The effectiveness of mobile videoconference-based intervention on stress reduction and resilience enhancement in employees: A randomized controlled trial

Running head: Videoconference-based intervention for stress reduction

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Abstract

Background: Videoconferencing-based treatments have shown great potential in increasing engagement and compliance by decreasing the barriers of time and distance. In general, employees tend to experience a lot of stress, but find it difficult to visit a clinic during office hours.
Objective: The purpose of this study was to investigate the effectiveness of a mobile videoconference-based intervention for stress reduction and resilience enhancement in employees.

Methods: Eighty-one participants were randomly allocated to one of three conditions: mobile videoconferencing, in-person, and self-care; among them, 72 completed the study. All participants underwent assessment via self-reported questionnaires before, immediately after, and 1-month after the intervention. Intervention lasted for 4 weeks and consisted of elements of cognitive behavior therapy, positive psychology, and meditation. Changes in clinical variables regarding stress and resilience across time were compared between treatment conditions.

Results: There were significant condition × time effects on variables measuring perceived stress, resilience, emotional labor, and sleep. Moreover, there were significant effects of condition on perceived stress and occupational stress.

Conclusions: Results indicate that both mobile videoconferencing and in-person interventions were comparably effective in decreasing stress and enhancing resilience. Further studies with a larger sample size and a longer follow-up period are warranted to investigate the long-term effect of mobile videoconferencing intervention.

Keywords: videoconferencing, stress reduction, resilience enhancement, employees, randomized controlled trial

Trial registration: ClinicalTrials.gov identifier: NCT03256682

Introduction

Stress is a major public health concern. It can cause serious psychological and physical problems, such as fatigue, sleeping problems, coronary diseases, depression, and even related mortality [1-4]. Hence, proper stress management of employees is particularly
important; work-related stress affects approximately 28% of all workers (5). Stress has also been reported to be a major factor in up to 80% of all work-related injuries and 40% of workplace turnovers [6]. Data shows that job stress accounts for over $300 billion annually as a result of increased absenteeism, employee turnover, diminished productivity, medical, legal, and insurance expenses, and worker compensation [7].”

Traditional face-to-face – or in-person – stress reduction interventions for employees have proven to be effective, with small-to-moderate effect sizes [8]. However, a major barrier to managing stress in employees is limited access due to time and location constraints, as it may be difficult for employees to find the time to see a psychiatrist during work hours on weekdays (9). The success of non-psychopharmacological psychiatric treatment is related to treatment adherence, which is linked to barriers like time and distance. A useful way to increase access, and thereby increase treatment adherence, is by incorporating telemedicine-based methods. Employees can easily access videoconferencing-based treatments at their convenience, i.e. during break hours in the workplace or after office hours at home [10].

There is a bulk of evidence suggesting that videoconferencing-based telepsychology is no less effective than in-person treatment in a variety of psychiatric disorders [11], including depression [12], panic disorders [13], obsessive compulsive disorder [14], post-traumatic stress disorder [15], and eating disorders [16]. A recent meta-analysis of 26 randomized controlled trials (RCTs) demonstrated non-inferiority of remote psychiatric counseling, with respect to both assessment and treatment, compared with in-person counseling [17]. To the best of our knowledge, to date, there has not been any study evaluating the effectiveness of videoconferencing in reducing stress and enhancing resilience in the workplace.

An important issue in videoconferencing is equipment. In most previous studies, participants were instructed to use the equipment provided at remote videoconference sites
However, travelling to these sites is no different from traveling to see a counselor; it would still be a barrier to treatment for those whose workplace or home is far from the videoconference site. To further increase accessibility to treatment, we used a mobile-based videoconferencing equipment. Access to treatment by smartphones can be particularly beneficial in South Korea, since almost all Korean employees own a smartphone (94% of all population), making it one of the countries with the highest smartphone ownership worldwide.

The purpose of this study was to compare the effects of mobile videoconference-based intervention on stress reduction and resilience enhancement with that of in-person and self-care methods in Korean employees. We hypothesized that the effectiveness of mobile videoconference condition would be superior to the control condition (self-care condition), but comparable to the in-person condition.

**Materials and Methods**

**Participants**

Participants were recruited via advertisements at the Seoul National University Hospital and at the Seoul National University Bundang Hospital between August 2017 and November 2017. The inclusion criteria were 1) 19 ≤ age < 65, 2) a score of 14 or higher on the Perceived Stress Scale (PSS) at baseline, 3) possession of an Android smartphone, and 4) currently employed full-time. Individuals diagnosed with depression, anxiety disorders, or insomnia were allowed to participate as long as their condition had been stable and no changes in their medication were anticipated. The exclusion criteria were 1) age < 19 or age ≥ 65, 2) cognitive disorders, such as intellectual disability or dementia, 3) neurological disorders, including epilepsy, stroke, or others, 4) history of schizophrenia or bipolar I disorder, 5) current report of suicidal ideation, and 6) non-pharmacological treatment or
counseling within the past 6 months.

During the screening process, psychiatric diagnoses were confirmed using the Mini International Neuropsychiatric Interview (MINI), which is a short, structured psychiatric interview designed to detect a wide range of DSM-IV and ICD-10 psychiatric disorders [19]. Questions are phrased to allow only “yes” or “no” answers. The Korean version has well-established validity and reliability [20]. MINI was conducted by two psychologists with a master’s degree education and two hours of training in advance.

With a predicted effect size of $d = 0.4$, alpha level of 0.05, desired power of 0.95, and correlation of 0.5 among repeated measures, the estimated total sample size using G-Power was 69 (23 participants per condition). Considering a drop-out rate of 20%, we aimed to recruit 87 participants.

Written informed consent was obtained from all participants after sufficient explanation of the study. The study protocol was approved by the Institutional Review Board of Seoul National University Bundang Hospital. (ClinicalTrials.gov identifier: NCT03256682)

Assessments

Demographic information, including age, gender, length of work (shorter than 3 years, 3 years or longer), marital status (married and not separated, others) and education status (more than a college education, less than a college education), was obtained using a self-reported questionnaire. The questionnaires were filled in by paper and not online. The primary outcome measures of this study were changes in scores of the PSS and BRS scales. Changes in scores of scales assessing emotional labor, occupational stress and insomnia were evaluated as secondary outcomes.

PSS is a 10-item questionnaire used to assess perceived stress [21]. It was designed
to measure the degree to which respondents found their life situations unpredictable, uncontrollable, and overloading, and included 10 direct queries asking about incidents that brought upon states of being upset, nervous, stressed, or irritated; four items were worded negatively and the rest positively. Answers were given on a 5-point Likert scale (0: never to 4: very often). Total scores were calculated after reversing the scores from positive items and then summing up all scores. Higher scores indicated higher levels of perceived stress.

We used the Korean Emotional Labor Scale (KELS) [22] to measure the level of emotional labor. Emotional labor was defined as the process by which workers have to control their feelings in accordance with the organizational demand and occupational role [23, 24]. KELS was developed to measure Korean-specific emotional labor and validated with a nation-wide random sample of 1042 Korean employees. It was based on the literatures related to emotional labor [25-31], emotional labor scales, such as Emotional Labour Inventory [32], Emotional Labor Scale [33], Emotion Work Requirements Scale [34], and Frankfurt Emotion Work Scale [35], and a focused group interview. KELS has five subscales: Effort to Control Emotion (5 items), Organizational Monitoring System (4 items), Demands of Emotional Labor (3 items), Emotional Damage (6 items), and Organizational Support System (7 items). Each item in the questionnaire was rated on a 4-point Likert scale, from 1 (not at all) to 4 (very much). Scores for each subscale were calculated based on the scoring method provided by the developers. The possible range for each subscale was 0-100, with higher scores representing higher levels of emotional labor. In this study, we only used the total score.

The level of job stress was measured using the Korean Occupational Stress Scale – Short Form (KOSS-SF), which is one of the most commonly used questionnaires in assessing job stress in South Korea [36]. It consists of 24 items measured on a 4-point Likert scale (1: never to 4: always). This scale is comprised of 7 subscales, including job demand,
job control, interpersonal conflict, job insecurity, organizational system, lack of reward, and workplace environment. The sum of each subscale was calculated and then converted to 100 points. We used the KOSS total score in the analysis; higher scores indicated a higher level of job stress.

The Brief Resilience Scale (BRS) was used to measure individual resilience [37]. It is aimed at assessing the most basic and original sense of resilience; in other words, “the ability to bounce back from stress [38].” It consists of 6 items, measured on a 5-point Likert scale (1: strongly disagree, 5: strongly agree). While other resilience scales measure personal characteristics that may promote positive adaptation, BRS is the only scale that targets and assesses resilience itself.

Insomnia was measured by Athens Insomnia Scale (AIS), which contains eight items scored on a 4-point Likert scale [39]. The total AIS score ranged from 0 to 24, with higher scores indicating greater symptom severity. AIS has been validated for screening insomnia in South Korean firefighters with good psychometric properties (Cronbach’s α of 0.88 and item-total correlation of 0.73) [40].

All self-reported questionnaires were completed by the participants before treatment, immediately after treatment, and 1-month after treatment.

At post-treatment, participants answered 4 questions about therapeutic alliance. Each item was rated on a 5-point Likert scale (1: disagree strongly, 5: agree strongly). The 4 questions were: 1) ‘I felt as if the therapist understood me well’; 2) ‘I felt as if the therapist was paying attention to what I was saying’; 3) ‘I could tell that the therapist was empathetic by his/her tone of voice’; and 4) ‘I felt comfortable during therapy sessions’.

Randomization and treatment conditions

Participants who met the screening criteria were randomly allocated (stratified by
organization) 1:1:1 to one of three treatment conditions by using REDCap (Research Electronic Data Capture) tools hosted at Seoul National University Bundang Hospital. Participants in the mobile videoconference and in-person conditions underwent 50-minute sessions of 1:1 therapy with one of three psychologists with a master’s degree education for 4 weeks (one session a week). The protocol of therapy was adapted from the Stress Management and Resilience Training: Relaxation Response Resilience Program (SMART-3RP) [41]. The SMART-3RP is an 8-week, 1.5-hour session program developed by the Benson-Henry Institute for Mind Body Medicine at Massachusetts General Hospital. This program is based on the principles of cognitive behavioral therapy and positive psychology in conjunction with methods that elicit a relaxation response. The goals of the program included 1) eliciting the relaxation response through meditation, 2) reducing overall stress reactivity, and 3) increasing connectedness to oneself and others. In this study, we modified the SMART program into a 4-week program (1-hour per session) and a brief summary of each session is presented in Table S1. The participants in the self-care condition only received a 4-week education material regarding the methods to self-regulate stress, and they were instructed to read one chapter a week. This material was also provided to the participants of other conditions as well.

**Apparatus**

For mobile videoconferencing, we used the ‘Hello Mindcare’ android application [42], which was developed to provide online counseling services. All participants downloaded the application free of charge. Using Web Real-Time Communication, ‘Hello Mindcare’ provides video communication by allowing direct peer-to-peer communication and eliminating the need to install plugins or activeX. With a highly secure system, all data shared during videoconference sessions were encoded using Transport Layer Security (TSL), 128 bit
block encryption algorithm ARIA (Academy, Research Institute, Agency) and Advanced Encryption Standard (AES). The ‘Hello Mindcare’ application provides a booking system, videoconferencing, document sharing, and workbooks for clients to fill in directly via smartphones. Therapists used the ‘Hello Mindcare’ Counselor web to manage schedules, participate in the videoconferencing sessions, and check the workbooks filled out by participants.

Statistical analysis

The demographic and clinical characteristics of each condition were compared by an analysis of variance (ANOVA) for continuous variables and Chi-square tests or Fisher’s exact tests for categorical variables. Condition, time, and condition × time effects on clinical variables were tested using repeated measure analysis of variance (RM-ANOVA), and age and marital status were included as covariates. For post-hoc analyses, we conducted pairwise comparisons of changes in the scores at post-treatment (post-treatment score – pre-treatment score) and at 1-month follow up (follow-up score – pre-treatment score) by analysis of covariance, with age and marital status included as covariates. All statistical analyses were performed using IBM SPSS Statistics ver. 22.0 software (IBM Corp.; Chicago, IL, USA). A two-tailed p-value < 0.05 was considered statistically significant.

Results

Among the 98 individuals who were screened, 17 did not meet the inclusion criteria; a total of 81 were enrolled and randomly allocated to one of three conditions. Among them, 4 in the mobile videoconference condition and 1 in the in-person condition dropped out after randomization but before treatment initiation (mobile videoconference condition: three had trouble installing the application in their smartphone and one refused participation due to
difficulty in scheduling appointments; in-person condition: one needed psychiatric treatment due to aggravation of psychiatric symptoms). As a result, 21 participants were allocated to the mobile videoconference condition, 27 to the in-person condition, and 28 to the self-care condition; all 81 subjects completed the pre-treatment assessment. Three participants in the mobile videoconference condition and 1 participant in the self-care dropped out after treatment engagement (mobile videoconferencing condition: two dropped out due to their personal schedules, one complained of unstable Wi-Fi connection; self-care condition: one dropped out of because of personal matters, but refused to give a detailed explanation). A total of 18 in the videoconference condition, 27 in the in-person condition, and 27 in the self-care condition completed all 4 sessions of the intervention and underwent the post-treatment and 1-month follow-up assessment (Fig 1).

The demographic and clinical characteristics of participants who completed the assessments at all three time points are presented in Table 1. The mean age of participants in the mobile videoconference condition and in-person condition was higher than that of the self-care condition \( (p < 0.001) \), and there was a significant difference in marital status among the conditions \( (p = 0.029) \); hence age and marital status were included as covariates in the main analyses. There were no significant differences in gender, length of work, education status, and baseline scores of the clinical variables. The drop-out rates after treatment engagement were 14.2% (3 out of 21), 0%, and 3.5% (1 out of 27) in the mobile videoconferencing, in-person, and self-care condition, respectively; but this distribution was not statistically significant \( (p = 0.091 \text{ by Fisher’s exact test}) \).

The effects of condition, time, and condition × time for all clinical variables are shown in Table 2; Fig 1 depicts the changes in the PSS, KELS, BRS, and AIS scores across time, respectively. The interaction between time and condition was significant for four clinical variables \( \text{PSS: } F = 3.1, p = 0.025; \text{BRS: } F = 3.9, p = 0.008; \text{KELS: } F = 2.8, p = \)
There were significant main effects for condition on PSS ($F = 8.7, p < 0.001$) and KOS ($F = 11.6, p < 0.001$).

At post-treatment, the mobile videoconferencing condition showed a greater decrease in the KELS scores at post-treatment, but this was not significant at follow-up (Table 2). There were no significant differences in any clinical variable between the mobile videoconferencing condition and in-person condition at follow-up. The mobile videoconferencing condition showed a greater decrease in the KELS scores compared with the self-care condition at post-treatment, but this was without significance at follow-up. The mobile videoconferencing condition showed a greater increase in the BRS scores at follow-up compared to the self-care condition. The in-person condition showed a greater decrease in the PSS, KOSS, BRS, and AIS scores at post-treatment compared with the self-care condition, and only the KOSS, BRS, and AIS scores were significant at follow-up.

Regarding the questions about therapeutic alliance, there was no difference in the scores of all four items between the videoconferencing condition and in-person condition (question 1: average score $4.7 \pm 0.6$ vs $4.7 \pm 0.4$, $p = 0.584$; question 2: average score $4.7 \pm 0.6$ vs $4.9 \pm 0.3$, $p = 0.315$; question 3: average score $4.6 \pm 0.5$ vs $4.9 \pm 0.3$, $p = 0.059$; question 4: average score $4.7 \pm 0.6$ vs $4.7 \pm 0.6$, $p = 0.978$).

**Discussion**

To the best of our knowledge, this is the first study investigating the effectiveness of a mobile videoconferencing-based intervention for stress reduction and resilience enhancement in employees. Videoconferencing was delivered using a smartphone application, thus combining the merits of both videoconferencing and mobile devices. Overall, there were significant condition × time effects on perceived stress, resilience, emotional labor, and sleep. According to the post-hoc analyses, there were no significant
differences between the mobile videoconferencing and in-person conditions at follow-up, suggesting that the mobile videoconferencing method was comparable to the in-person method.

At follow-up, both the mobile videoconferencing condition and in-person condition had significantly enhanced resilience compared with the self-care condition, which was the primary goal of intervention. Resilience enhancement has been recognized as an important part of stress reduction. Resilience refers to the process that allows individuals to adapt positively despite stress or trauma [43]. Resilience-based interventions emphasize strengths within individuals and community members to persevere and recover from environmental, physical, or emotional stress [44]. Previous research regarding resilience suggests approaches that build on strengths rather than problem-focused strategies [43]. Southwick and Charney suggested five essential components to resilience interventions: 1) emotional regulation training to recognize and manage reactivity and impulsivity; 2) cognitive behavioral approaches to reframe thought processes and increase positive emotion; 3) physical health information on exercise, nutrition, sleep, and relaxation to increase protective behavior; 4) social support to build connections with family, peers, and mentors to increase protective factors; and 5) neurobiological components, such as mindfulness-based stress reduction, to increase the ability to manage stress [45]. Our intervention contained most of these components, leading to successful resilience enhancement.

Most studies on videoconferencing-based treatments have focused on addressing rural populations. A few studies have investigated the effectiveness of videoconferencing in homebound populations, such as disabled adults with dementia or older adults with depression [46, 47]. This study suggests that telepsychology methods can be useful to even young employees living in metropolitan areas. Most adults in their 30’s and 40’s are savvy with smartphones. Such methods allow employees to access treatment at their convenience,
as long as they have Wi-Fi or LTE connection [10]. Videoconferencing via smartphones can also be cost-effective, as many people already own smartphones, and they will be able to save travel costs [48].

To date, a variety of effective stress management programs for employees have been proposed and are available [49]. A recent meta-analysis found that while CBT interventions yielded the largest effect sizes, relaxation and meditation techniques were the most popular [50]. SMART program includes both of these components and has been found to improve resilience and minimize perceived stress in palliative care clinicians, medical interpreters, and resident physicians [41]. The intervention duration for the original SMART program was 8 weeks; however, this study showed that this intervention can be effective even after only 4 sessions. Moreover, this study also found that this intervention was not only effective, but also had a low drop-out rate (videoconferencing condition 14.2%, in-person condition 0% after treatment engagement) compared with previous studies. For comparison, a recent meta-analysis found that the mean completion of workplace psychological treatments was 45%, with a range of 3% to 95% [51]. With respect to the 0% drop-out rate in the in-person condition, almost 40% of participants were employees of hospitals in which the study took place; hence high accessibility may have attributed to low drop-out rate.

Although there was no statistical significance at follow-up, the post-hoc analysis revealed that the mobile videoconferencing condition had a greater effect on emotional labor compared with both the in-person and self-care conditions at post-treatment. Emotional labor is a unique type of stress experienced in employees. Brotheridge and Grandey proposed that there may be two sources to job-related stress: emotional demands of the work environment and employees’ ability to control their emotions. This indicates that workers with emotionally demanding jobs and a low capacity for emotional control would likely experience the greatest job-related stress [24]. Among the participants who completed the study, 19 (26.4%) were
nurses. Given that emotional labor is the key to making patients feel safe and comfortable [52], many nurses experience emotional labor, resulting in higher job stress, poorer health, greater self-alienation, and increased frequency of depressive mood [53]. The results of this study suggest that mobile videoconference intervention may be effective in reducing emotional labor in employees, at least in the short-term.

A major concern of videoconference treatment is the quality of therapeutic alliance between patient and therapist [54]. Therapeutic alliance has been defined as a collaborative effort by therapist and patient to facilitate healing [55]. In this study, there were no significant differences between the conditions in therapeutic alliance ratings. Our findings demonstrate that stress intervention via mobile videoconferencing does not compromise therapeutic alliance, which is in line with previous telepsychology research results [56].

There are a few notable limitations to this study. The length of intervention and follow-up interval was relatively short. This study provides no information on the long-term effect of mobile videoconference interventions. Participants were mostly female and all Korean, limiting the generalizability to the male gender and other ethnic groups. We did not exclude those with depression, insomnia, or anxiety disorders, making the study population clinically heterogeneous; as the sample size was not sufficient for subgroup analyses according to the presence or absence of psychiatric diagnosis, we were unable to evaluate whether the psychiatric diagnoses had other influences on the effects of mobile videoconference treatment. Moreover, we did not measure if the intervention improved any workplace variables, such as work performance, absenteeism, and turn-over rate. There is a possibility of a selection bias caused by recruitment of highly motivated participants. Lastly, participants and therapists were not blinded to their treatment conditions, which may have caused an expectation bias.
Conclusions

This study demonstrates that videoconferencing-based stress reduction interventions can be effective in employees. Further studies with larger sample size and longer follow-up interval may be helpful in determining the long-term effect of this intervention.

Acknowledgments

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Conflict of interests

None

Abbreviations

RCT: randomized controlled trial
PSS: Perceived Stress Scale
MINI: Mini Neuropsychiatric Interview
KELS: Korean Emotional Labor Scale
KOSS-SF: Korean Occupational Stress Scale – Short Form\nBRS: Brief Resilience Scale
AIS: Athens Insomnia Scale
SMART-3RP: Stress Management and Resilience Training: Relaxation Response Resilience Program
CBT: cognitive behavior therapy
ANOVA: analysis of variance
RM-ANOVA: repeated measure analysis of variance
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Table 1. Demographic and clinical characteristics of participants in videoconferencing, in-person and self-care conditions

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Videoconference(^a) (n = 18)</th>
<th>In-person(^b) (n = 27)</th>
<th>Self-care(^c) (n= 27)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean (SD)</td>
<td>36.2 (9.2)</td>
<td>36.7 (10.3)</td>
<td>46.6 (9.6)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>(a,b &lt; c)(^*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (female), N (%)</td>
<td>17 (94.4)</td>
<td>25 (92.6)</td>
<td>25 (92.6)</td>
<td>0.965</td>
</tr>
<tr>
<td>Education &gt; college education, N (%)</td>
<td>16 (88.9)</td>
<td>24 (88.9)</td>
<td>18 (66.7)</td>
<td>0.070</td>
</tr>
<tr>
<td>Marital status, married and unseparated, N (%)</td>
<td>10 (55.6)</td>
<td>17 (63.0)</td>
<td>24 (88.9)</td>
<td><strong>0.029</strong></td>
</tr>
<tr>
<td>Length of work &gt; 3 years, N (%)</td>
<td>14 (77.8)</td>
<td>14 (51.9)</td>
<td>19 (70.4)</td>
<td>0.157</td>
</tr>
<tr>
<td>PSS, mean (SD)</td>
<td>23.5 (4.2)</td>
<td>23.0 (3.3)</td>
<td>24.6 (4.1)</td>
<td>0.296</td>
</tr>
<tr>
<td>BRS, mean (SD)</td>
<td>16.3 (4.1)</td>
<td>16.9 (3.5)</td>
<td>17.2 (4.0)</td>
<td>0.750</td>
</tr>
<tr>
<td>KELS, mean (SD)</td>
<td>61.1 (17.1)</td>
<td>57.1 (15.6)</td>
<td>59.1 (14.6)</td>
<td>0.700</td>
</tr>
<tr>
<td>KOSS, mean (SD)</td>
<td>52.8 (7.7)</td>
<td>53.1 (9.5)</td>
<td>57.5 (9.3)</td>
<td>0.121</td>
</tr>
<tr>
<td>AIS, mean (SD)</td>
<td>16.3 (3.2)</td>
<td>16.7 (4.2)</td>
<td>16.6 (4.1)</td>
<td>0.942</td>
</tr>
</tbody>
</table>

Abbreviations: SD, standard deviation; PSS, Perceived Stress Scale; BRS, Brief Resilience Scale; KELS, Korean Emotional Labor Scale; KOSS, Korean Occupational Stress Scale; AIS, Athens Insomnia Scale

\(^*\): post-hoc test by LSD
Table 2. Changes in clinical scores across time according to condition

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Videoconference (n=18), mean(SD)</th>
<th>In-person (n = 27), mean(SD)</th>
<th>Self-care (n=27), mean(SD)</th>
<th>Condition effect</th>
<th>Time effect</th>
<th>Condition × time effect at f/u</th>
<th>Post-treatment between-condition comparisons</th>
<th>1 month f/u between-condition comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre  Post 1 month f/u</td>
<td>Pre  Post 1 month f/u</td>
<td>Pre  Post 1 month f/u</td>
<td>F (p-value)</td>
<td>F (p-value)</td>
<td>F (p-value)</td>
<td>VC vs IP p = 0.001</td>
<td>VC vs IP p = 0.147</td>
</tr>
<tr>
<td>PSS</td>
<td>23.5 (4.2) 17.4 (6.0) 16.4 (3.7)</td>
<td>23.0 (3.3) 15.1 (4.3) 13.9 (4.1)</td>
<td>24.6 (4.1) 20.5 (4.0) 17.4 (4.9)</td>
<td>8.7 (&lt;0.001)</td>
<td>2.1 (0.130)</td>
<td>3.1 (0.025)</td>
<td>VC vs SC p = 0.081</td>
<td>VC vs SC p = 0.005</td>
</tr>
<tr>
<td>KOSS</td>
<td>52.8 (7.7) 46.6 (11.0) 45.3 (10.5)</td>
<td>53.1 (9.4) 44.2 (10.4) 42.5 (9.7)</td>
<td>57.5 (9.3) 53.9 (8.6) 54.1 (11.7)</td>
<td>11.6 (&lt;0.001)</td>
<td>0.2 (0.723)</td>
<td>2.5 (0.063)</td>
<td>IP vs SC p = 0.040</td>
<td>IP vs SC p = 0.009</td>
</tr>
<tr>
<td>KELS</td>
<td>61.1 (17.2) 47.5 (17.8) 49.2 (17.1)</td>
<td>57.1 (15.6) 52.0 (12.4) 49.4 (12.6)</td>
<td>59.1 (14.6) 55.2 (19.0) 53.1 (16.6)</td>
<td>0.4 (0.657)</td>
<td>0.6 (0.543)</td>
<td>2.8 (0.034)</td>
<td>VC vs IP p = 0.034</td>
<td>VC vs IP p = 0.033</td>
</tr>
<tr>
<td>BRS</td>
<td>16.3 (4.1) 19.6 (5.1) 20.2 (4.4)</td>
<td>16.9 (3.5) 20.2 (3.7) 21.0 (3.3)</td>
<td>17.2 (4.0) 18.3 (3.7) 18.0 (4.3)</td>
<td>2.8 (0.066)</td>
<td>2.5 (0.095)</td>
<td>3.9 (0.008)</td>
<td>VC vs SC p = 0.141</td>
<td>VC vs SC p = 0.038</td>
</tr>
<tr>
<td>AIS</td>
<td>16.3 (3.2) 13.8 (3.1) 14.2 (3.2)</td>
<td>16.7 (4.2) 13.6 (3.2) 12.8 (3.0)</td>
<td>16.6 (4.1) 15.7 (3.6) 15.5 (4.6)</td>
<td>2.6 (0.082)</td>
<td>0.1 (0.838)</td>
<td>4.5 (0.005)</td>
<td>VC vs IP p = 0.036</td>
<td>VC vs IP p = 0.030</td>
</tr>
</tbody>
</table>

Abbreviations: SD, standard deviation; f/u, follow-up; PSS, Perceived Stress Scale; BRS, Brief Resilience Scale; KELS, Korean Emotional Labor Scale; KOSS, Korean Occupation Stress Scale; AIS, Athens Insomnia Scale
Figure 1. Flowchart of the study process

Figure 2. Change in PSS, KELS, BRS, and AIS scores across time according to condition

Abbreviations: f/u, follow-up
(a) Change in PSS score across time
(b) Change in KELS score across time
(c) Change in BRS score across time
(d) Change in AIS score across time

Abbreviations: PSS, Perceived Stress Scale; KELS, Korean Emotional Labor Scale; BRS, Brief Resilience Scale; AIS, Athens Insomnia Scale

Supplementary Table S1. Protocol of the stress reduction and resilience enhancement intervention

<table>
<thead>
<tr>
<th>Session</th>
<th>Theme</th>
<th>Main contents</th>
</tr>
</thead>
</table>
| 1 | Understanding stress and relaxation response | - Explanation of the goal of the intervention  
- Setting rules  
- Exploring the current stressful situation of the participant  
- Understanding the body’s responses to stress  
- Understanding the concept of mindfulness and relaxation response  
- Mindfulness and relaxation exercises |
| 2 | Creating adaptive perspectives through correction of cognitive distortions | - Review of homework  
- Understanding the concepts of cognitive-behavioral therapy (CBT)  
- Finding cognitive distortions regarding stress  
- Correction of cognitive distortions using CBT methods  
- Mindfulness and relaxation exercises |
| 3 | Promoting positivity through a healthy lifestyle | - Review of homework  
- Healthy eating  
- Recuperative Sleep  
- Promoting physical activity  
- Positive thinking (from pessimism to optimism)  
- Mindfulness and relaxation exercises |
| 4 | Humor, empathy and staying resilient | - Review of homework  
- Learning about humor as a coping mechanism  
- Humor Strategies  
- Tips for staying resilient  
- Mindfulness and relaxation exercises  
- Ending comments |