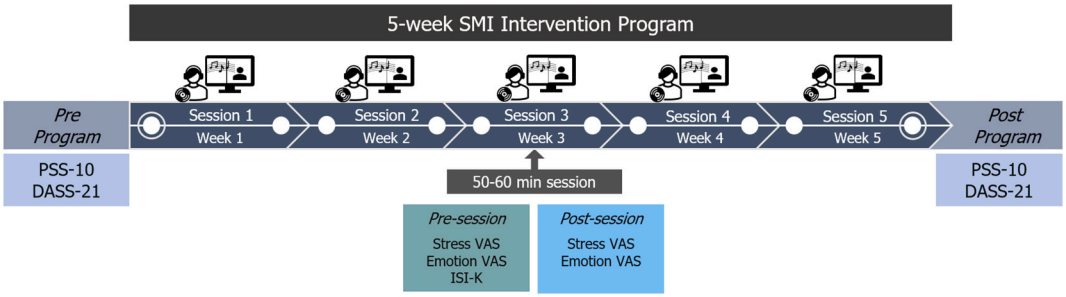

Fig. 1. Data collection process (PSS-10=Perceived Stress Scale; DASS=Depression Anxiety Stress Scale).

depressive disorder were excluded from the study.

2.3. Procedures

The participants were recruited between June 2021 and February 2022 through flyers distributed to ICU nurses working at S Hospital, Seoul, Korea. The flyers provided information on the study objectives, procedures, and eligibility criteria. Eligible participants who expressed interest met the researchers personally to provide written consent. During this meeting, participants were given questionnaires and drawing materials. Each participant was assigned to an accredited MI music therapist and participated in a five-week online intervention. The intervention consisted of five weekly online individual sessions of 50–60 min over five weeks. The sessions were scheduled at times convenient for the participant. The study was conducted between June 2021 and April 2022.

Fig. 1 illustrates the intervention and data collection processes. A printed questionnaire was distributed before the intervention began.

During each session, the participants were instructed to complete their questionnaire and manually rate their perceived stress and emotional state before and after each session while still online with their music therapist. This process allowed the therapists to ensure that the participants completed the required items; however, they remained unaware of the participants' specific responses. Upon completion, all questionnaires were collected by a research team member who was not affiliated with the music therapist.

2.4. SMI intervention

This was the first study to implement online receptive music therapy for medical staff by integrating listening to music and verbal interactions. We modified the traditional SMI approach to focus on stress management among ICU nurses by addressing potential stressors and facilitating awareness and coping strategies through integrating physical and psychological relaxation.

Participants were instructed to log in to their weekly online session using ZOOM from a quiet and private room and to use earphones to minimize external disturbances. At the beginning of each session, the therapist conducted a quick technical assessment, optimized the volume of the music, and adjusted the self-views on the screen to facilitate face-to-face verbal interactions.

Each session started with a pre-discussion (10 min), during which participants discussed their current stress and level of emotion and identified any stressors from the past week. After the discussion, the therapists selected two or three music pieces based on the emotional and psychological needs of the participants, as identified in the session introduction. The participants selected the final piece of music for further discussion. The music selections (5 min) were based on calming and relaxing musical features, such as slow tempo and repetitive forms with minimal development. Subsequently, the therapists verbally guided the participants through the relaxation and imagery processes. This involved guiding the participants to listen attentively to the selected music. A single piece of music was repeated two or three times. The participants were instructed to illustrate the imagery experience once the music ended. The entire process took approximately 25–30 min to complete. Finally, in the post-discussion (15 min), the music imagery experience and changes in stress and emotion while listening to music were discussed to verbally integrate the experience. Meanings and aspects of the experiences that could be applied to daily life and stressful work situations are also discussed. At the end of the session, a streaming link for the music was provided to the participants They were instructed to listen to music at least daily and whenever they needed to de-stress. Table 1 lists the SMI procedure.

2.5. Measures

Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10) [31]. The PSS-10 measures an individual's evaluation of how stressful the situations were that they had faced in the past month. The scores ranged from 0 to 40 and were interpreted as follows: 0–13 (low), 14–26 (moderate), and 27–40 (high). The internal consistency of the present sample, as measured using Cronbach's alpha coefficient, was 0.72.

Table 1
Session procedures.

Stage	Procedure	Contents	Duration (min)
1	Pre-discussion	• Current stress and emotion level • Stressors • Personal use of music in the past week	10
2	Music selection	• Based on pre-discussion • Calming and relaxing music with slow tempo, repetitive form, and fewer musical developments	5
3	Physical and psychological relaxation through attentive music listening	• Verbally guided relaxation • Entraining physical arousal and body sensations to music • Music-induced imagery experience • Illustration of imagery	30
4	Post-discussion	• Changes in stress and emotion levels induced during music listening • Application to daily life and stressful situations • Instructions for self-application of music in daily life	15

Psychological distress was measured using the Depression Anxiety Stress Scale (DASS-21) [32], comprising three subscales: depression, anxiety, and stress. The 21-item scale provides scores for each subscale, indicating the degree of psychological symptoms experienced by an individual during the past week. The recommended cutoff scores for depression are 0–9 (normal), 10–13 (mild), 14–20 (moderate), 21–27 (severe), and ≥28 (extremely severe). The cutoff scores for anxiety were 0–7 (normal), 8–9 (mild), 10–14 (moderate), 15–19 (severe), and ≥20 (extremely severe). In terms of stress, the cutoff scores were 0–7 (normal), 8–9 (mild), 10–14 (moderate), 15–19 (severe), and ≥20 (extremely severe). The overall Cronbach's alpha for the DASS-21 was 0.90. The Cronbach's alpha values for depression, anxiety, and stress were 0.83, 0.64, and 0.83, respectively.

Additionally, we assessed changes in the participants' perceived stress, emotional levels, and sleep quality within the intervention period and across each of the five sessions. Perceived current stress and emotional levels were rated before and after each session using a visual analog scale (VAS) with four items: stress, energy, tension, and valence. The three dimensions (energy, tension, and valence) were adopted from a previous study [33]. We chose the VAS because of its high sensitivity in assessing momentary changes [34] and greater efficiency in examining perceived stress than other stress scales [35].

Participants were asked to mark a vertical line on a 100 mm horizontal line to indicate their perceived stress and emotional state at that particular moment. At each end of the scale, the degree of perceived stress and emotion was indicated as follows: no stress at all, extreme stress (stress), low energy–high energy (emotion-energy), relaxed–tense (tension), and negative–positive (valence).

Sleep quality was measured using the Korean version of the Insomnia Severity Index (ISI–K), validated by Cho et al. [36], administered before each session to assess the participants' level of sleep disturbance. The scores ranged from 0 to 28, with higher scores indicating greater sleep disturbance. A cutoff score of 15.5 is suggested to discriminate clinical insomnia.

2.6. Sample size

The sample size was calculated using the G*Power Version 3.1.9.6 program based on similar single-group intervention studies to reduce ICU nurses' stress and psychological symptoms [37]. The effect size was calculated by entering the differences in the mean and standard deviations (SDs) of the DASS-21 stress scores (M = 3.14, SD = 5.75) from a previous study. A power analysis for a two-sided one-group paired *t*-test yielded the need for a minimum of 29 participants based on DASS-21 scores (power = 80 %, α = 0.05, effect size = 0.546).

2.7. Data analysis

Descriptive statistics were used to analyze the participant demographics and ratings at each time point. To confirm the effects of the program, we conducted a paired *t*-test to analyze changes in participants' PSS-10 and DASS-21 scores before and after the program. Individual subscales were analyzed to detect variations in depression, anxiety, and stress. Additionally, we calculated p-values using Holm–Bonferroni corrections, considering the familywise error rates of multiple comparisons. To examine the changes over the intervention period for each session, we used a generalized linear mixed model (GLMM) with a link identity function and an unstructured covariance matrix to consider individual differences among participants. We used the GLMM because it has been suggested to be especially useful for analyzing repeated measures and non-normally distributed data. For perceived stress and emotion ratings, the number of sessions and pre- and post-session ratings were modeled as fixed effects, whereas for ISI–K scores, the GLMM model did

Table 2
Demographic characteristics (N = 29).

Characteristic	*N*	Percentage (%)	*M*	*SD*
Age, years			27.93	5.23
Gender				
Woman	23	79.3		
Man	6	20.7		
Work experience, months			55.66	64.50
Unit				
PICU	4	13.8		
SICU	11	37.9		
MICU	4	13.8		
NCU	6	20.7		
CAICU	4	13.8		
Preference for music listening				
Yes	29	100.0		
No	0	0.0		
Average daily music listening time				
Not at all	1	3.4		
<30min	15	51.7		
<1 h	9	31.0		
<2 h	3	10.3		
>2 h	1	3.4		

Note. PICU: Pediatric Intensive Care Unit; SICU=Surgical Intensive Care Unit; MICU = Medical Intensive Care Unit; NCU=Neurosurgical Care Unit; CAICU: Cancer Intensive Care Unit.

not include pre- and post-session rating effects. Random effects to correct for individual differences at baseline were included in the model for all measures. All statistical analyses were conducted using SPSS Statistics software (version 27.0; IBM Corp., Armonk, NY, USA).

3. Results

3.1. Participant demographics

Participant recruitment was conducted over nine months. We recruited 36 participants, 32 of whom were enrolled in the study. Subsequently, two withdrew due to scheduling conflicts. One participant was identified as an outlier with scores greater than three standard deviations above the mean. This participant was presumed to have a clinically relevant mental condition. Thus, 29 participants were included in the final data analysis. The mean age of the participants was 27.93 years (SD = 5.23); additionally, there were 23 female nurses and six male nurses, with an average work experience of 55.66 months (SD = 64.50). All participants were current ICU nurses, and 26 worked rotational shifts. They reported enjoying listening to music, and the majority reported doing so daily. Demographic characteristics are presented in Table 2.

The PSS-10 and DASS-21 scores at baseline indicated that 82.8 % of the participants had moderate stress, and 10.3 % and 6.9 % had low and high perceived stress, respectively. The mean PSS-10 score was 19.24 (SD = 4.54). Participants' DASS-21 mean scores were within the normal cutoff range; however, a considerable number of participants experienced depression, anxiety, and stress symptoms. The mean ISI–K score at baseline was 17.27 (SD = 5.75), which was slightly higher than the cut-off score [36] (Table 3).

3.2. Pre–post changes

The paired *t*-test results revealed an overall decrease in the participants' perceived stress and psychological distress after the intervention. There was a significant decrease in PSS-10 [$t(28) = 2.431$, $p = .045$], DASS-Depression [$t(28) = 2.587$, $p = .045$], DASS-Anxiety [$t(28) = 2.885$, $p = .035$], and DASS-Total [$t(28) = 2.857$, $p = .035$] in the post-test results compared with the pre-test results (Table 4).

3.3. Changes over intervention period

GLMM results demonstrated a significant main effect of the number of sessions on perceived stress ratings ($\beta = -2.52$, $p = 0.001$), perceived energy ($\beta = 1.78$, $p = 0.001$), and perceived tension ($\beta = -1.72$, $p = 0.001$). However, the main effect on perceived valence did not reach significance ($\beta = 0.21$, $p = 0.684$). Results on sleep quality showed no significant main effect of the number of sessions on ISI–K scores, as well ($\beta = -0.24$, $p = 0.265$). These results suggest that significantly lower stress and tension, and higher energy levels were perceived during the intervention period as the sessions proceeded.

In terms of changes before and after each session, GLMM results indicated a highly significant post-session main effect on all VAS

Table 3
Baseline measurements (N = 29).

Measure	Number (N = 29)	Percentage (%)	*M*	*SD*
PSS-10			19.24	4.54
Low (0–13)	3	10.3		
Moderate (14–26)	24	82.8		
High (27–40)	2	6.9		
DASS-Total (0–42)			27.86	16.80
DASS-Depression			8.55	6.89
Normal (0–9)	18	62.1		
Mild (10–13)	4	13.8		
Moderate (14–20)	5	17.2		
Severe (21–27)	2	6.9		
Extremely severe (28+)	0	0.0		
DASS-Anxiety			6.55	5.18
Normal (0–7)	17	58.6		
Mild (8–9)	4	13.8		
Moderate (10–14)	6	20.7		
Severe (15–19)	1	3.4		
Extremely severe (20+)	1	3.4		
DASS-Stress			12.76	6.98
Normal (0–14)	20	69.0		
Mild (15–18)	3	10.3		
Moderate (19–25)	5	17.2		
Severe (26–33)	1	3.4		
Extremely severe (34+)	0	0.0		
ISI–K			17.27	5.75

Note. PSS-10, Perceived Stress Scale; DASS, Depression Anxiety Stress Scale; ISI–K, Insomnia Severity Index-Korean version.

Table 4
Changes in the perceived stress and psychological distress after participating in the SMI intervention (N = 29).

Outcome measure	Pre-test		Post-test		*df*	*t*	*p*	Adjusted *p* (Holm-Bonferroni)	*d*
	M	SD	M	SD					
PSS-10	19.24	4.55	17.29	3.98	28	2.431	0.022	0.045*	0.45
DASS-Total	27.86	16.79	20.34	14.01	28	2.857	0.008	0.035*	0.53
DASS-Depression	8.55	6.88	5.79	5.16	28	2.587	0.015	0.045*	0.48
DASS-Anxiety	6.55	5.18	4.21	3.87	28	2.885	0.007	0.035*	0.54
DASS-Stress	12.76	6.98	10.34	7.19	28	2.017	0.053	0.053	0.38

Note. PSS=Perceived Stress Scale; DASS = Depression Anxiety Stress Scale.

measures, including perceived stress ($\beta = -18.34$, $p < 0.001$), energy ($\beta = 7.01$, $p < 0.001$), tension ($\beta = -21.78$, $p < 0.001$), and valence ($\beta = 14.13$, $p < 0.001$). These results imply that the participants reported significantly lower stress and tension levels and perceived higher levels of energy and positive emotions after participating in the session than before. Table 5 summarizes the GLMM results. Fig. 2 shows the predicted mean values for each variable, based on the GLMM results. Fig. 2(a) depicts the changes in variables before and after the intervention program, while Fig. 2(b) illustrates the changes in variables at the end of each session within the program.

4. Discussion

This study investigated the effects of an online SMI intervention on perceived stress, psychological distress, and sleep quality in ICU nurses. The results revealed a significant decrease in perceived stress and psychological distress after the intervention. Furthermore, the findings suggest that perceived stress and tension levels significantly decreased, whereas energy levels significantly increased with the number of sessions. Notable changes were also observed after each session, including a decrease in perceived stress and tension levels and an increase in energy levels and positive emotions.

This study supports previous research suggesting the importance of focusing on positive rather than negative experiences and psychological resources to facilitate positive motivational mechanisms in workplace stress management [38]. Moreover, focusing on positive events and reflecting on these experiences has been reported to lead to decreased stress and improved health among ICU nurses [39]. In particular, considering how the SMI intervention led to positive changes in stress and psychological distress levels, positive emotional experiences, and reflections on personal needs appear to be key factors. This was supported by the significant effects on perceived stress and emotional ratings observed during the intervention period. In this study, the main focus of the SMI intervention was to provide individual rather than group sessions, emphasizing individuals' positive resources to cope with stress and psychological distress. The findings show that the intervention offered an opportunity to experience individually meaningful positive emotions facilitated by music, providing a multimodal experience [40]. Consistent with previous findings, these results support the use of SMI interventions for stress management among ICU nurses.

Table 5
Summary of the fixed effects for the respective measures (N = 29).

Measure (fixed effect)	Estimate	*SE*	*t*	*p*
Perceived stress VAS				
Intercept	74.05	3.54	20.92	
Number of sessions	−2.52	0.72	−3.49	0.001
Post-session	−18.34	1.52	−12.05	<0.001[b]
Perceived emotion VAS				
Energy				
Intercept	36.30	4.08	8.90	
Number of sessions	1.78	0.53	3.38	0.001
Post-session	7.01	1.87	3.76	<0.001[b]
Tension				
Intercept	74.65	4.92	15.18	
Number of sessions	−1.72	0.76	−2.28	0.023[a]
Post-session	−21.78	2.30	−9.49	<0.001[b]
Valence				
Intercept	40.46	3.06	13.21	
Number of sessions	0.21	0.52	0.41	0.684
Post-session	14.13	1.47	9.64	<0.001[b]
ISI–K				
Intercept	16.85	1.06	15.90	
Number of sessions	−0.24	0.22	−1.12	0.265

Note. VAS = Visual Analog Scale; ISI–K = Korean version of the Insomnia Severity Index.
**$p < .01$.
[a] $p < .05$.
[b] $p < .001$.

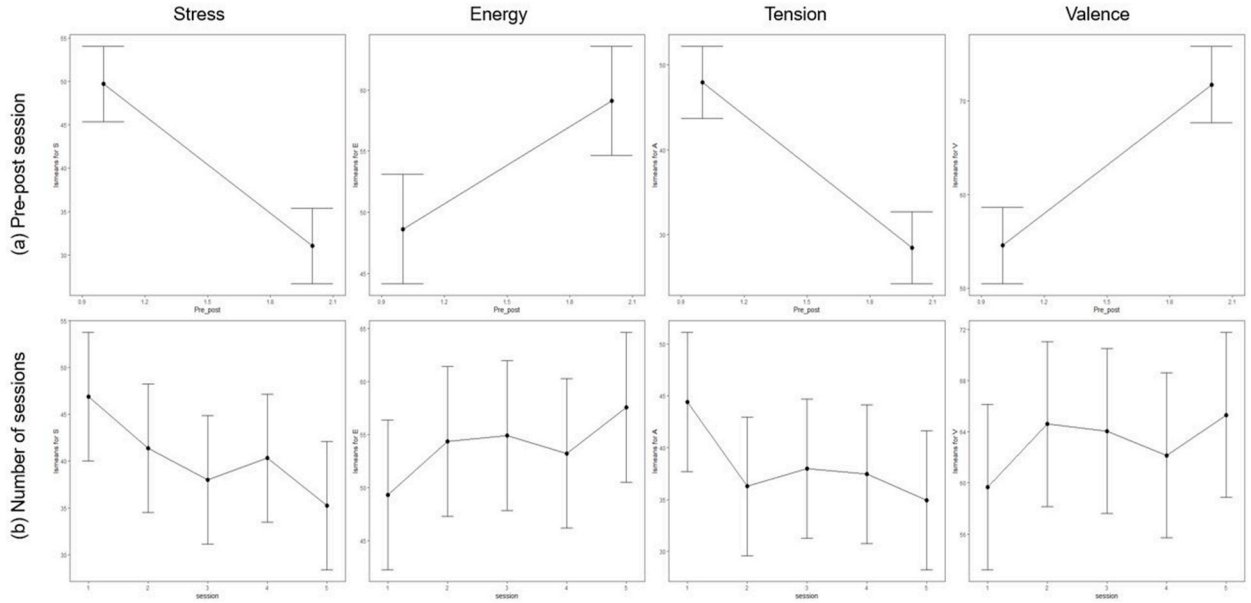

Fig. 2. Predicted mean values by pre-post session status and over each session with error bars representing 95% confidence intervals based on the Generalized Linear Mixed Model results.

Nevertheless, pre-post changes in the PSS-10 and DASS-21 stress subscales showed some inconsistent results in this study. There are several potential reasons for these outcomes. ICU nurses' work environments and stressors are considerably more complex than those of other nurses as they constantly deal with extremely sick patients and their family members, which requires resilience [41]. Thus, dealing with day-to-day stress alone may be insufficient to achieve long-term effects. However, findings of significantly beneficial changes over the intervention period may imply promising effects in promoting substantial changes over longer periods.

The results of a previous study combining music and muscle relaxation for stress reduction in ICU nurses showed no difference between the intervention and control groups in PSS-10 scores at 4 weeks; however, after 8 and 12 weeks, the intervention group showed a significantly lower perceived stress score [42]. In comparison, the current study revealed significant decreases in PSS-10 scores at five weeks; this may suggest a more promising benefit of the SMI program, which has been shown to decrease stress and emotions, as measured by a VAS in the first session. The results of this study highlighted the beneficial effects of SMI interventions for ICU nurses and indicated that even a single session can potentially be impactful.

The changes measured during the intervention period indicated that the number of sessions significantly decreased perceived stress and tension and increased perceived energy. Thus, long-term interventions can aid ICU nurses in managing ongoing stress and psychological distress. However, this effect was not observed for the perceived tension or valence. Therefore, the findings should be interpreted with caution. Contrary to previous studies that reported a close relationship between stress and sleep quality among nurses [43,44], we observed non-significant results regarding sleep quality. This may be related to participants' irregular shift work. Previous studies have suggested that specialized instruments are required to assess sleep quality in shift-work nurses [45]. Future studies should consider multidimensional evaluations that are not limited to self-reported assessments of sleep characteristics in shiftwork nurses.

Our study has some limitations owing to its small sample size and simple research design, which should be addressed in future studies. The sample showed moderate levels of stress and psychological distress at baseline. Thus, the findings may not apply to those at high risk of stress and psychological distress. Furthermore, the homogeneity of the participants was not considered in this preliminary study. Factors that influence nurses' work stress, such as age, work experience, and environmental factors, should be considered in future studies. Another limitation is the absence of a control group, which restricts our ability to definitively attribute changes in stress levels to the SMI intervention. Without control conditions, we cannot rule out the possibility that factors such as natural fluctuations in stress, external events, or the passage of time may have influenced the results. Future research should incorporate a randomized controlled design to validate the findings of this study. This study had several strengths. This is one of the first studies to examine the effectiveness of online music therapy interventions for stress reduction among nurses. These findings provide fundamental information regarding music interventions for stress management among ICU nurses. Moreover, our study provides information on the changes not only after intervention participation, but also over the course of the intervention, furthering our understanding of the intervention process. In addition, the SMI intervention was specially designed as individual sessions supporting participation and individualized work, which can benefit long-term stress management. The online nature of the intervention also minimized the risk of infection, considering the nature of the participants' work.

These preliminary findings indicate that SMI may support ICU nurses' internal strengths by activating their psychological resources [46]. Moreover, music therapy interventions based on the MI method provide opportunities to strengthen psychological well-being [29,47]. Integrating self-work into interventions may increase sustainability. Considering ICU nurses' high stress levels, SMI

interventions can be a viable and flexible approach to help this population develop self-help skills to manage work stress and overload effectively. The findings have notable implications for online music interventions that hold the potential for broader implementation.

Ethical statement

The study procedure was reviewed and approved by the Institutional Review Board of Severance Hospital (4-2019-0207), Seoul, Korea. Participants provided written consent after meeting with the researchers personally.

Data availability statement

Data supporting the findings of this study are available upon request from the corresponding authors. The data have not been stored in a publicly accessible repository due to the sensitive nature of the personal health information collected during the preliminary stages of research. In adherence to stringent privacy and ethical standards, approval for secondary use or public disclosure of these data was not obtained. Nonetheless, we are committed to enabling access to the data while ensuring confidentiality and ethical compliance. Researchers interested in accessing the data may contact the corresponding authors to discuss conditions for data access. This policy ensures that all data sharing meets the necessary ethical and legal requirements.

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CRediT authorship contribution statement

Aimee Jeehae Kim: Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis, Data curation. **Sungwon Na:** Writing – review & editing, Writing – original draft, Investigation, Data curation. **Jung Yeon Kim:** Writing – original draft, Investigation. **Soo Ji Kim:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization. **Jeongmin Kim:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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