The Role of Tailored Timing and Frequency Prompts on the Efficacy of an Internet-Delivered Stress Recovery Intervention for Healthcare Workers: A Randomized Controlled Trial

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Abstract

Background: Prompts offer a promising strategy to promote client engagement in internet-delivered cognitive behavioral therapy (ICBT). However, if the prompts do not meet the needs of clients, they can potentially be more obtrusive rather than helpful.

Objective: The aim of this study was to test if prompts tailored based on timing and frequency, aligned with pre-intervention goal setting, can increase usage and the efficacy of a therapist-supported ICBT stress recovery intervention for healthcare workers.

Methods: The two-arm randomized controlled trial included 87 healthcare workers (98.9% female, aged 19-68 years: M = 39.61, SD = 11.49): 43 in the standard intervention group and 44 in the tailored prompts group. The primary outcome measure was the Recovery Experiences Questionnaire (REQ), and the secondary outcomes were the Perceived Stress Scale (PSS-4), the Patient Health Questionnaire (PHQ-4), and the World Health Organization-Five Well-Being Index (WHO-5). The self-report data were collected online at pre-intervention (September 2022), post-intervention (October 2022), and 6-month follow-up (May 2023).

Results: The results showed that tailored prompts, although appreciated by the majority (95.5%), did not improve intervention usage indicators, such as the number of logins (P = .364), modules completed (P = .482), exercises completed (P = .297), or the time spent using the program (P = .567). Similarly, tailored prompts did not increase the effects of the intervention in terms of stress recovery skills (Cohens d ranging from 0.31 to 0.85), perceived stress (d: -0.08; -0.70), depression (d: -0.11; -0.38), anxiety (d: -0.32; -0.64) or psychological well-being (d: 0.26; 0.46). In addition, the standard intervention group showed greater long-term stress recovery effects than the group using the internet-delivered intervention supplemented by tailored prompts (? = -0.24, P = .029).

Conclusions: Although the study confirmed the efficacy of the program, the merits of tailored prompts in ICBT for stress recovery were not supported. Future research is needed to test the effects of the stress recovery intervention supplemented by goal setting and tailored prompts. Clinical Trial: The trial has been registered on ClinicalTrials.gov (NCT05553210).

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Keywords: internet interventions; mental health; stress; healthcare workers; short message service (SMS).

Introduction

Background

Healthcare workers (HCWs) are at risk of stress, burnout, and other mental health problems [1,2]. However, long working hours, night shifts, rigid schedules, and prevailing stigma can make it difficult for them to engage in traditional psychological treatment [3]. ICBT could be a viable alternative and has shown efficacy in helping HCWs develop stress recovery skills, reduce stress, anxiety, and depression, and improve overall psychological well-being [4,5]. However, findings in these studies also indicated that only half of the included participants familiarized themselves with the full content of the intervention. A qualitative study of early dropouts revealed that many identified barriers to engagement, such as a lack of time or motivation and unmet expectations or

needs [6]. Across a range of diagnoses, better adherence has emerged as a predictor of better outcomes in internet interventions for adults [7]. Thus, it is crucial to find ways to motivate HCWs' engagement in internet interventions but in a way that considers individual needs and time constraints.

To enhance retention in ICBT, various persuasion techniques, such as text message reminders, have been proposed [8]. The inclusion of prompts to encourage engagement in internet interventions for healthy behavior and mental health has shown promising results [9]. Research findings are, however, inconsistent, with studies finding no significant clinical benefits of supplementary prompts in digital treatment [10]. Indeed, if prompts received are not relevant for the user, they can have the opposite effect and be more obtrusive rather than helpful [11]. Tailoring the frequency and timing of prompts could be a potential solution in internet-delivered stress management treatment [12], although there is still scarce knowledge of whether this affects engagement and intervention effects. Another suggested solution to reducing negative emotions caused by reminders is to set goals [13], such as how much time a user intends to spend on treatment. To conclude, setting usage goals and delivering tailored prompts could be a way to promote the engagement of healthcare workers and consequently increase the efficacy of the internet-delivered stress recovery intervention.

Goal of This Study

In this study, we aimed to test whether the inclusion of tailored prompts aimed at achieving usage goals can increase the efficacy of an ICBT stress recovery intervention for healthcare workers in a randomized controlled trial (RCT). The “For Recovery from Stress” (FOREST) is a 6-week ICBT intervention [14], incorporating mindfulness and focused on stress recovery [15]. FOREST+ is the updated version of FOREST, designed to meet the needs of healthcare workers [5]. Four objectives were set: (1) to analyze associations between tailored prompts and different engagement indicators in a stress recovery intervention; (2) to assess whether the intervention with tailored prompts is more effective in improving stress recovery skills as compared to the standard intervention; (3) to test if the inclusion of tailored prompts can improve the effects of the internet intervention on stress, anxiety, depression, and psychological well-being, and (4) to explore how having an option to receive tailored prompts alters the users program evaluation.

Methods

Study design

A two-arm randomized controlled trial (RCT) was conducted to investigate how usage goal setting with prompts tailored by timing and frequency would be related to the usage and the efficacy of an internet-delivered intervention for stress recovery. Eligible participants were randomized (1:1) by an independent researcher into two study groups: a standard intervention group or a tailored prompts group, using built-in randomization functionality in the hosting platform. Before registering for the study, participants were informed that the intervention would be provided either with tailored prompts or without. Both groups started using the program after randomization in October 2022. The assessments took place on three occasions: (1) pre-intervention (September 2022), (2) post-intervention (October 2022), and (3) at the 6-month follow-up (May 2023). Informed consent was obtained online at the time of enrolment prior to the pre-intervention assessment. Participants' self-reported data and data on the use of the program were collected using a secure platform, *Iterapi*, which hosted the program [16]. The study was approved by the Vilnius University Psychology Research Ethics Committee (Reference No. 2021-03-22/61). The trial has been registered on ClinicalTrials.gov (NCT05553210). See Multimedia Appendix 1 for the study’s CONSORT-

EHEALTH checklist [17].

Recruitment and Procedure

The call for participation in the intervention was disseminated across the country through various social networks, emails to regional and national professional HCWs societies and groups, and healthcare institutions. Those interested could register for the intervention via the intervention website, which provided detailed information about the program and the research study. After completing the registration form and the pre-intervention questionnaire, participants were contacted for a brief phone interview to ensure that they met the eligibility criteria for the study: (1) currently working in a health care facility; (2) adult (>18 years); (3) comprehend Lithuanian; (4) access to a device with internet connection. Certain exclusion criteria have also been identified: (1) high risk of suicide; (2) acute psychiatric crisis; (3) exposure to the current interpersonal violence. Participants who did not meet the eligibility criteria (n = 9) were referred elsewhere for psychological support if needed.

Intervention

FOREST+ is a 6-week stress recovery program specifically designed in close collaboration with healthcare professionals for healthcare workers in Lithuania [5]. FOREST+ was developed as a modification of FOREST for nurses [4,14]. The FOREST+ program consists of six modules, opened on a weekly schedule: (1) Introduction; (2) Psychological detachment; (3) Distancing; (4) Mastery; (5) Control; and (6) Keeping the change alive. The modules provide psychoeducational information based on the principles of CBT, mindfulness, and four components of stress recovery (mastery, control, psychological detachment, and distancing), as well as various exercises such as mindfulness recordings and self-assessment of bodily tension and stress. The user interface of the program is shown in Figure 1. The language of the program was Lithuanian, and the content of the modules is described in Table 2.

Figure 1. User interface.

Table 2. Description of the program modules.

Module	Description	Exercises
 1. Introduction	The initial module introduces how to use the program and provides psychoeducational content on occupational stress. Exercises focusing on stressors and symptoms of burnout are included, as well as a short relaxation audio recording for mindful breathing.	4
 2. Psychological detachment	The focus is on managing stress through body relaxation and improving sleep quality. An exercise for progressive muscle relaxation is included, as well as exercises to assess the level of tension in the body, along with a recording for relaxation before bedtime.	4
 3. Distancing	The module goes further on the importance of detachment from work during leisure time. Exercises alongside the psychoeducational material are designed to identify intrusive thoughts and activities that help distract oneself from thoughts about work. Two relaxations are included: one for raising awareness of the present and one for walking meditation.	3
 4. Mastery	This module covers another part of stress recovery – nurturing leisure time and a sense of competence outside work. The exercises in this part allow the user to assess the level of physical activity and the activities that help to relax and feel a sense of mastery. A brief relaxation recording and a video of body stretching exercises are included.	3
 5. Control	The ways to actively pursue work-life balance are presented in the module, and the importance of feeling in control of one's time is explained. The exercises are designed to help set daily needs and notice activities that interfere with work-life balance.	3
 6. Keeping the change alive	The last module focuses on how to sustain the change after the end of the program. The exercises are designed to review the activities covered during the program and the relaxation exercises that could help maintain work-life balance. Also included is a relaxation recording for overall relaxation.	2

The program is delivered with therapist support using a low-intensity approach. Once the users had completed a weekly worksheet, they received personalized feedback from their therapist. Participants could also contact their therapist via text messaging integrated into the intervention platform. In addition to communication with the therapist, clients received support from administrators via emails to keep them informed about the progress of the program and to remind them to join a new module or complete worksheets. Administrators also called the participants for a short interview before the intervention and in the middle of the program to inform them of the progress and answer any questions they may have on the use of the intervention.

In the tailored prompts group, client-administrator communication was supplemented by reminders via the short messages service (SMS). Prompts consisted of a short text asking if the participant had already taken the time to unwind and a link to the mindfulness exercises for that week. SMS prompts were tailored to each participant in the group during a phone interview with the study administrator before using the program. Participants were asked how actively they planned to engage with the program and whether they would need short text message reminders to achieve this. When participants indicated that supplementary prompts would be necessary, they were asked about preferences of prompt frequency (i.e., once a week, twice a week, every workday, or every workday twice a day) and timing (before noon – sometime in the morning or afternoon – sometime in the evening). Participants in the standard intervention group did not schedule a plan for the tailored prompts and did not receive them.

Measures

Demographic questionnaire

The pre-intervention measures were used to collect socio-demographic and work-related

information. Socio-demographic data were collected by asking questions on gender, age, education, relationship status, experience of psychological treatment or support, and the use of medication for mental health difficulties. Information on work-related aspects such as position, work status, type of service, and work experience was also included.

Recovery from stress

An overall recovery from stress experience was measured by the Recovery Experiences Questionnaire (REQ)[15]. The REQ consists of 16 items (e.g., "*I take time for leisure*"). Each of the items can be evaluated on a 5-point Likert-type scale, where 1 is "*Totally Disagree*" and 5 is "*Totally Agree*"; scores are calculated by adding up the points, with higher scores indicating a more pronounced stress recovery experience. The REQ showed good validity in the Lithuanian sample [18]. In this study, the REQ McDonald's Omega was excellent at all three measurements: $\omega_{T1} = 0.87$, $\omega_{T2} = 0.90$, $\omega_{T3} = 0.88$.

Perceived stress

The brief Perceived Stress Scale (PSS-4) [19] was used to measure stress levels. The PSS-4 consists of four questions (e.g., "*In the last month, how often have you felt that you were unable to control the important things in your life?*"). The questions are answered on a 5-point Likert-type scale, where 0 is "*Never*" and 4 is "*Very often*"; with the final score calculated by summing all the responses (reversing the scores of items 2 and 3). Higher scores show higher levels of perceived stress. Studies show good psychometric properties of the PSS-4 scale [20]. The PSS-4 McDonald's Omega in the current sample was moderate but close to the acceptable level of 0.70 [21]: $\omega_{T1} = 0.67$, $\omega_{T2} = 0.69$, $\omega_{T3} = 0.61$.

Anxiety and depression

Participants' levels of anxiety and depression were assessed using the four-item Patient Health Questionnaire (PHQ-4)[22]. The PHQ-4 consists of two items to assess depression (e.g., "Feeling down, depressed or hopeless") and two to assess anxiety (e.g., "*Feeling nervous, anxious or on edge*"). The respondent rates how much each item bothered them on a 4-point Likert-type scale, where 0 is "*Not at all*" and 3 is "*Nearly every day*". Adding the item scores for each subscale gives an estimated level of depression or anxiety. Research has shown good PHQ-4 psychometric properties in the Lithuanian sample [18]. The PHQ-4 Cronbach's alpha in the current sample for the anxiety subscale was acceptable: $\alpha_{T1} = 0.70$, $\alpha_{T2} = 0.74$, $\alpha_{T3} = 0.78$; as well as for the depression subscale: $\alpha_{T1} = 0.71$, $\alpha_{T2} = 0.82$, $\alpha_{T3} = 0.80$.

Psychological well-being

The psychological well-being was measured with the World Health Organization-Five Well-Being Index (WHO-5). WHO-5 consists of five items (e.g., "*I have felt calm and relaxed*"), which are rated on a 6-point Likert-type scale, where 0 is "*At no time*" and 5 is "*All the time*". The final percentage well-being score (ranging from 0 to 100) is calculated by summing the item scores and then multiplying the raw score by 4. Higher final scores indicate better psychological well-being. The WHO-5 has been translated and used in Lithuanian sample studies [23]. The WHO-5 McDonald's Omega in the current sample was good: $\omega_{T1} = 0.83$, $\omega_{T2} = 0.86$, $\omega_{T3} = 0.82$.

Acceptability

The post-intervention measurement included questions on the user experience of the program. Participants were asked to indicate their perceived likability (ranging from 1 = "*I did not like it at all*" to 5 = "*I liked it a lot*") and usefulness (1 = "*Not useful at all*", 5 = "*Very useful*"), as well as whether they would recommend the program to other healthcare workers (1 = "*Not at all"*, 5 = "*Definitely would recommend*"). In the tailored prompts group, participants were also asked how

they evaluated the short message prompts they received (0 = "*Very negatively*", 10 = "*Very positively*").

Use

During the pre-intervention assessment, participants were asked how actively they expected to use the program, where 1 was "*I will not use it*" and 10 was "*I will use it a lot*". At the post-intervention evaluation, participants were asked how actively they actually had used the program (1 – "*I did not use it*" and 10 – "*I used it a lot*") and how much time on average per week they had managed to devote to the program (1 – "*Not at all*" and 6 – "*>2 hours*"). The congruence of use expectations was measured by subtracting the score reflecting the pre-intervention expected usage from the post-intervention assessment of subjective usage. Moreover, participants' usage information was exported directly from the platform. Data were collected on the number of logins, modules opened and completed (from 0 to 6), exercises completed (from 0 to 19), messages received from the therapist, and messages sent to the therapist.

Statistical Analysis

To assess the effect of the program on primary (stress recovery) and secondary outcomes (perceived stress levels, anxiety, depression, psychological well-being), a Latent Change Modeling (LCM) approach [24] using *Mplus 8.8* [25] was carried out. To estimate the within-group effects of the standard intervention and the intervention supplemented by tailored prompts, a series of multi-group LCMs were performed, reporting changes in primary and secondary outcomes from pre-intervention to post-intervention and from pre-intervention to 6-month follow-up in each group separately. To calculate the between-group effects, a series of conditional LCM was computed in a full sample by regressing the intervention condition (0 = standard intervention group; 1 = tailored prompts group) on the changes in outcome scores. Moreover, we ran a series of univariate regression analyses to explore whether prompt timing and frequency were associated with changes in outcomes in the tailored prompts group. A Maximum Likelihood with Robust standard errors (MLR) estimator was used in latent change analyses. The Full Information Maximum Likelihood (FIML) algorithm was used for handling the missing data. Moreover, between-group and within-group effect sizes were calculated according to the guidelines for calculating the correct effect size in the LCM [26]. The effect sizes were interpreted according to the recommendations of Cohen (1988) [27], i.e. 0.20 = small effect, 0.50 = medium effect, and 0.80 = large effect.

In addition, IBM SPSS 28 was used to compare the demographic, work-related, and psychological support factors between the tailored prompts group and the standard intervention group using the Student's t-test and Chi-Square test. Differences between RCT groups and subgroups on program usage and evaluation factors were compared using Student's t-test and ANOVA with Bonferroni Post-hoc test.

Results

The study flowchart is shown in Figure 2. More than one hundred individuals registered to participate in the intervention. In total, 91 individuals met eligibility criteria and were randomized to one of the two study groups: tailored prompts group (TG; n = 46) or standard intervention group (SG; n = 45). Four of the participants did not log in to the program (two from each group) and were therefore not included in the data analysis. The final data analysis included 87 participants (n_{TG} = 44, n_{SG} = 43).

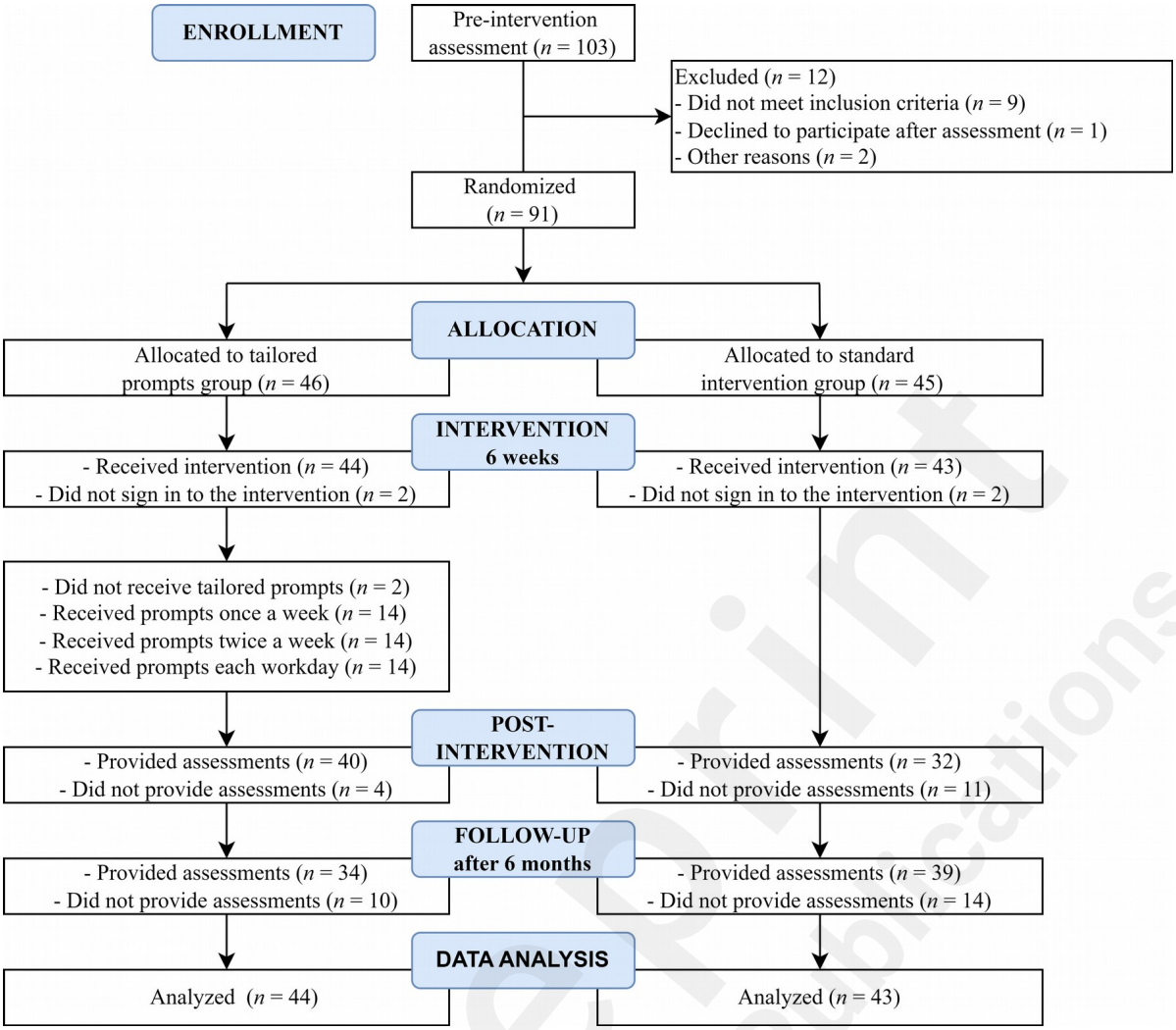

Figure 2. Study flow chart.

Participant Demographics

A majority of the included participants were female (*n* = 86, 98.9%). Participants ranged in age from 19 to 68 years (*M* = 39.61, *SD* = 11.49). Around a quarter of the participants were licensed medical doctors (*n* = 24, 27.6%), 9.2% (*n* = 8) were resident doctors, 31.0% (*n* = 27) nurses, and 32.2% (*n* = 28) other healthcare workers (psychologists, social workers, complementary and alternative health professionals, public health professionals, oral care professionals). The standard intervention group and the tailored prompts groups did not differ significantly in the pre-intervention (baseline) measures of sociodemographic, work-related, and psychological support factors. The sample characteristics of the groups at baseline are shown in Table 1.

Table 1. Sample characteristics of standard intervention and tailored prompts groups at baseline.

Variable		Standard intervention group (*n* = 43)	Tailored prompts group (*n* = 44)	Significance statistics
Gender				
	Female	42 (97.7%)	44 (100.0%)	χ^2 (1) = 1.04, *P* = .309
	Male	1 (2.3%)	0 (0.0%)	
Age (years)				
	M (*SD*)	39.53 (11.09)	39.68 (11.99)	*t* (85) = -0.06, *P* = .953
	Range	19-68		

Education				
	Secondary or lower	2 (4.7%)	3 (6.8%)	χ^2 (2) = 0.73, *P* = .693
	Post-secondary or professional college	10 (23.3%)	13 (29.5%)	
	University	31 (72.1%)	28 (63.6%)	
Long-term relationship				
	No	11 (25.6%)	12 (27.3%)	χ^2 (1) = 0.03, *P* = .858
	Yes	32 (74.4%)	32 (72.7%)	
Position				
	Medical doctor		13 (29.5%)	χ^2 (3) = 1.56, *P* = .668
	Resident doctor	5 (11.6%)	3 (6.8%)	
	Nurse	15 (34.9%)	12 (27.3%)	
	Other	12 (27.9%)	16 (36.4%)	
Work status				
	Part-time	2 (4.7%)	5 (11.4%)	χ^2 (2) = 1.76, *P* = .415
	Full-time	18 (41.9%)	20 (45.5%)	
	> Full-time	23 (53.5%)	19 (43.2%)	
Type of services*				
	Outpatient	19 (44.2%)	26 (59.1%)	χ^2 (1) = 1.94, *P* = .164
	Inpatient	18 (41.9%)	11 (25.0%)	χ^2 (1) = 2.78, *P* = .095
	Rehabilitation	3 (7.0%)	5 (11.4%)	χ^2 (1) = 0.50, *P* = .479
	Nursing	9 (20.9%)	4 (9.1%)	χ^2 (1) = 2.40, *P* = .121
	Paramedics	9 (20.9%)	5 (11.4%)	χ^2 (1) = 1.47, *P* = .225
	Intensive care	1 (2.3%)	5 (11.4%)	χ^2 (1) = 2.77, *P* = .096
Work experience				
	< 2 years	6 (14.0%)	7 (15.9%)	χ^2 (3) = 0.43, *P* = .934
	2-5 years	11 (25.6%)	9 (20.5%)	
	6-10 years	3 (7.0%)	4 (9.1%)	
	>10 years	23 (53.5%)	24 (54.5%)	
In psychological treatment				
	No	38 (88.4%)	41 (93.2%)	χ^2 (1) = 0.60, *P* = .438
	Yes	5 (11.6%)	3 (6.8%)	
Taking medication due to mental health difficulties				
	No	42 (97.7%)	41 (93.2%)	χ^2 (1) = 1.00, *P* = .317
	Yes	1 (2.3%)	3 (6.8%)	
Recent use of other self-help apps				
	No	41 (95.3%)	37 (84.1%)	χ^2 (1) = 2.97, *P* = .085
	Yes	2 (4.7%)	7 (15.9%)	

* Multiple-answer questions.

Use and Support Received

In the tailored prompts group (*n* = 44), the majority of individuals included in the study opted to receive SMS prompts (*n* = 42, 95.5%), with a majority choosing to receive them once a week in the afternoon (*n* = 10, 37.0%). Only two participants (4.5%) preferred not to receive supplementary prompts. The distribution of message preferences for all participants who took part in the pre-intervention interviews (*n* = 47) is shown in Appendix Table 1.

All participants included in the study logged in to the program up to 27 times (*M* = 8.69, *SD* = 6.02). Student t-test showed no significant difference in the number of logins when comparing the tailored prompts group (M = 9.27, SD = 5.84) and the standard intervention group (*M* = 8.09, *SD* = 6.22, *t* (85) = -0.91, *P* = .364). More than half of the participants (*n* = 50, 57.5%) of the full sample opened all program modules; but there was no significant difference in the number of program modules opened between the tailored prompts group (*M* = 4.89, *SD* = 1.82) and standard intervention group (*M* = 4.28, *SD* = 2.03; *t* (83.57) = -1.47, *P* = .146). Around one-fifth of participants (*n* = 18, 20.7%)

from the full sample fully completed all six program modules (see Table 3); as previously, no difference between the tailored prompts group (M = 3.25, SD = 2.15) and standard intervention group (M = 2.91, SD = 2.38) in completed modules was observed (t (85) = -0.71, P = .482). There was no statistically significant difference between the tailored prompts group (M = 12.52, SD = 6.73) and standard intervention group (M = 10.95, SD = 7.21) in relation to the number of program exercises (N = 19) completed (t (85) = -1.05, P = .297).

Table 3. Number of program modules completed (N = 87).

	Total	Standard intervention group (n = 43)	Tailored prompts group (n = 44)
	n (%)	n (%)	n (%)
0 modules	17 (19.5)	10 (23.3)	7 (15.9)
1 module	15 (17.2)	8 (18.6)	7 (15.9)
2 modules	3 (3.4)	3 (7.0)	0 (0.0)
3 modules	9 (10.3)	2 (4.7)	7 (15.9)
4 modules	13 (14.9)	4 (9.3)	9 (20.5)
5 modules	12 (13.8)	7 (16.3)	5 (11.4)
6 modules	18 (20.7)	9 (20.9)	9 (20.5)

When asked how much time participants spent using the program on average per week, 33.3% (n = 24) indicated that they spent less than 15 minutes, 40.3% (n = 29) spent 15 to 30 minutes, and 26.4% (n = 19) spent more than an hour. There was no difference between the two RCT groups with regard to the average time spent while using the program (χ^2 (2) = 1.13, P = .567).

No significant difference was found between the two groups and the congruence of use expectations (measured by subtracting the score reflecting pre-intervention expected usage from post-intervention assessment of usage; M_{SG} = -1.91, SD_{SG} = 2.49; n_{SG} = 33; M_{TG} = -1.93, SD_{TG} = 2.49, n_{TG} = 40; t (71) = 0.03, P = .978). However, ANOVA analysis (see Appendix Table 2) showed that, on average, participants in the tailored prompts group who chose to receive SMS reminders each workday (M = -3.67, SD = 1.78) found themselves using the program less actively than they had expected at pre-intervention assessment in comparison to those who chosen to receive reminders only once a week (M = -0.39, SD = 2.29; Mean difference = 3.28, P = .003, 95% C.I. [0.92; 5.64]).

In total, program users received from 0 to 8 messages from their therapists. There was no significant difference between therapist support messages received in the tailored prompts group (M = 4.36, SD = 1.93) and the standard intervention group (M = 3.98, SD = 2.10; t (85) = -0.90, P = .373). Participants sent 0 to 5 messages to their therapists, with the majority (n = 64, 73.6%) not contacting them. One-fifth of the participants (n = 19, 21.8%) sent one message to their therapist, and only four (4.6%) contacted the therapist more than once. No difference was found between the tailored prompts group and the standard intervention group in messages sent (χ^2 (2) = 1.10, P = .576).

Intervention effects

The trajectories of outcomes in each group are shown in Figure 3, and Table 4 presents outcome means and standard deviations. Within-group effect sizes and 95% C.I. are presented in Table 5. There was a significant change in the tailored prompts group (P = .017) and a non-significant change in the level of stress recovery in the standard intervention group (P = .056) at the post-intervention assessment (see Figure 3, Graph A). The effects of the change from pre-intervention to post-intervention were small for both groups. The results were significant at the 6-month follow-up, with small effects in the tailored prompts group (P = .027) and large effects in the standard intervention group (P < .001). In both groups, however, there were no significant changes in perceived stress levels at post-intervention assessment (TG: P = .609; SG: P = .152). However, a significant decrease

in perceived stress levels was observed at the 6-month follow-up, with moderate effects in the standard intervention group ($P < .001$) and moderate effects in the tailored prompts group ($P = .002$) (see Table 5).

Table 4. Means and standard deviations of study outcomes at pre-intervention, post-intervention, and 6 months follow-up.

	Standard intervention group (n = 43)			Tailored prompts group (n = 44)		
	T1	T2	T3	T1	T2	T3
Variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Stress recovery	51.16 (9.12)	53.93 (8.50)	59.19 (9.54)	51.98 (8.96)	54.90 (7.81)	55.51 (9.49)
Stress	7.56 (2.31)	7.28 (2.41)	6.07 (2.51)	7.52 (2.50)	7.28 (3.11)	6.07 (3.56)
Anxiety	2.81 (1.45)	2.30 (1.62)	1.80 (1.65)	3.16 (1.64)	2.64 (1.61)	2.20 (1.69)
Depression	2.47 (1.48)	2.11 (1.61)	1.81 (1.90)	2.71 (1.67)	2.15 (1.67)	2.50 (2.04)
Psychological well-being	40.84 (15.49)	48.51 (17.45)	48.87 (19.31)	39.09 (19.01)	44.03 (18.00)	46.37 (17.40)

Note. T1 – pre-intervention, T2 – post-intervention, T3 – 6-month follow-up.

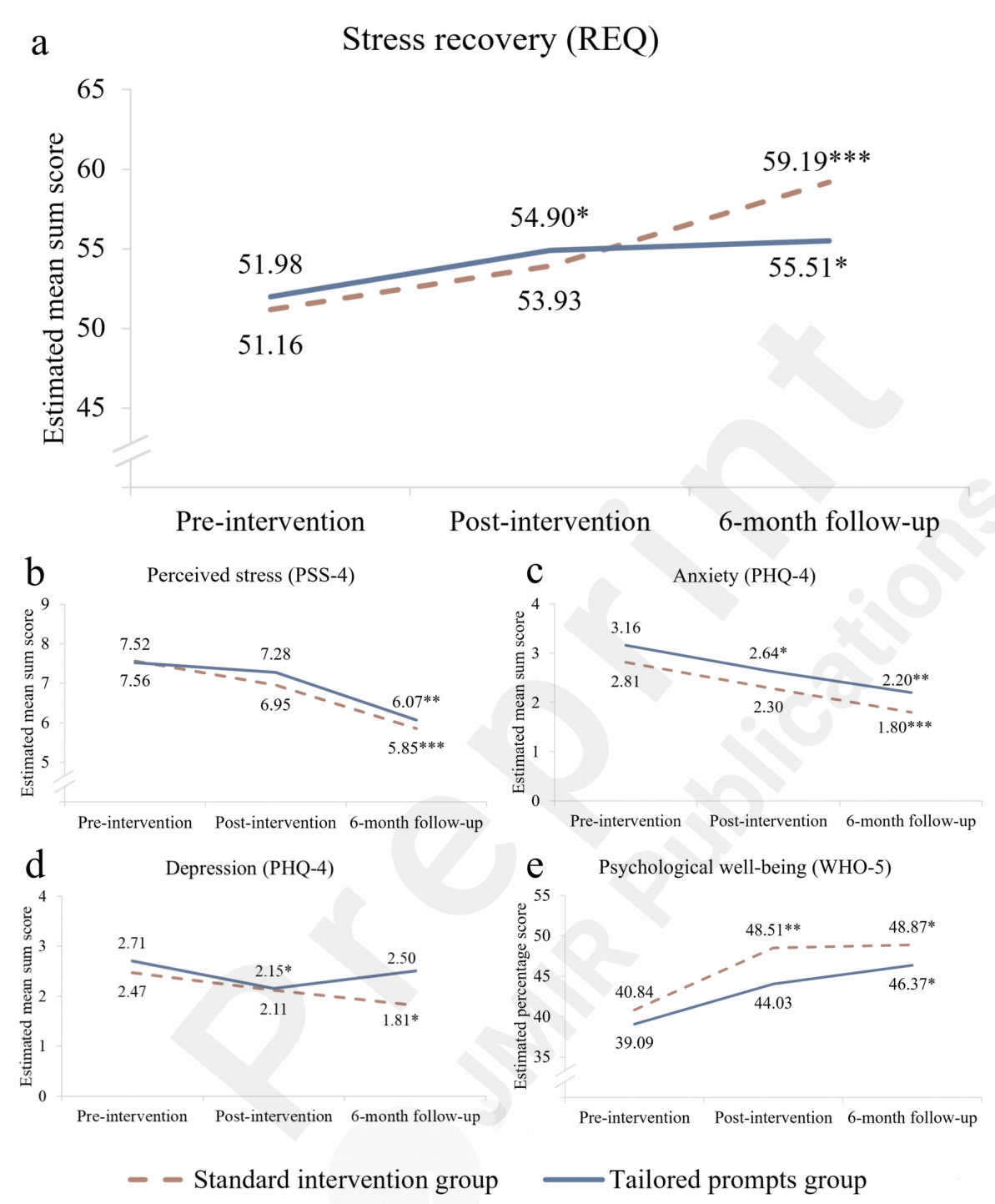

Figure 3. Trajectories of changes in primary and secondary outcomes in the groups of participants receiving standard intervention (n = 43) and intervention supplemented with tailored SMS prompts (n = 44). Significant statistics are presented for the within-group outcomes from baseline to post-intervention and from baseline to 6-month follow-up. * P < .05; ** P < .01; *** P < .001.

Changes in anxiety, depression, and psychological well-being in both groups were also tested (see Table 5). The analysis showed a significant (P = .027) reduction in anxiety in the tailored prompts group and a non-significant (P = .064) reduction in the standard intervention group at the post-

intervention assessment, with small effects. In both groups, this change remained significant (P <.01) after 6 months, with moderate effects. In addition, depression levels decreased significantly (P = .039) in the tailored prompts group after the intervention but were no longer significant (P = .548) at 6-month follow-up. In contrast, in the standard intervention group, the level of depression was significantly (P = .033) reduced at the 6-month follow-up but not at the post-intervention (P = .208). The intervention effects on depression were small for both groups (see Table 5). Psychological well-being after the intervention increased significantly (P = .020) in the standard intervention group but not in the tailored prompts group (P = .091). Although at 6-month follow-up, the increase compared to baseline was significant in both groups (P < .05), with small to moderate effects.

When comparing the tailored prompts group with the standard intervention group, there was no significant difference in the level of stress recovery immediately after the intervention (β = 0.01, P = .928). However, there was a significant difference between the groups when comparing the changes 6 months after the intervention (β = -0.24, P = .029), indicating that the group with the standard intervention had a greater increase in recovery from stress after six months as compared to the group receiving tailored prompts, with a moderate between-group effect (see Table 5). As for secondary outcomes, there was no significant difference in the changes of stress, anxiety, depression, and psychological well-being after the intervention when comparing the tailored prompts group with the standard intervention group, nor was there a significant difference in changes 6 months after the intervention. In the tailored prompts group, there was no association between changes in outcomes after the intervention and 6-month follow-up and the frequency and timing of received prompts. However, a significant positive association was found between perceived stress levels at baseline and choosing to receive more frequent prompts (β = 0.27, P = .034) and to receive them in the afternoon (β = 0.42, P = <.001). The full results of multiple univariate regression analyses of the intervention outcomes are presented in Appendix Table 3.

Table 5. Intervention effect sizes.

		Within-group effect size		Between-group effect size	
		Pre-post	Pre-follow-up	Pre-post	Pre-follow-up
Variable	Group	*d* [95% C.I.]	*d* [95% C.I.]	*d* [95% C.I.]	*d* [95% C.I.]
Stress recovery	SG	0.31 [-0.11; 0.74]	0.85 [0.41; 1.29]	0.02 [-0.40; 0.44]	-0.49 [-0.92; -0.07]
	TG	0.34 [-0.08; 0.77]	0.38 [-0.04; 0.80]		
Stress	SG	-0.26 [-0.68; 0.17]	-0.70 [-1.14; -0.27]	0.15 [-0.27; 0.57]	0.10 [-0.32; 0.52]
	TG	-0.08 [-0.50; 0.33]	-0.47 [-0.89; -0.04]		
Anxiety	SG	-0.33 [-0.75; 0.10]	-0.64 [-1.08; -0.21]	0.00 [-0.42; 0.42]	0.04 [-0.38; 0.46]
	TG	-0.32 [-0.74; 0.10]	-0.57 [-1.00; -0.15]		
Depression	SG	-0.23 [-0.65; 0.19]	-0.38 [-0.81; 0.04]	-0.13 [-0.55; 0.29]	0.28 [-0.14; 0.71]
	TG	-0.33 [-0.75; 0.09]	-0.11 [-0.53; 0.31]		
Psychological well-being	SG	0.46 [0.03; 0.89]	0.45 [0.03; 0.88]	-0.16 [-0.58; 0.26]	-0.04 [-0.46; 0.38]
	TG	0.26 [-0.16; 0.68]	0.40 [-0.03; 0.82]		

Note. SG – standard intervention group; TG – tailored prompts group; C.I. – confidence interval; *d* = Cohens d.

Acceptability

In the tailored prompts group (n = 40), the majority (97.5%; n = 39) of the participants rated prompting more positively than negatively (>5 on a scale from 0 to 10; M = 8.45, SD = 1.26). Moreover, most of the participants (80.5%, n = 58) found the program to be useful regardless of the RCT group (χ^2 (4) = 3.59, P = .464). There was no significant group effect with regard to participants liking the program (χ^2 (4) = 2.77, P = .596), with 87.5% (n = 63) in the total sample indicating that they overall liked it. Most of the participants (91.7%, n = 66) indicated that they would recommend the program to other healthcare workers regardless of the group (χ^2 (4) = 2.76, P = .600).

Discussion

Principal Results

The aim of this study was to test whether the inclusion of tailored prompts to pursue the individual usage intensity goal would increase engagement and efficacy of ICBT stress recovery intervention for healthcare workers. While users expressed satisfaction with the intervention and received supplementary prompts, results revealed that tailored prompts had no significant effects on usage indicators and were not associated with additional stress recovery, perceived stress, anxiety, depression, or psychological well-being outcomes. The results thus bring new insights to the field of research on internet interventions and call to consider the possible effects of supplementary tailored prompts when designing or testing internet interventions.

Comparisons with Prior Work

This study was the first to support that the effects of an internet-delivered stress recovery intervention are sustained after six months. In contrast to previous trials, reporting positive mental health effects after three months [4,5], participants in the current study exhibited significant improvements when using the standard intervention in primary (stress recovery) and secondary outcomes (stress, anxiety, depression, psychological well-being) six months post-intervention, with a small to large effect size. However, in the intervention supplemented by tailored prompts, the decrease in depression was no longer significant at the 6-month follow-up, and the effects on stress recovery, stress, anxiety, and psychological well-being were small to moderate despite the overall positive evaluation of tailored SMS prompts. These findings affirm the efficacy of the internet-delivered stress intervention in fostering enduring improvements in the well-being of healthcare workers. The merits of tailored prompts are, however, not supported.

We did not observe significant differences between the groups in terms of the program's effects on stress, anxiety, depression, or psychological well-being. However, tailored prompts were associated with a smaller, albeit significantly improved, intervention effect on the primary outcome – stress recovery. A possible explanation for this result may refer to the fact that an important part of stress recovery is a sense of control – which activity to pursue during leisure time, when and how to pursue it [15]. It is possible that constant reminders to take time to unwind could inhibit the development of this stress recovery

skill. Moreover, the unanticipated effect of tailored prompts may refer to the thwarted sense of agency, i.e., attributing improvement to oneself rather than to others, e.g., researchers, – which is positively related to the effectiveness of therapy [28]. Participants who did not receive tailored prompts were able to attribute success to themselves, which may have led to more developed stress-coping skills. Lastly, tailored reminders to make time for the program according to the goals set acts as self-monitoring, which can have negative effects, for instance, when feeling guilty about not achieving goals [13]. Further research is needed to clarify what works for whom in order to ensure optimal participant engagement and outcome effects.

Secondly, the trial did not find that tailored SMS prompts positively impacted healthcare workers' engagement in an internet-delivered stress recovery intervention. To begin with, we found no differences in the program use indicators (e.g., number of logins, exercises completed) between the two study groups. Similarly, a study by Morrison et al. (2017) reported that adaptive tailoring of notification timing does not enhance the use of a smartphone-based stress management app [12]. On the other hand, we found that participants who received tailored prompts were more likely to use the program more than they expected before the intervention. However, this may also reflect a perception that the program required more of their time than they would have intended. It is also likely that SMS prompts may have an impact on other adherence variables not measured in this study, such as faster login and login duration [29]. However, we should bear in mind that while adherence is important, involvement is possibly a stronger predictor of intervention effects, and it has been suggested that it may act as a working mechanism for persuasive technologies [8]. Thus, further research should test other factors of engagement that might be influenced by including tailored prompts.

Limitations

The results of this study should be viewed in the context of its limitations. Even though previous research has found the tested stress recovery intervention to be effective at post-intervention assessment [4,5], in the current study, no significant changes in the perceived stress at post-intervention were found in comparison to baseline assessment. This could be explained by one of the shortcomings of this study – the modest sample size. As well as by different measures used, as the short version of the PSS scale had relatively low reliability in our study, it may not have captured more nuanced changes. Secondly, the results of this study cannot be generalized to a broader population, as participants were predominantly female and healthcare workers.

Despite the limitations, this novel study provides a further understanding of how internet intervention effects can be influenced by the inclusion of tailored prompts to achieve usage goals. Further research is needed to answer the question of what works for whom, as it might show that supplementary prompts may be beneficial for helping develop other skills not tested in this study or for different kinds of program users (e.g., less motivated). Thus, future research should further investigate factors that contribute to the adherence, and the efficacy of internet interventions, as well as the underlying mechanism between them, to contribute to the development of psychological treatment.

Conclusions

The results of this study have highlighted that techniques for the promotion of engagement in internet interventions, in this case, SMS prompts, may not necessarily have a beneficial effect, even if they are tailored to the needs of participants. Thus, when seeking to improve stress recovery skills in a sample of healthcare workers, it is important to look for factors other than tailored prompts that determine engagement and treatment success. Finally, the developers of internet-delivered interventions should carefully consider if their intervention should be supplemented by tailored prompts, even if they are broadly acceptable, as they may undermine the acquisition of some skills targeted.

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Conflicts of Interest

No potential conflict of interest was declared by the author(s).

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Abbreviations

ANOVA: analysis of variance
HCWs: healthcare workers
ICBT: internet-delivered cognitive behavior therapy
LCM: latent change modeling
PHQ-4: Patient Health Questionnaire - 4
PSS-4: Perceived Stress Scale - 4
RCT: randomized controlled trial
REQ: Recovery Experiences Questionnaire
WHO-5: World Health Organization-Five Well-Being Index

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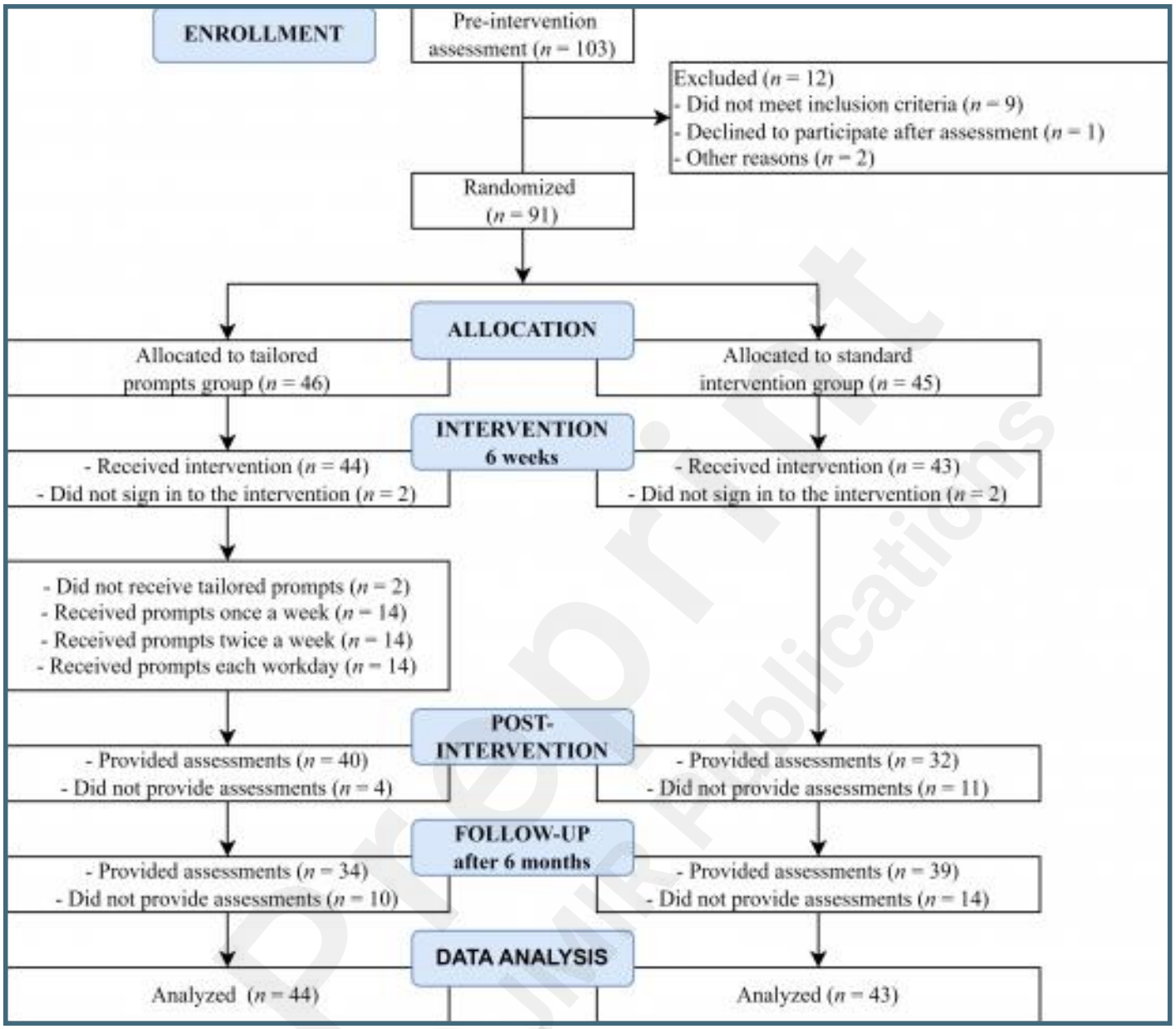
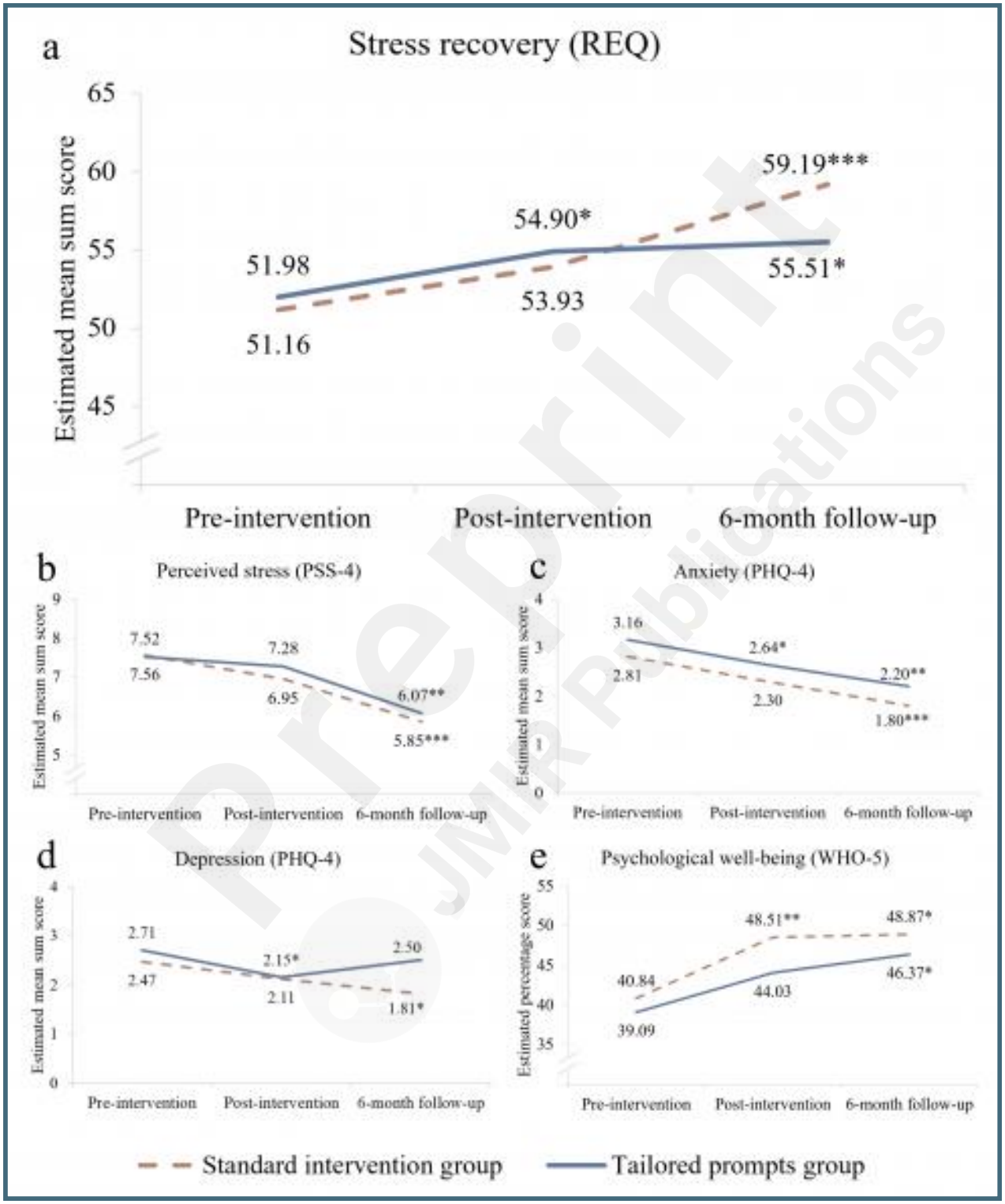
Supplementary Files

User interface.

Study flow chart.



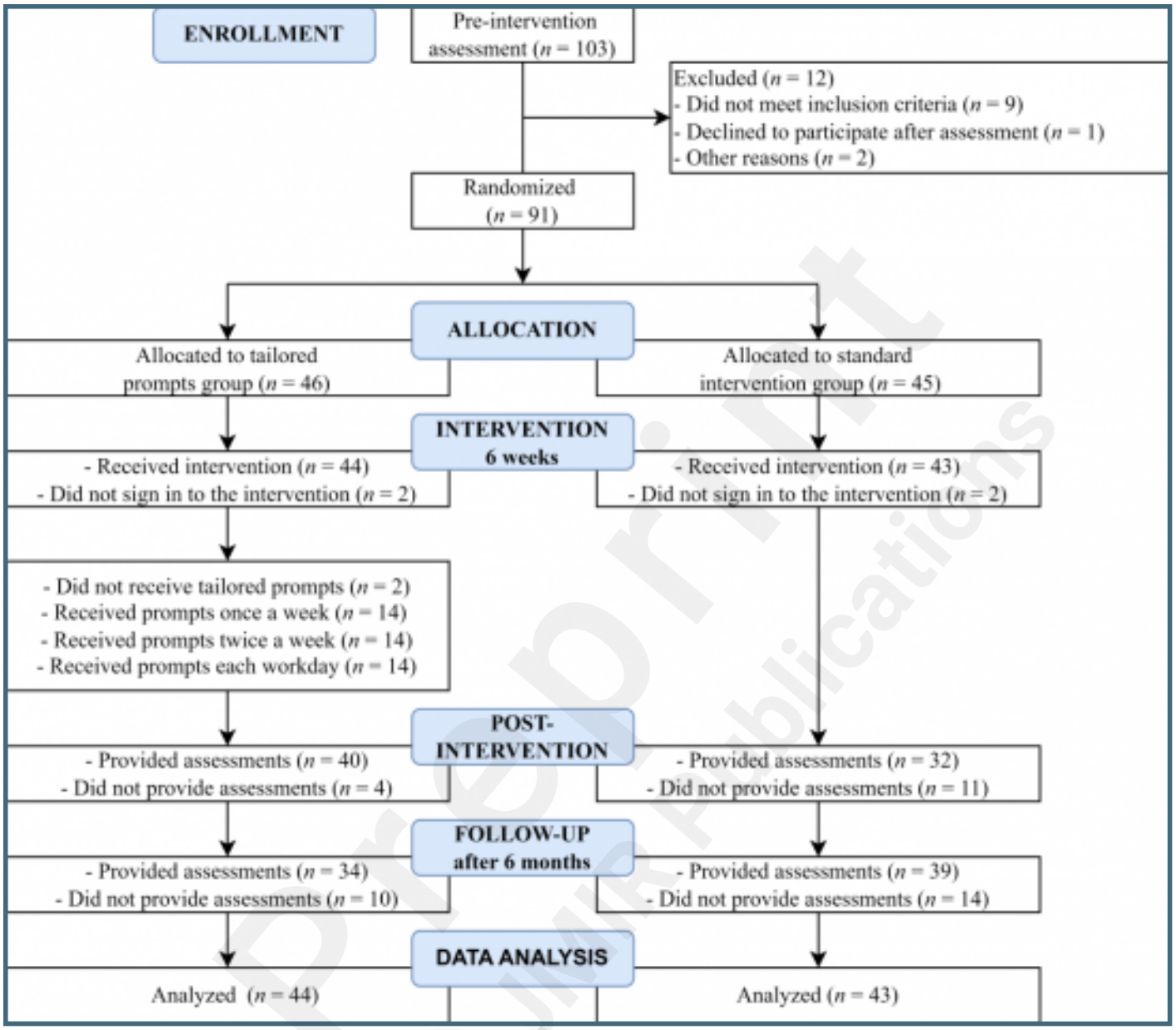
Trajectories of changes in primary and secondary outcomes in the groups of participants receiving standard intervention (n = 43) and intervention supplemented with tailored SMS prompts (n = 44). Significant statistics are presented for the within-group outcomes from baseline to post-intervention and from baseline to 6-month follow-up. * P < .05; ** P < .01; *** P < .001.



Figures

User interface.

Study flow chart.



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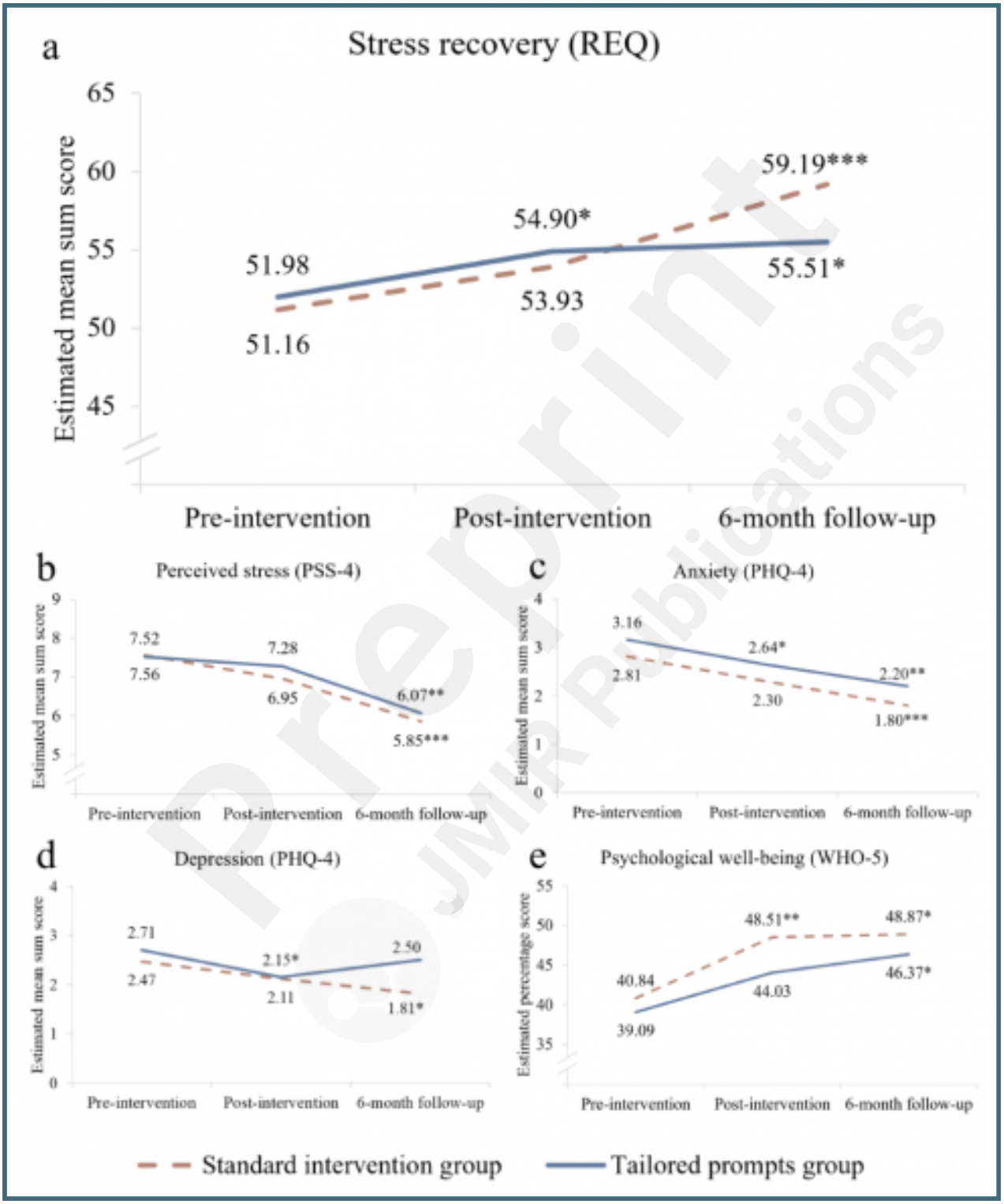


Multimedia Appendixes

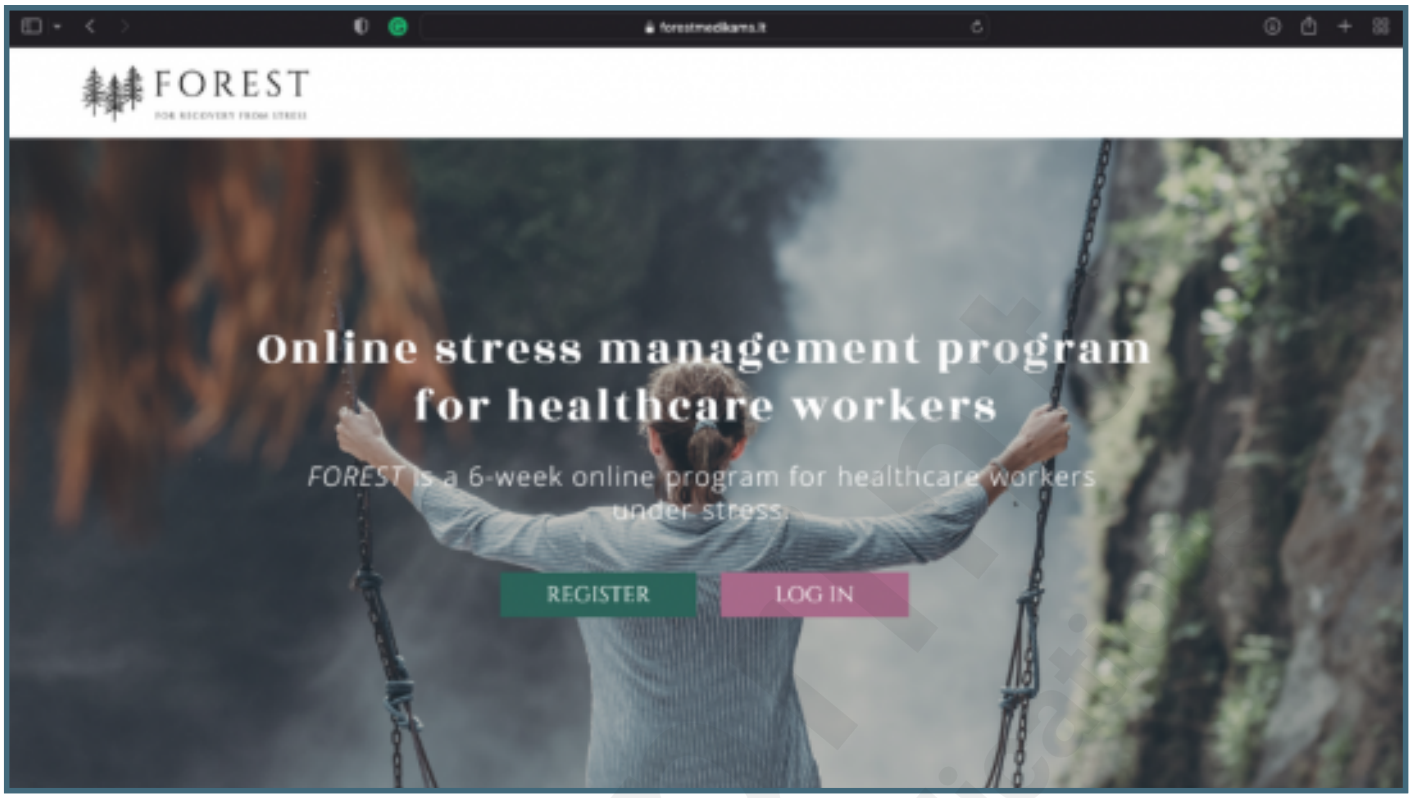
Supplementary material.
URL: http://asset.jmir.pub/assets/b7bf9448e2980a277a7faa6783654a4a.docx

CONSORT (or other) checklists

CONSORT checklist.
URL: http://asset.jmir.pub/assets/47f6e58cdedc756dfdc68840d7156cce.pdf

TOC/Feature image for homepages

Feature image for homepage.



Optional feature image for homepage.