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The efficacy of internet-based stress recovery intervention FOREST for healthcare staff amid COVID-19 pandemic: Randomized Controlled Trial

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The efficacy of internet-based stress recovery intervention FOREST for healthcare staff amid COVID-19 pandemic: Randomized Controlled Trial

Abstract

Background: The COVID-19 pandemic demanded exceptional physical and mental effort from healthcare workers worldwide. Since healthcare workers often refrain from seeking professional psychological support, internet-delivered interventions could serve as a viable alternative option.

Objective: We aimed to investigate the effects of a therapist-guided six-week CBT-based internet-delivered stress recovery intervention among medical nurses using an RCT design. We also aimed to assess program usability.

Methods: 168 nurses working in a healthcare setting (M_{age} = 42.12, SD_{age} = 11.38; 97% female) were included in the study. The intervention group included 77 participants, and the waiting list control group had 91 participants. Self-report data were collected online at three timepoints: pre-test, post-test, and three-month follow-up. The primary outcome was stress recovery. Secondary outcomes included measures of perceived stress, anxiety, depression, psychological well-being, posttraumatic stress disorder (PTSD), complex PTSD, and moral injury.

Results: We found that the stress recovery intervention FOREST improved stress recovery, including psychological detachment (*d*=0.83 [0.52; 1.15]), relaxation (*d*=0.93 [0.61; 1.25]), mastery (*d*=0.64 [0.33; 0.95]), and control (*d*=0.46 [0.15; 0.76]). The effects on psychological detachment, relaxation, and mastery remained stable at three months follow-up. The intervention was also effective in reducing its users' stress (*d*=-0.49 [-0.80; -0.18]), anxiety symptoms (*d*=-0.31 [-0.62; -0.01]), depression symptoms (*d*=-0.49 [-0.80; -0.18]) and increasing psychological well-being (*d*=0.53 [0.23; 0.84]) with the effects on perceived stress, depression symptoms, and well-being remaining stable at three-month follow-up. High user satisfaction and good usability of the intervention were also reported.

Conclusions: The present study demonstrated that an internet-based intervention for healthcare staff could increase stress recovery skills, promote psychological well-being, and reduce stress, anxiety, and depression symptoms, with most of the effects being stable over three months.

Trial Registration: NCT04817995 (https://clinicaltrials.gov/ct2/show/NCT04817995). Registration date: March 30, 2021. Date of first recruitment: April 1, 2021.

Keywords: Efficacy; internet-based intervention; healthcare staff; RCT; stress recovery

What is already known

- The COVID-19 pandemic demanded exceptional physical and mental efforts from healthcare workers worldwide.
- There is some evidence that internet-delivered programs targeting various mental health components might be effective in healthcare professionals' sample.
- However, no efficacy studies on stress recovery have been conducted with healthcare workers.

What this paper adds

- The present study demonstrated that an internet-based intervention for healthcare staff could increase stress recovery skills, promote psychological well-being, and reduce stress, anxiety, and depression symptoms, with most of the effects being stable over three months.
- Participants assessed the intervention as very good, and their satisfaction with the program was high.
- Since healthcare workers face heavy workloads and seldom seek professional psychological support, internet-based stress recovery intervention could be a feasible option for increasing the well-being of medical nurses.

The efficacy of internet-based stress recovery intervention FOREST for nurses amid COVID-19 pandemic: Randomized Controlled Trial

Background

The COVID-19 pandemic demanded exceptional physical and mental efforts from healthcare workers worldwide. A significant number of healthcare workers experienced medium to high emotional load or extremely acute stress [1]. Additionally, many reported psychological symptoms, including anxiety, fear, distress, and depression, leading to stress-related conditions and insomnia [2]. Distress factors comprised quarantine, heavy workload, the fear of infecting themselves and their family members, witnessing patients' poor and deteriorating conditions, and the requirement to wear protective gear [2]. Also, the presence of trauma-related stress among healthcare staff ranged between 7.4 to 35%. In particular, this occurred among women, nurses, frontline workers, and workers who experienced physical symptoms [3]. Moreover, a significant proportion of healthcare professionals began to consider a career change, and this ideation was related to higher levels of depression, stress, anxiety, and lower psychological well-being [4]. This context highlights the need for psychosocial support for healthcare workers targeted at recovery from stressful experiences.

Since healthcare workers face various emotional challenges as well as trauma related to the specifics of their work and seldom seek professional psychological support, often due to the mental health stigma [5–7], internet-delivered interventions could serve as a viable alternative option for providing psychological services. There is some evidence from previous RCTs that internet-delivered programs targeting various mental health components might be effective in both healthcare professionals and other non-clinical samples. Among healthcare professionals, internet-delivered programs showed potential in equipping participants with coping skills to manage stress [8], reducing stress levels [9], improving some components of well-being [10], and enhancing work engagement [9,11]. A decrease in perceived stress [12] and changes in anxiety, depression, productivity, and academic work impairment [13], among other positive outcomes, have also been observed in other adult samples.

However, to the best of our knowledge, no efficacy studies on stress recovery have been conducted with healthcare workers. Stress recovery refers to a process during which individual functional systems that have been called upon during a stressful experience return to their prestress levels [14]. An understanding of successful recovery experiences highlights the importance of refraining from work demands and avoiding activities that call upon the same functional systems or internal resources as those required at work. Alternatively, gaining new internal resources such as energy, self-efficacy, or positive mood should also help restore threatened resources [15]. Using a data-driven approach, four distinct recovery experiences have been differentiated: psychological detachment, relaxation, mastery, and control [15]. Psychological detachment refers to refraining from being occupied by work-related duties and disengaging oneself mentally from work. Relaxation is a process that contrasts psychological strains and is often associated with leisure activities. Mastery experiences imply off-job activities that distract from the job and provide challenging experiences and learning opportunities in other domains. Control refers to the degree to which a person can decide which activity to pursue during leisure time and when and how to pursue this activity [15].

Although there is some research on internet-based stress intervention programs, and evidence suggests that they are effective in reducing stress within the healthcare staff and other samples, no RCTs have assessed whether internet-delivered interventions can improve stress recovery. High physical and emotional load among healthcare workers, especially in the context of difficult pandemic conditions, highlights the need for brief and easily accessible interventions that help reduce stress, which is inevitable during extreme pandemic conditions. Interventions should also enhance stress recovery skills, which could equip medical personnel with relevant psychological resources to sustain the effects of stress reduction. Therefore, we aimed to investigate the effects of an internet-based stress recovery intervention on stress recovery skills among nurses in the context of the COVID-19 pandemic using a randomized controlled trial design and comparing the intervention group with a waiting list control group. We also aimed to investigate the effects of the intervention on perceived stress, anxiety and depression symptoms, psychological well-being, posttraumatic stress disorder (PTSD) and complex PTSD symptoms, and moral injury. Additionally, we aimed to assess the usability of the stress recovery intervention.

Methods

Design

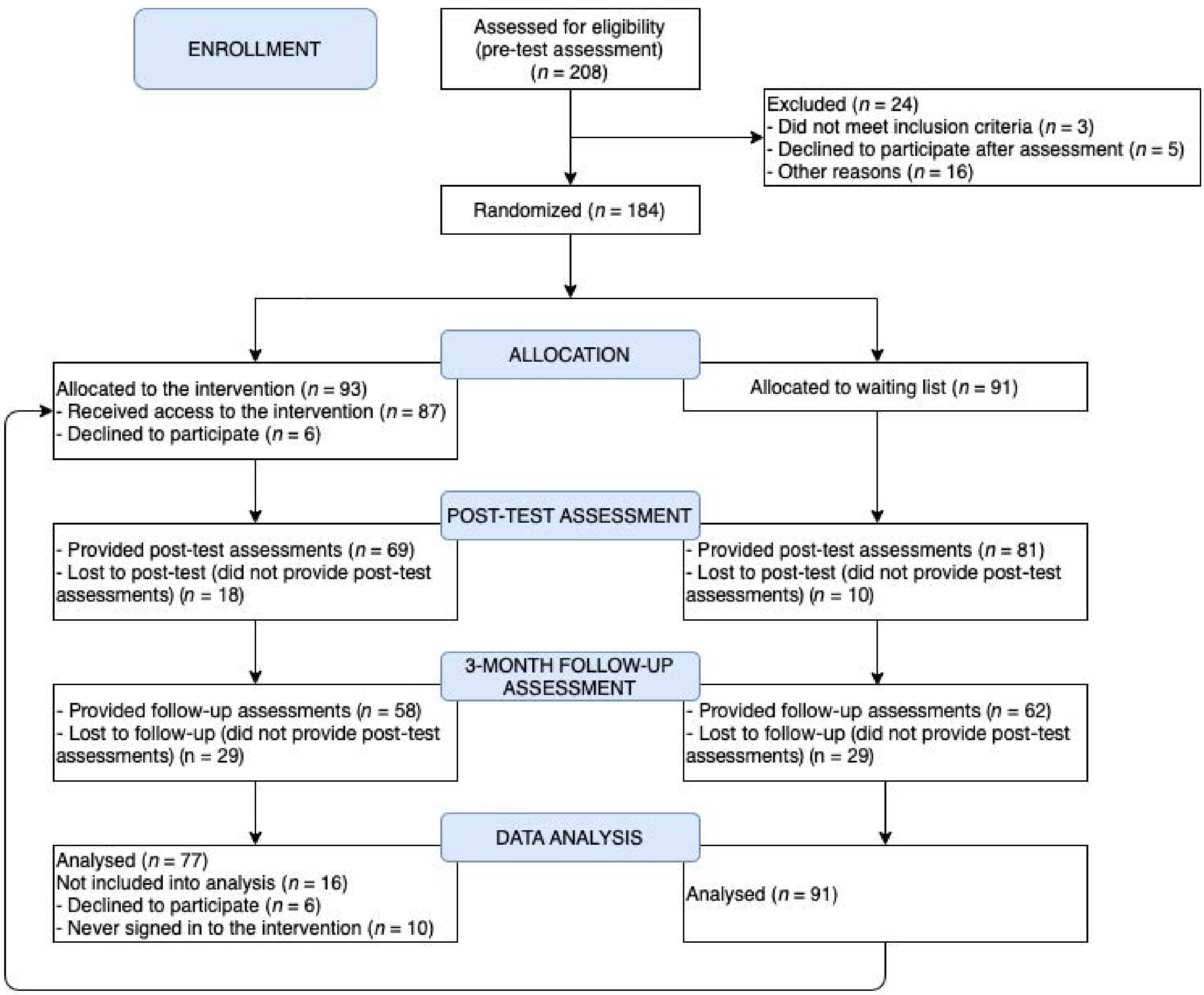
A two-armed randomized controlled trial was conducted in Lithuania, comparing the six-week online intervention FOREST participants against a waiting list control group. We randomly allocated participants to the intervention or the waiting list control group (allocation ratio 1:1). Participants assigned to the intervention group received the intervention immediately after randomization, whereas participants in the waiting list control group received the same intervention six months later. Assessments took place at three-time points: pre-test T1 (April/2021), post-test T2 (June-July/2021), and 3-month follow-up T3 (September-October/2021). Self-report data were collected using a secure encrypted treatment platform – Iterapi [16]. All procedures involved in the trial were consistent with the ethical standards. The study was approved by Vilnius University Psychology Research Ethics Committee (Reference No. 2021-03-22/61). The trial was registered at www.clinicaltrials.gov (NCT04817995, March 30, 2021). In the current study, the data were reported following the CONSORT statement for reporting parallel group trials [17].

Participants

Participants were enrolled after disseminating invitations to participate in the program through social networks of nurses, healthcare institutions, and press releases to national media throughout the whole country. Recruitment was carried out in April/2021 (date of first recruitment: April 1, 2021). Individuals interested in participation registered on the study website www.forestmedikams.lt, where all the information about the study was presented. Potential participants were informed about the length of the program, its overall structure, and each module's structure; it was also highlighted that the program is internet-based, delivered remotely, and the intensity of the program can be chosen by the participants themselves. Participants provided informed consent and completed pre-test assessment questionnaires during the online registration. After registration, individuals who fully completed the online pre-test assessment were contacted by phone for a brief interview to finalize their eligibility for the current study; also, their questions regarding the program and all the procedures were answered. A flowchart of the study is presented in Figure 1.

To be included in the study, participants had to be nurses working in a healthcare setting, at least 18 years old, comprehend Lithuanian, and have a device with an Internet connection. Predefined exclusion criteria were an acute psychiatric crisis, high suicide risk, alcohol/drug addiction, and interpersonal violence.

Figure 1. Flowchart of the study.



Randomization

Eligible participants were randomly assigned to either the intervention or the waiting list control group. Randomization was conducted by a researcher not associated with the current study using the random number calculation procedure (www.random.org). No stratification was applied. Before registering for the study, participants were informed that they would get access to the intervention either in April/2021 or October/2021.

Intervention

The intervention FOREST has been described in detail previously [18]. In brief, it is a six-week online program based on cognitive behavior therapy (CBT), with the inclusion of mindfulness principles. Program used for the current study was developed by clinical psychologists and researchers with expertise in stress-related conditions and internet-delivered interventions; the program FOREST is available for researchers interested upon a reasonable request. The program consists of six modules: Introduction, Psychological detachment, Distancing, Mastery, Control, and Keeping the change alive. Every module consists of psychoeducation on the specific topic, several exercises, and a reminder to message the psychologist who responds to the participant within 24 hours. Participants were provided with access to a new program module weekly on the same weekday, and they received an email stating the availability of the new module. Also, additional weekly reminders were sent to the participants who had not signed into the intervention platform, had not read the new material, or had not done the new exercises. Eight psychologists were involved in the study. The psychologists' role included giving feedback to participants after completing the intervention exercises, answering questions, and providing psychological support. Responses by the psychologists were standardized according to the guidelines, and weekly supervision meetings were held.

Measures

Stress recovery

The Recovery Experiences Questionnaire (REQ) [15] was used to measure stress recovery. The REQ comprises 16 items measuring four components of stress recovery: (1) psychological detachment (e.g., "I forget about work"), (2) relaxation (e.g., "I kick back and relax"), (3) mastery (e.g., "I learn new things"), and (4) control (e.g., "I feel like I can decide for myself what to do") with 4 items on each subscale. The participants indicated their level of agreement with the REQ items on a 5-point Likert scale ranging from 1 "totally disagree" to 5 "totally agree". Cronbach's alpha was good for the total REQ in the current study at T1 ($\alpha = .89$), indicating sufficient internal consistency. Each subscale also showed good or acceptable internal consistency: psychological detachment ($\alpha = .83$), relaxation ($\alpha = .85$), mastery ($\alpha = .78$), and control ($\alpha = .82$).

Stress

The Perceived Stress Scale (PSS-4) [19] was used to measure the perceived level of stress. The PSS-4 comprises 4 items (e.g., "In the last month, how often have you felt that you were unable to control the important things in your life?"). The participants indicated their level of agreement with items on a 5-point Likert scale ranging from 0 “never” to 4 “very often”. Cronbach’s alpha was acceptable for the PSS-4 in the current study at T1 (α = .73).

Depression and anxiety

The Patient Health Questionnaire-4 (PHQ-4) [20] was used to measure depression and anxiety symptoms. The PHQ-4 comprises 4 items and 2 subscales with two items each: anxiety symptoms (e.g., “Feeling nervous, anxious or on edge”), and depression symptoms (e.g., “Little interest or pleasure in doing things”). The participants indicated their level of agreement with the PHQ-4 items on a 4-point Likert scale ranging from 0 “not at all” to 3 “nearly every day”. Cronbach’s alpha was good for the PHQ-4 in the current study at T1 (α = .88).

Psychological well-being

The World Health Organization Well-being Index (WHO-5) [21] was used to measure psychological well-being. The WHO-5 comprises 5 items (e.g., “I have felt cheerful and in good spirits”). The participants indicated their level of agreement with the WHO-5 items on a 6-point Likert scale ranging from 0 “at no time” to 5 “all the time”. Cronbach’s alpha was good for the WHO-5 in the current study at T1 (α = .89).

Posttraumatic stress disorder

The International Trauma Questionnaire (ITQ) [22] was used to measure symptoms of posttraumatic stress disorder (PTSD) and complex posttraumatic stress disorder (CPTSD). As PTSD and CPTSD are reactions to trauma exposure, the ITQ responses were collected only from participants who reported exposure to at least one lifetime traumatic event as measured with the trauma exposure screening. The ITQ comprises 18 items constituting two parts, that is, a subscale of the core PTSD symptom cluster (6 symptom items, e.g., “Having upsetting dreams that replay part of the experience or are clearly related to the experience”) and a subscale for CPTSD-specific symptoms of Disturbances in Self-Organization (DSO, 6 symptom items, e.g., “When I am upset, it takes me a long time to calm down”). The additional 6 items measure functional impairment either related to PTSD symptoms (3 items) or DSO symptoms (3 items). The participants indicated their level of agreement with ITQ items on a 5-point Likert scale ranging from 0 “not at all” to 4 “extremely”. Cronbach’s alpha was good for the ITQ in the current study at T1 (α = .86), as well as for subscales of PTSD (α = .86) and DSO (α = .83).

Moral injury

The Moral Injury Outcome Scale (MIOS) [23] was used to measure moral injury. The MIOS comprises 14 items (e.g., "I have lost faith in humanity"). The participants indicated their level of agreement with the MIOS items on a 5-point Likert scale ranging from 0 "strongly disagree" to 4 "strongly agree". Cronbach's alpha was good for the MIOS in the current study at T1 (α = .89).

Usability of the FOREST intervention

Participants were asked to evaluate the usability of the FOREST intervention by indicating how useful (from 1 "not useful at all" to 5 "very useful"), satisfactory (from 1 "I did not like it at all" to 5 "I liked it a lot"), and easy to use (from 1 "it was not easy at all" to 5 "it was very easy") the program had been. Participants were also asked to report their subjective impression regarding the improvement of mental well-being (from 1 "worsened a lot" to 5 "improved a lot"), physical health (from 1 "worsened a lot" to 5 "improved a lot"), general understanding of oneself and one's well-being (from 1 "not at all" to 5 "definitely improved"), and recommending the program to others (from 1 "not at all" to 5 "definitely would recommend").

Data analysis

To estimate intervention effects, we used the latent change modeling approach [24]. In latent change models, the *intercept* represents the mean level of the measure at the first measurement point (pre-test), and the *slope* represents the change from one measurement point to the other. To compare the intervention and the control groups in terms of outcome measures at the baseline, we regressed the intervention condition (0 = waiting list control group; 1 = intervention group) on the intercepts of variables of interest. To indicate the intervention effects, we regressed the intervention condition on the slopes of outcome variables. The immediate intervention effects were indicated by the regression coefficients on slopes from pre- to post-tests, and the sustainability of effects over the period of three months was indicated by the regression coefficients on slopes from pre-test to follow-up. To contrast the changes in the intervention and the control groups, we ran the series of multiple-group latent change models, indicating the change of outcome variables from pre- to post-test and from pre-test to follow-up in each group separately. We tested the intervention effects on separate stress recovery components of psychological detachment, relaxation, mastery, and control using the sum scores for each subscale. We tested the intervention effects on secondary outcomes (perceived stress, anxiety and depression symptoms, and well-being) using the sum scores of the respective measures. Finally, we tested the effects on PTSD and DSO symptoms in a sample of participants who had experienced at least one traumatic event and moral injury in a sample of participants who had experienced an event or events that may lead to moral injury using the sum scores of respective measures. To have the latent change models identified, in all models, we fixed the residuals to zero.

Further, we calculated between-group and within-group effect sizes, following the correct effect size calculation recommendations for latent change models [25]. The between-group pre- to post-test and pre-test to follow-up effect sizes were calculated using the mean slopes from pre- to post-test and from pre-test to follow-up in the intervention group and waiting list control group, respectively, and the standard deviations of the intercept in each group. The within-group pre- to post-test and pre-test to follow-up effect sizes were calculated by using the intercepts in each group indicating the level of the measure at the pre-test, estimated means at post-test or follow-up, and standard deviations of the intercepts. Bias-corrected effect sizes [26] were reported. In all analyses, the magnitude of the effect expressed in *d* was interpreted according to Cohen [27], that is, 0.50 = medium effect, and 0.80 = large effect.

Independent samples *t*-test and χ^2-test were used to test for between-group differences in demographic characteristics using IBM SPSS Statistics version 26. The latent change analyses were performed with Mplus 8.2 [28]. No data imputation was applied. Full information maximum likelihood (FIML) estimator was used in latent change analyses for handling the missing data [29].

Results

Participants

The participant flowchart is presented in Figure 1. Overall, 208 individuals registered for the study and completed the pre-test assessment. After the exclusion of 24 individuals (due to not meeting inclusion or meeting exclusion criteria (two were not medical nurses, and one had an alcohol addiction), declining to participate, and other reasons), 184 participants were randomly assigned to the intervention group (n = 93) or waiting list control group (n = 91). Sixteen participants from the intervention group declined to participate after randomization (n = 6) or never signed into the intervention application (n = 10); therefore, were excluded from the analysis.

The final study sample comprised 168 nurses (M_{age} = 42.12, SD_{age} = 11.38; 97% female): 77 in the intervention group and 91 in the waiting list control group. Descriptive data on study participants at the pre-test are presented in Table 1. Analysis of the chi-square and t-test showed no statistically significant differences between the intervention and waiting list control groups at pre-test for any of demographic characteristics. Also, there were no differences between intervention and waiting list control groups at pre-test in terms of stress recovery components of psychological detachment, relaxation, mastery, and control, as well as no differences were found for perceived stress, anxiety and depression symptoms, well-being, PTSD and DSO symptoms, and moral injury between the two groups (Table 2).

Table 1. Characteristics of the study participants (n = 168) at pre-test.

Variable	**Intervention group (n = 77) n (%)**	**Control group (n = 91) n (%)**	**Significance statistics**
Gender			
Female	75 (97.4)	88 (96.7)	$\chi^2(1) = 0.07$, p = .790
Male	2 (2.6)	3 (3.3)	
Age			
M (*SD*)	40.39 (11.90)	43.58 (10.77)	$t(166) = 1.82$, p = .070
Range	23-61	23-65	
Position			
Nurse	72 (93.5)	88 (96.7)	$\chi^2(1) = 0.94$, p = .332
Assistant nurse	5 (6.5)	3 (3.3)	
Education			
Secondary or lower	1 (1.3)	1 (1.1)	
Higher or non-university higher	43 (55.8)	56 (61.5)	$\chi^2(2) = 0.56$, p = .756
Higher university	33 (42.9)	34 (37.4)	
Working status			
Part-time	6 (7.8)	1 (1.1)	
Full-time	28 (36.4)	39 (42.9)	$\chi^2(2) = 4.93$, p = .085
More than full-time	43 (55.8)	51 (56.0)	
Department			
Surgical	6 (7.8)	8 (8.8)	
Therapy	32 (41.6)	38 (41.8)	
Anesthesiology and intensive care	14 (18.2)	14 (15.4)	$\chi^2(5) = 3.35$, p = .646
Outpatient care	12 (15.6)	9 (9.9)	
Emergency	7 (9.1)	8 (8.8)	
Other	6 (7.8)	14 (15.4)	
Work experience			
<2 years	10 (13.0)	6 (6.6)	
2-5 years	12 (15.6)	12 (13.2)	$\chi^2(3) = 6.04$, p = .109
6-10 years	12 (15.6)	7 (7.7)	
>10 years	43 (55.8)	66 (72.5)	
Long-term relationship			
No	18 (23.4)	26 (28.6)	$\chi^2(1) = 0.58$, p = .445
Yes	59 (76.6)	65 (71.4)	
Consulting a psychologist			
No	70 (90.9)	87 (95.6)	$\chi^2(1) = 1.50$, p = .220
Yes	7 (9.1)	4 (4.4)	

Taking medication due to mental health difficulties			
No	72 (93.5)	86 (94.5)	$\chi^2(1) = 0.07$, $p = .785$
Yes	5 (6.5)	5 (5.5)	
Recently used other self-help app			
No	65 (84.4)	79 (86.8)	$\chi^2(1) = 0.20$, $p = .658$
Yes	12 (15.6)	12 (13.2)	
Worked with COVID-19 patients			
No	23 (29.9)	28 (30.8)	$\chi^2(1) = 0.02$, $p = .900$
Yes	54 (70.1)	63 (69.2)	
Experienced the death of COVID-19 patient(s)			
No	50 (64.9)	52 (57.1)	$\chi^2(1) = 1.06$, $p = .303$
Yes	27 (35.1)	39 (42.9)	
Was diagnosed with COVID-19			
No	60 (77.9)	68 (74.7)	$\chi^2(1) = 0.24$, $p = .628$
Yes	17 (22.1)	23 (25.3)	
Had someone close to them diagnosed with COVID-19			
No	34 (44.2)	42 (46.2)	$\chi^2(1) = 0.07$, $p = .795$
Yes	43 (55.8)	49 (53.8)	
Lost a loved one due to COVID-19			
No	72 (93.5)	88 (96.7)	$\chi^2(1) = 0.94$, $p = .332$
Yes	5 (6.5)	3 (3.3)	
Was vaccinated against COVID-19			
No	21 (27.3)	24 (26.4)	$\chi^2(1) = 0.02$, $p = .896$
Yes	56 (72.7)	67 (73.6)	

Engagement in the intervention and attrition

In the intervention group, participants were considered engaged in the present study if they had signed into the intervention platform at least once. Most of the participants (77/87, 88.5%) met this criterion. Of those who signed into the intervention platform, 24.7% (19/77) signed in <5 times, 37.7% (29/77) signed in 5-10 times, 37.7% (29/77) signed in 11-20 times. Participants signed into the separate modules of the intervention as follows: 98.7% (76/77) to the first (Introduction), 88.3% (68/77) to the second (Psychological detachment), 80.5% (62/77) to the third (Distancing), 67.5% (52/77) to the fourth (Mastery), 62.3% (48/77) to the fifth (Control), and 53.2% (41/77) to the sixth (Keeping the change alive) module. More than half of the participants from the intervention group provided post-test (61/77, 79.2%) and follow-up (52/77, 67.5%) assessments. From the waiting list control group, 89.0% (81/91) of participants provided post-test and 68.1% (62/91) follow-up assessments. Thus, the attrition rates were 15.5% (26/168) at the post-test and 32.1% (54/168) at follow-up.

Intervention outcomes

The results of latent change analyses are presented in Table 2. The analyses revealed a statistically significant intervention effect on the increase of stress recovery components of psychological detachment, relaxation, and mastery both from pre- to post-test and from pre-test to follow-up; the positive effect on the change of control scores was observed from pre- to post-test only. During the study period, psychological detachment, relaxation, and mastery increased in the intervention group. Psychological detachment and mastery remained stable in the control group over three months. Relaxation decreased in the control group from pre- to post-test and returned to the baseline level at the three-month follow-up. The Control increased in the intervention group from pre- to post-test and returned to the baseline level at the three-month follow-up, while in the control group, it remained stable over the study period. Effect sizes are presented in Table 3. The between-group effect sizes from pre- to post-test indicated a large intervention effect on the increase of psychological detachment and relaxation scores, a moderate intervention effect on the increase of mastery score, and a small intervention effect on the increase of control score. Also, a large increase in psychological detachment, a moderate increase in relaxation, and mastery scores were observed from pre-test to follow-up. The within-group effect sizes from pre- to post-test and from pre-test to follow-up indicated a moderate increase in psychological detachment and relaxation scores and a small increase in mastery and control scores in the intervention group. No statistically significant within-group changes were observed in the control group.

The latent change analyses of the secondary outcomes (perceived stress, anxiety symptoms, depression symptoms, and well-being) indicated statistically significant intervention effects on a decrease in perceived stress and increase in well-being both from pre- to post-test and from pre-test to follow-up. The statistically significant intervention effects on decrease in depression and anxiety symptoms were observed from pre- to post-test only. Perceived stress, depression, and anxiety symptoms decreased, and well-being increased in the intervention group over three months, while all these outcomes remained stable in the control group. Effect sizes are presented in Table 3. The between-group effect sizes from pre- to post-test indicated a moderate intervention effect on the increase of well-being score and a small intervention effect on the decrease of perceived stress, anxiety symptoms, and depression symptoms scores. Also, a moderate decrease in perceived stress score and a small decrease in depression symptoms score, and a small increase in well-being score were observed from pre-test to follow-up. The within-group effect sizes from pre- to post-test indicated a moderate decrease in perceived stress and depression symptoms scores, a moderate increase in well-being scores, and a small decrease in anxiety symptoms scores in the intervention group. Also, a large decrease in perceived stress score, a moderate increase in well-being score, and a small decrease in depression symptoms score were observed from pre-test to follow-up in the intervention group. No statistically significant within-group changes were observed in the control group.

Finally, the latent change analyses of PTSD and DSO symptoms in a sample of participants who had experienced at least one traumatic event and moral injury were performed in a sample of participants who had experienced an event or events that may lead to moral injury. Traumatic experiences were reported by 66.2% (*n* = 51) of the intervention group participants and 76.9% (*n* = 70) of the participants from the waiting list control group. The analyses revealed a statistically significant intervention effect on PTSD symptoms from pre- to post-test, but not from pre-test to follow-up. No intervention effects on DSO symptoms were observed. In the intervention group, PTSD and DSO symptoms remained stable over three months; in the control group, PTSD symptoms increased from pre- to post-test and returned to baseline level at follow-up when DSO symptoms remained stable over time. Neither between- nor within-group effects were found in either of the groups.

Events that may lead to moral injury were reported by 63.6% (*n* = 49) of the intervention group participants and 51.6% (*n* = 47) of the participants from the waiting list control group. The analysis revealed no statistically significant intervention effects on moral injury scores. Moral injury decreased statistically significantly over three months in the intervention and control groups. No between-group effects were found, but a small decrease in moral injury score was observed from pre-test to follow-up in the intervention and control groups.

Table 2. Baseline comparison and intervention effects as well as mean intercepts and slopes for intervention (n = 77) and the control (n = 91) groups.

	Intercept		$\beta_{baseline}$	**Slope (pre-post)**		$\beta_{pre\text{-}post}$	**Slope (pre-follow-up)**		$\beta_{pre\text{-}follw\text{-}up}$
***N* = 168**	***M***	**Var**		***M***	**Var**		***M***	**Var**	
Psychological detachment									
Intervention	10.87	12.71	0.05	2.49^{***}	17.36	0.35^{***}	2.60^{***}	13.53	0.37^{***}
Control	10.58	7.34		-0.13	9.34		-0.23	12.06	
Relaxation									
Intervention	13.18	10.46	-0.06	2.14^{***}	11.82	-0.57^{***}	1.71^{***}	14.49	0.30^{***}
Control	13.55	7.15		-0.60^{*}	7.43		-0.27	5.90	
Mastery									
Intervention	12.96	8.87	-0.03	1.47^{***}	10.20	0.30^{***}	1.47^{***}	10.20	0.24^{**}
Control	13.17	9.52		-0.49	9.03		-0.45	11.04	
Control									
Intervention	14.46	7.76	0.02	1.19^{***}	7.16	0.26^{***}	0.89	11.62	0.14
Control	14.36	9.64		-0.17	6.19		0.10	5.30	
Perceived stress									
Intervention	7.99	6.07	0.05	-1.61^{***}	5.29	0.35^{***}	-2.02^{***}	8.92	-0.33^{***}
Control	7.70	8.10		-0.29	9.29		0.10	9.71	
Anxiety symptoms									
Intervention	2.66	2.43	-0.10	-0.66^{***}	2.40	-0.15^{*}	-0.44^{*}	2.20	-0.10
Control	2.99	3.22		-0.13	3.24		-0.13	2.74	
Depression symptoms									
Intervention	2.53	1.86	-0.03	-0.75^{***}	2.44	-0.22^{**}	-0.53^{*}	2.75	-0.15
Control	2.64	2.85		0.01	2.98		-0.01	3.02	
Well-being									
Intervention	9.61	21.80	0.01	2.65^{***}	21.06	0.28^{***}	2.84^{***}	25.67	
Control	9.51	23.50		0.09	16.98		0.50	16.71	0.25^{**}
PTSD symptoms (*N* = 121)									
Intervention (n = 51)	6.86	23.88	-0.06	-0.69	24.75	-0.20^{*}	0.02	31.47	-0.05
Control (n = 70)	7.57	41.79		1.19^{*}	19.27		0.74	38.75	
DSO symptoms (*N* = 121)									
Intervention (n = 51)	8.77	21.20	0.01	-1.11	22.07	-0.16	-1.14	17.92	-0.07
Control (n = 70)	8.69	28.59		0.27	13.18		-0.55	19.29	
Moral injury (*N* = 121)									
Intervention (n = 49)	20.76	95.53	-0.13	-1.83	52.12	-0.03	-4.78^{**}	83.12	-0.09
Control (n = 47)	22.96	47.87		-1.31	59.43		-3.26^{*}	65.54	

* $p \leq 0.05$, **. $p \leq 0.0$, *** $p \leq 0.001$. PTSD – posttraumatic stress disorder; DSO – disturbances in self-organization

Table 3. Intervention effect sizes.

Variable	Group	Within-group pre-test and post-test *d* [95% CI]	Within-group pre-test and follow-up *d* [95% CI]	Between-group pre-test and post-test *d* [95% CI]	Between-group pre-test and follow-up *d* [95% CI]
Psychological detachment	Intervention	0.70 [0.37; 1.02]	0.73 [0.40; 1.05]	0.83 [0.52; 1.15]	0.90 [0.58; 1.22]
	Control	-0.05 [-0.34; 0.24]	-0.08 [-0.38; 0.21]		
Relaxation	Intervention	0.66 [0.33; 0.98]	0.53 [0.21; 0.85]	0.93 [0.61; 1.25]	0.67 [0.36; 0.98]
	Control	-0.22 [-0.52; 0.07]	-0.10 [-0.39; 0.19]		
Mastery	Intervention	0.49 [0.17; 0.81]	0.49 [0.17; 0.81]	0.64 [0.33; 0.95]	0.63 [0.32; 0.94]
	Control	-0.16 [-0.45; 0.13]	-0.15 [-0.44; 0.15]		
Control	Intervention	0.42 [0.10; 0.74]	0.32 [0.00; 0.64]	0.46 [0.15; 0.76]	0.27 [-0.04; 0.57]
	Control	-0.05 [-0.35; 0.24]	0.03 [-0.26; 0.32]		
Perceived stress	Intervention	-0.65 [-0.98; -0.33]	-0.82 [-1.15; -0.49]	-0.49 [-0.80; -0.18]	-0.79 [-1.10; -0.47]
	Control	-0.10 [-0.39; 0.19]	0.03 [-0.26; 0.33]		
Anxiety symptoms	Intervention	-0.42 [-0.74; -0.10]	-0.28 [-0.60; 0.04]	-0.31 [-0.62; -0.01]	-0.18 [-0.49; 0.12]
	Control	-0.07 [-0.36; 0.22]	-0.07 [-0.36; 0.22]		
Depression symptoms	Intervention	-0.55 [-0.87; -0.23]	-0.39 [-0.71; -0.07]	-0.49 [-0.80; -0.18]	-0.33 [-0.64; -0.03]
	Control	0.01 [-0.28; 0.30]	-0.01 [-0.30; 0.28]		
Well-being	Intervention	0.56 [0.24; 0.89]	0.61 [0.28; 0.93]	0.53 [0.23; 0.84]	0.49 [0.18; 0.80]
	Control	0.02 [-0.27; 0.31]	0.10 [-0.19; 0.39]		
PTSD symptoms	Intervention	-0.14 [-0.53; 0.25]	0.00 [-0.38; 0.39]	-0.32 [-0.68; 0.04]	-0.12 [-0.48; 0.24]
	Control	0.18 [-0.15; 0.52]	0.11 [-0.22; 0.45]		
DSO symptoms	Intervention	-0.24 [-0.63; 0.15]	-0.25 [-0.64; 0.14]	-0.27 [-0.63; 0.09]	-0.12 [-0.48; 0.25]
	Control	0.05 [-0.28; 0.38]	-0.10 [-0.43; 0.23]		
Moral injury	Intervention	-0.19 [-0.58; 0.21]	-0.49 [-0.89; -0.08]	-0.06 [-0.46; 0.34]	-0.18 [-0.58; 0.22]
	Control	-0.19 [-0.59; 0.22]	-0.47 [-0.88; -0.06]		

PTSD – posttraumatic stress disorder; DSO – disturbances in self-organization

Usability of the FOREST intervention

After using the program, of those intervention group participants who had provided post-test assessments and signed into the intervention at least once (n = 61), most of them assessed the program FOREST as useful (51/61, 83.6%), satisfactory (53/61, 86.9%), and easy to use (56/61, 91.8%). Also, a great part of the participants reported that the program FOREST improved their mental well-being (45/61, 73.8%), physical health (28/61, 45.9%), and a general understanding of themselves and their well-being (37/61, 60.7%). Finally, most participants (54/61, 88.5%) indicated that they would recommend the program FOREST to others. We have also explored the links between the level of engagement to the intervention and participants' perception of its usefulness. We found that participants' perception of the intervention as useful was positively related to the times logged in to the intervention (p = .044, *rho* = .259), but not with the number of modules logged in (p = .079, *rho* = .226).

Discussion

Principal findings

In the present study, we aimed to investigate the effects of the internet-based stress recovery intervention on stress recovery, as well as perceived stress, anxiety and depression symptoms, psychological well-being, PTSD and complex PTSD symptoms, and moral injury among medical nurses in the context of the COVID-19 pandemic. We also aimed to assess the usability of the program among its users. We found promising intervention effects indicating that stress recovery intervention FOREST fostered stress recovery skills, including psychological detachment, relaxation, mastery, and control, and most of the effects remained stable three months after the intervention. In addition, the intervention was effective in reducing its users' stress, depression, and anxiety symptoms as well as increasing psychological well-being with stable decreased stress and depression symptoms as well as improved psychological well-being three months after the intervention. Finally, we found that participants assessed the intervention as very good, and their overall satisfaction with the program was high.

Study findings revealed that using a six-week duration internet-based stress recovery intervention improved healthcare workers' skills of disengaging from work both physically and mentally, taking time for relaxation, getting involved in challenging experiences that distract from work and learning opportunities in other domains, as well as for deciding which activities to pursue during leisure time as well as when and how to do that. All the skills gained remained stable several months later, except for the control skill. It may be that control skill is the most difficult to acquire compared to psychological detachment, relaxation, and mastery skills. Also, all the information and exercises regarding control were presented in the intervention’s last and single module. In contrast, other components were introduced earlier in time and were reminded in further modules. Therefore, the acquisition of the control skill could be related to its insufficient representation, especially having in mind that the last modules were used less by its users than the first modules. Nevertheless, most of the stress recovery skills acquired while using the intervention were stable over the three months, and this looks promising, taking into consideration the heavy workloads and stressful experiences of medical staff.

It is important to note that healthcare workers who were using this CBT-based internet-delivered intervention not only gained stress recovery skills that remained active after three months, but their perceived stress levels were also reduced and remained reduced over three months. It would be interesting to explore whether stress recovery works as a mediator in reducing stress levels; possibly, the intervention could have indirect effects on reducing stress levels through the increase of recovery skills. It is also important that anxiety and depression symptoms were reduced while using the intervention. However, only depression symptoms remained reduced over three months, while anxiety symptoms returned to the baseline level. It may be that more specific intervention may be needed to address anxiety symptoms. One of the most relevant findings of the current study is that the intervention helped reduce various symptoms and improved its participants’ quality of life. After using the program, they felt more rested, calm, cheerful, active, and more interested in their daily lives.

Another interesting aspect that should be considered is the benefits of the intervention despite the decreasing engagement with every module. We believe that the intervention started providing benefits from its very beginning. We hypothesize that people, in this case, medical nurses, benefited from the intervention from its first module, meaning that simply identifying all the stressors experienced, naming the most important ones, and trying to understand their possible impact on a person’s daily life can be of extreme importance in order of improving mental health. It is possible that the more intervention is used, the more effective it is, but the very first effect starts with the first engagement. The possibility of addressing experiences, difficulties, and challenges might help to understand the links between these experiences and daily lives.

To the best of our knowledge, it was among the first studies that explored the efficacy of internet-based stress recovery intervention for healthcare workers. However, there are several studies that our results could indirectly be compared. Other studies that assessed the effectiveness of online programs in the healthcare professionals sample showed similar results to ours. Internet-based interventions were effective in improving well-being [10], reducing stress levels [9], and equipped with stress management skills [8]. The results suggest that online programs have the potential to help healthcare workers to improve their well-being.

Limitations

Several limitations should be addressed regarding the current study. First, the study was conducted with a waiting list as a control condition. The results could be replicated with an active control condition in future trials, which would allow testing whether stress recovery intervention has unique benefits compared to other interventions. Second, the intervention comprised multiple components (psychoeducation via texts and videos, various exercises, and communication with a psychologist). Due to the study design, it is impossible to identify which components contributed to the intervention effects the most. Therefore, future research should address these questions. Third, the study focused on medical nurses, and it remains unclear whether these findings can be generalized to other healthcare workers or other professions in general. Also, regarding the generalizability of results, all study participants were self-referred, which may present the risk of volunteer bias. Finally, the current study explored the effects of the intervention right after the intervention and after three months; such a follow-up period is still too short to assess the stability of the intervention effects in the long term, and future studies should address this issue.

Conclusion

The current study demonstrates that internet-based stress recovery intervention for healthcare staff can effectively increase stress recovery skills, such as psychological detachment, relaxation, and mastery, and have a positive effect on reducing stress and depression symptoms and increasing psychological well-being. In addition, the intervention has the potential to increase stress recovery skill control and reduce anxiety symptoms. Moreover, participants assessed the intervention as very good, and their satisfaction with the program was high. Since healthcare workers face heavy workloads and seldom seek professional psychological support, internet-based stress recovery intervention could be a feasible option for increasing the well-being of medical nurses.

Acknowledgments

Not applicable.

Conflict of Interest

None declared.

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