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Evaluating the Effectiveness of a One-Week Multimodal Prevention Program for Slowing down and Stress Reduction Performed in a German Health Resort: Results of a Randomized Controlled Trial

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Introduction

Nowadays, the term "stress" is commonly in use in everyday life – primarily with a negative connotation – whether in work or leisure time, in social duties, personal relationships, or even in school [1]. Due to technical improvements in communication media, everyday life in these days is characterized by permanent availability via mobile phone or E-mail. Because of the 24/7 connectedness of employees, boundaries between work and home become blurred, shifting stressors of work into leisure time [2–6]. Derks and Bakker [6] showed that daily exhaustion due to work-home interference is more pronounced among employees who use their smartphones compared to nonusers.

Further, not being able to meet the daily requirements, e.g., as a result of continuously being interrupted on daily routines or workflow [7], might turn into a stressor, which in the end can result in sickness due to the experienced stress and hectic symptoms. Stressors negatively impact upon one's personal balance and foster the rise of uncertainty, pressure, and anxiety [8], potentially leading to stress responses on the physical, behavioral, and psychological level [8].

In the German Health Interview and Examination Survey for Adults (DEGS1), performed in Germany between 2008 and 2011, Hapke et al. [9] studied the effect of chronic stress on health and mental well-being in a representative sample of 5,850 Germans aged between 18 and 64 years. The authors found high-level chronic stress with a prevalence of 11% among the population (13.9% in women and 8.2% in men). The study further showed that in highly stressed people, psychological impairments such as burnout syndrome, depressive symptoms, or sleep disturbances are more often present (61.1%) than among unstressed or less stressed people (17.0%) [9]. Looking at the results published by Russ et al. [10], experienced stress seems to pose even more serious risks. As the authors reported, stress appears to be associated with mortality. They analyzed individual data of 68,222 people from the Health Survey from England in order to study the relation between psychological distress and mortality. They found a dose-response association between psychological distress and an increased risk of mortality. It is of particular importance that according to their results, even the presence of psychological distress on a lower level seems to increase the risk for mortality.

Taking into account these findings and considering the increase in stress-related health impairments, as for example burnout syndrome [11], new concepts are necessary to overcome the negative impact of daily stressful overwhelming to prevent stress-related health risks and diseases and to improve the quality of daily life of stressed people. However, the effectiveness of new approaches needs to be evaluated before they are implemented, e.g., in health promotion strategies or in particular settings. In their meta-analysis, Richardson and Rothstein [12] determined the effects of stress management programs carried out in occupational settings. The authors built on a meta-analysis published by van der Klink et al. [13] which included only randomized experiments and conducted a comprehensive search in six databases, taking into account various research fields and also "gray literature." Richardson and Rothstein [12] performed extensive analyses to shed light on the effectiveness of stress management interventions from different perspectives as due to the variety and large number of interventions and outcome measures, the effectiveness of programs remained unclear. The authors categorized the interventions reported in the 36 studies included into cognitive-behavioral, relaxation, organizational, and multimodal intervention types and found a large significant effect size for cognitive-behavioral interventions and a small but significant

effect size for multimodal programs (Cohen's $d = 0.239$). They further report larger effects for programs including only one or two treatment components and lasting only 1–4 weeks. Regarding the outcome variables being addressed in all different intervention types, Richardson and Rothstein [12] found the largest effect size for stress (Cohen's $d = 0.727$) among outcomes psychological in nature. When considering multimodal intervention programs only, the authors reported a slightly decreased but still moderate to large effect size (Cohen's $d = 0.595$) for stress outcomes. In view of these findings, it is worth knowing whether an intervention on stress reduction, consisting of various components and lasting only 1 week, is effective to potentially be implemented in an occupational stress management program.

The overall aim of the present study was therefore to evaluate the effectiveness of a 1-week multimodal prevention program for slowing down and stress reduction carried out in the Bavarian health resort of Bad Reichenhall. The specific aims were to study the effects of the prevention program on (1) subjectively experienced stress, (2) well-being, and (3) self-rated current health status.

Materials and Methods

Study Design

The study was designed as a three-armed randomized controlled trial (RCT) with measurements pre/post the intervention phase as well as 1, 3, and 6 months after the end of the intervention phase. Participants were allocated by centralized randomization to either an "intervention group" (IG, group A), a "vacation group" (control group B), or a "home group" (control group C). We implemented the vacation-in-health-resort comparison (group B) to take account of the expected effect arising from a recreational stay in the health resort [14]. One summer (early July) and two fall (early and mid October) date options were offered for selection to participate in the program, resulting in three subgroups (i.e., July: A1-B1-C1; early October: A2-B2-C2; mid October: A3-B3-C3) per date option and study arm. All assessment dates were based on the date option chosen.

Study Population

We included adult people aged between 18 and 70 years with a score of at least 12 on the Screening Scale of Chronic Stress of the Trier Inventory for Chronic Stress (TICS-SSCS) [15, 16]. Based on the results of a representative study on chronic stress among Germans, a TICS-SSCS score ≥12 indicates an above-average stress level [9]. We only excluded people having an acute illness. Participants were recruited by the health resort through multiple sources such as a study website, local newspapers, flyers, advertisements, and press releases.

Randomization

A random allocation sequence – containing the group letters A, B, and C – was automatically generated in a 1:1:2 ratio as we expected a higher dropout rate in control group C. Identification numbers were matched to the randomization sequence and stored encrypted. The identification numbers were assigned to the participants by the first author according to the day informed consent was given, whereby the randomization sequence remained hidden.

Intervention

The 1-week multimodal prevention program consisted of (1) an everyday 2-h educational component (health coaching session) combined with (2) six 1-h relaxation units (e.g., hatha yoga, qigong, progressive muscle relaxation, etc.) and (3) five physical activity elements lasting 45–120 min each (e.g., hiking, biking, aqua aerobics, etc.). Balneotherapeutic elements such as sole baths, Kneipp hydrotherapy, and sole inhalation lasting 30–60 min each were also part of the program.

A certified health coach held the 2-h health coaching sessions – the key elements of the entire prevention program. The six coaching units covered the following main topics: self-exploration, individual analysis of stressors, and resilience ability at different levels including meta level to build up personal health resources and capabilities for identifying and handling stressful situations. Themes such as chronobiology, sleep, personal balance, as well as identifying causes for lack of energy and sources of power were also discussed. In the first unit, participants of the IG were given a diary with the topics of the coaching, in which they could write down their personal impressions during the course of the week and which was to serve as a handout to look up after the intervention. All previously mentioned exercise and relaxation courses were given either by the same health coach or by experienced health professionals.

The intervention itself was carried out in the health resort of Bad Reichenhall. For practicability reasons, we offered different date options for the participants' stay at the health resort. Individuals allocated to the IG or group B had the possibility to choose one out of three date options for their 1-week trip to Bad Reichenhall. Therefore, the participants of the IG and group B stayed at the health resort in small groups not exceeding a size of 10 persons, according to the date option chosen. The IG and group B stayed at the health resort of Bad Reichenhall at the same time, but did not get into contact during their stay. For both the IG and group B, accommodation costs were covered by the study.

Group B did neither get treatment or intervention nor instructions how to spend the week at the health resort. At the beginning, we introduced to the participants of the vacation group – as we equally did to the participants of the IG – leisure, activity, and recreational opportunities of the health resort. Compared to the IG, however, the vacationers experienced no demands at all during their entire stay, such as getting up early to take part in the prevention program. Study participants randomized to group C stayed at home, continued their daily routine, and did not get any further treatment or advice. After study completion, a monetary incentive was given to participants of the control group C for their effort in taking part in the study.

Outcome Measures

The primary study outcomes were subjectively experienced stress assessed using the Perceived Stress Questionnaire (PSQ) [17] and the TICS [15]. With the 20 items of the German short version of the PSQ, internal stress reactions as well as perceived external stressors are represented in the four subscales "worries," "tension," "joy," and "demands" [18]. The total score of the PSQ ranges between 0 and 100, with a higher score indicating higher level of perceived stress.

The TICS is a standardized questionnaire to assess chronic stress [15]. It consists of 57 items referring to the nine subscales "work overload," "social overload," "pressure to perform," "work discontent," "excessive demands at work," "lack of social recognition," "social tension," "social isolation," and "chronic worrying" [19]. With the data of the TICS, a profile of chronic stress can be generated; changes over time can be demonstrated. Twelve out of the 57 TICS items form the short TICS-SSCS, representing the fol-

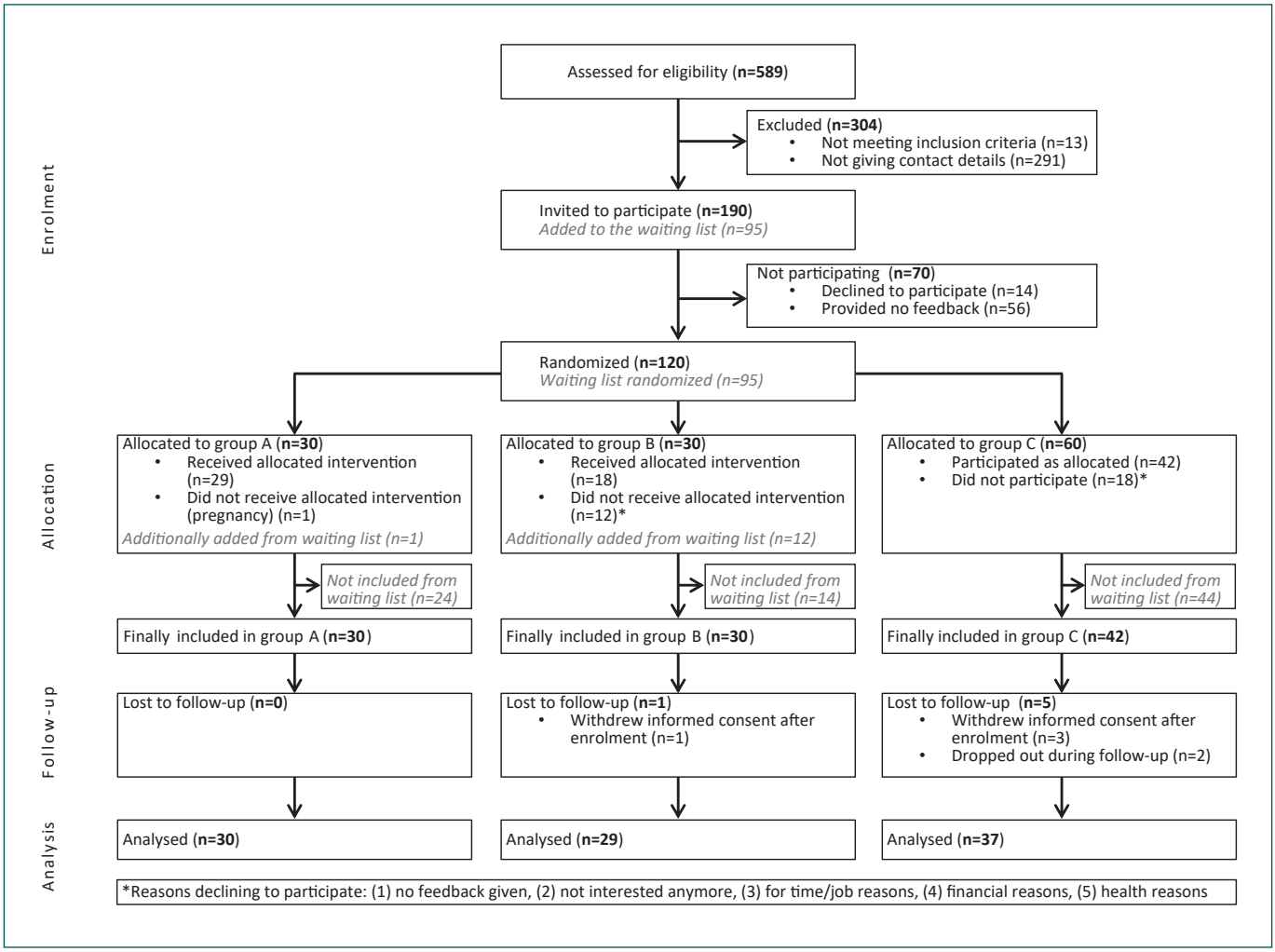

Fig. 1. Flow diagram of the process of enrolment, allocation, follow-up, and analysis.

lowing five aspects of stress: "work overload," "social overload," "pressure to perform," "lack of social recognition," and "chronic worrying" [15]. Raw TICS-SSCS data can score from 0 to 48; T-transformed values range between 17 and 98 [20]; the higher the score, the higher the burden of stress.

Further, we studied participants' mental well-being using the World Health Organization 5-Item Well-Being Index (WHO-5) [21], a standardized questionnaire that consists of five items covering the domains "positive mood," "vitality," and "general interest," besides current health status using the EuroQol visual analog scale (EQ-5D VAS) for self-rated actual health (0–100; 100 = best health) [22].

The individuals of the different study groups completed the study questionnaires at the same time according to the date option chosen.

Sample Size

Sample size estimation was performed using G*Power [23] based on the main outcome instrument PSQ with an expected effect size of 0.35 [24] for group differences tested by ANOVA, a power of 0.8, and a significance level of 0.05. The resulting estimated sample size was $n = 82$. Therefore, a sample size of 100 participants had to be recruited for an estimated dropout rate of 15%. To guarantee successful recruitment, we implemented a waiting list of interested persons who fulfilled the inclusion criteria, but provided feedback after the number of participants to be invited had already been reached. All individuals of the waiting list were additionally randomized as previously described.

Data Collection

Over a period of 6 months, data were collected five times using the above-mentioned instruments in paper-based questionnaires: 1 week before the intervention phase (baseline – T1), at the end of the intervention phase (T2), as well as 1 (T2b), 3 (T3), and 6 (T4) months after the intervention phase had terminated. Sociodemographic data were obtained at baseline only. Data were simultaneously collected for the participants of the IG and groups B and C.

Data Analysis

Sociodemographic data and baseline characteristics were analyzed using descriptive statistics and compared between all groups using ANOVA, χ^2 test, and Kruskal-Wallis test according to the level of measurement of the respective variables.

We compared changes from baseline in primary (PSQ, TICS-SSCS raw values) and secondary outcomes (WHO-5 and EQ-5D VAS) between the IG and vacation control group B as well as between the IG and home control group C using descriptive statistics, ANOVA (for simultaneously comparing changes from base-

Table 1. Baseline sociodemographic and clinical characteristics

	Total (n = 96)	IG (n = 30)	Control group B (n = 29)	Control group C (n = 37)
Female	71 (74.0%)	21 (70.0%)	20 (69.0%)	30 (81.1%)
Age, years	48.0 (9.5)	49.5 (10.9)	45.3 (8.5)	48.9 (8.9)
Age groups				
<40 years	20 (20.8%)	4 (13.3%)	9 (31.0%)	7 (18.9%)
40–49 years	31 (32.3%)	10 (33.3%)	11 (37.9%)	10 (27.0%)
50–59 years	35 (36.5%)	10 (33.3%)	7 (24.1%)	18 (48.7%)
≥60 years	10 (10.4%)	6 (20.0%)	2 (6.9%)	2 (5.4%)
Marital status				
Married/cohabiting	60 (62.5%)	18 (60.0%)	16 (55.2%)	27 (73.0%)
Separated/divorced/widowed	17 (17.7%)	6 (20.0%)	7 (24.1%)	4 (10.8%)
Single	20 (20.8%)	6 (20.0%)	8 (27.6%)	7 (18.9%)
Highest education level				
Basic secondary school certificate	6 (6.3%)	2 (6.7%)	1 (3.4%)	3 (8.1%)
Intermediate secondary school certificate	19 (19.8%)	9 (30.0%)	3 (10.3%)	7 (18.9%)
Qualification for university	19 (19.8%)	7 (23.3%)	8 (27.6%)	4 (10.8%)
University degree	48 (50.0%)	12 (40.0%)	16 (55.2%)	20 (54.1%)
Other	8 (8.3%)	1 (3.3%)	3 (10.3%)	4 (10.8%)
Employment status				
Full-time work	42 (43.8%)	11 (36.7%)	13 (44.8%)	18 (48.7%)
Part-time work	21 (21.9%)	7 (23.3%)	6 (20.7%)	8 (21.6%)
Self-employed	22 (22.9%)	8 (26.7%)	6 (20.7%)	8 (21.6%)
Housewife/househusband, student, other	5 (5.2%)	3 (10.0%)	0 (0.0%)	2 (5.4%)
Retired, unemployed	5 (5.2%)	1 (3.3%)	4 (13.8%)	0 (0.0%)
Missing	3 (3.1%)	1 (3.3%)	0 (0.0%)	2 (5.4%)
PSQ total score	56.2 (18.5)	53.0 (19.9)	58.6 (20.5)	56.9 (15.5)
TICS screening scale[1]	23.9 (8.6)	24.7 (7.4)	24.2 (9.3)	23.0 (7.6)
WHO-5 total score	39.1 (19.1)	40.7 (19.7)	37.2 (21.6)	39.4 (16.8)
EQ-5D VAS	69.4 (17.3)	69.5 (17.1)	66.1 (17.9)	71.8 (16.9)

Values are presented as n (%) or mean (SD). EQ-5D VAS, EuroQol visual analog scale; IG, intervention group; PSQ, Perceived Stress Questionnaire; TICS, Trier Inventory for Chronic Stress; WHO-5, World Health Organization 5-Item Well-Being Index. [1] Raw values according to Schulz et al. [20].

line for all three groups), and t tests (for comparing the IG vs. group B and for comparing the IG vs. group C). The results from the t tests are presented using the mean difference between the two groups and its 95% CI. Standardized effect sizes (Cohen's d) were calculated as the difference between two means divided by the pooled SD. We further used ANCOVA to assess the differences in scores between groups at a certain time point while controlling for the baseline measures. For ANCOVA we present the parameter estimate for group with its 95% CI. Moreover, the TICS profiles based on the t-transformed TICS values including the nine subscales are presented for all groups.

Data analysis was performed for all participants who completed the baseline assessments and at least one follow-up assessment. Effects were judged significant at $p < 0.05$ unless otherwise stated. Statistical analyses were performed using R version 3.6.1 and SAS 9.3.

Results

In total, 102 people were included in the study. Four persons withdrew informed consent after enrolment and 2 participants were lost during follow-up; hence, data from 96 participants were available for analysis (Fig. 1).

Participant Characteristics at Baseline

Table 1 shows sociodemographic data and baseline measures for the entire population and by study groups. The mean age was 48.0 years (SD 9.5) and the majority of the participants were female (74%). Half of the study population was highly educated with a university degree or a university of applied sciences degree. Almost 44% of the participants were in paid fulltime employments, 22% in part-time employments, and 23% were self-employed. The baseline averaged scores were 56.2 (SD 18.5) in PSQ, 23.9 (SD 8.6) in raw TICS-SSCS, 39.1 (SD 19.1) in WHO-5, and 69.4 (SD 17.3) in EQ-5D VAS. We found no statistically significant differences between groups at baseline in terms of demographics or baseline measures.

Change from Baseline

All data regarding change from baseline for the IG compared to vacation control group B as well as for the IG compared to home control group C are presented in Tables 2 and 3.

Table 2. Changes in primary and secondary outcomes from baseline to post intervention, 1-, 3-, and 6-month follow-up (IG vs. group B)

	IG (A) Change from baseline			Vacation control group (B) Change from baseline			ANOVA *p* value	Change from baseline – difference between groups mean (95% CI)	Pooled SD	Effect size (Cohen's *d*)	Between-group ANCOVA[a] parameter estimate for group (95% CI)
	n	mean	SD	*n*	mean	SD					
PSQ											
At 1 month	29	−11.98	16.17	27	−14.17	16.06	0.2978	2.19 (−6.46 to 10.83)	16.12	0.14	0.12 (−7.28 to 7.53)
At 3 months	29	−10.95	20.58	26	−11.25	15.01	0.7901	0.30 (−9.38 to 9.99)	18.17	0.02	−1.57 (−10.12 to 6.97)
At 6 months	27	−13.35	16.03	28	−9.17	16.51	0.1615	−4.18 (−12.98 to 4.62)	16.28	−0.26	−5.39 (−14.32 to 3.54)
TICS-SSCS											
At 3 months	29	−6.34	7.46	26	−3.73	5.83	0.2401	−2.61 (−6.22 to 0.99)	6.74	−0.39	−2.42 (−5.82 to 0.99)
At 6 months	27	−6.44	8.16	28	−2.75	6.32	0.0490[b]	−3.70 (−7.66 to 0.27)[c]	7.28	−0.51	−3.44 (−7.31 to 0.43)[d]
WHO-5											
Post intervention	30	14.80	17.92	29	18.07	16.06	0.0673[c]	−3.27 (−12.14 to 5.60)	17.03	−0.19	−1.74 (−9.19 to 5.71)
At 1 month	29	16.83	22.46	27	16.74	18.26	0.1435	0.09 (−10.85 to 11.03)	20.55	0.00	2.06 (−7.76 to 11.88)
At 3 months	28	12.29	23.14	27	9.19	15.56	0.3505	3.10 (−7.56 to 13.76)	19.79	0.16	4.70 (−5.20 to 14.61)
At 6 months	27	15.11	17.55	25	10.72	17.27	0.7820	4.39 (−5.31 to 14.10)	17.42	0.25	5.88 (−4.68 to 16.45)
EQ-5D VAS											
Post intervention	30	10.17	13.46	29	13.52	10.88	0.0156[b]	−3.35 (−9.73 to 3.03)	12.26	−0.27	−2.25 (−7.50 to 3.01)
At 1 month	29	10.79	12.67	28	9.21	13.76	0.0558[c]	1.58 (−5.45 to 8.61)	13.22	0.12	2.11 (−3.97 to 8.20)
At 3 months	29	5.72	18.68	27	7.70	12.95	0.9254	−1.98 (−10.56 to 6.60)	16.18	−0.12	−1.49 (−9.48 to 6.51)
At 6 months	27	8.33	17.26	28	8.68	13.63	0.3504	−0.35 (−8.79 to 8.10)	15.52	−0.02	0.12 (−7.59 to 7.84)

EQ-5D VAS, EuroQol visual analog scale; IG, intervention group; PSQ, Perceived Stress Questionnaire; TICS-SSCS, Screening Scale of Chronic Stress of the Trier Inventory for Chronic Stress; WHO-5, World Health Organization 5-Item Well-Being Index. [a] Between-group ANCOVA adjusted for baseline values (group B as reference). [b] *p* value for ANOVA <0.05. [c] *p* value for ANOVA, *p* value for *t* test for comparison of differences between groups <0.1 (*t* test: $p = 0.0669$). [d] *p* value for between-group ANCOVA <0.1 ($p = 0.0805$).

Table 3. Changes in primary and secondary outcomes from baseline to post intervention, 1-, 3-, and 6-month follow-up (IG vs. group C)

	IG (A) Change from baseline			Home control group (C) Change from baseline			ANOVA *p* value	Change from baseline – difference between groups mean (95% CI)	Pooled SD	Effect size (Cohen's *d*)	Between-group ANCOVA[a] parameter estimate for group (95% CI)
	n	mean	SD	*n*	mean	SD					
PSQ											
At 1 month	29	−11.98	16.17	35	−8.27	12.90	0.2978	−3.71 (−11.16 to 3.73)	14.47	−0.26	−5.58 (−12.53 to 1.37)
At 3 months	29	−10.95	20.58	37	−9.89	15.17	0.7901	−1.06 (−10.23 to 8.11)	17.74	−0.06	−2.74 (−10.59 to 5.11)
At 6 months	27	−13.35	16.03	37	−7.17	18.35	0.1615	−6.18 (−14.81 to 2.45)	17.41	−0.35	−7.11 (−15.47 to 1.26)[b]
TICS-SSCS											
At 3 months	29	−6.34	7.46	37	−4.26	6.77	0.2401	−2.09 (−5.64 to 1.47)	7.08	−0.29	−1.68 (−4.81 to 1.45)
At 6 months	27	−6.44	8.16	37	−2.53	7.67	0.0490[c]	−3.91 (−7.95 to 0.12)[d]	7.88	−0.50	−3.48 (−7.12 to 0.16)[b]
WHO-5											
Post intervention	30	14.80	17.92	37	7.57	16.10	0.0673[d]	7.23 (−1.19 to 15.66)[d]	16.94	0.43	7.82 (0.81 to 14.83)[e]
At 1 month	29	16.83	22.46	35	9.37	21.05	0.1435	7.46 (−3.52 to 18.43)	21.70	0.34	7.97 (−1.23 to 17.16)[b]
At 3 months	28	12.29	23.14	36	16.78	22.03	0.3505	−4.49 (−15.93 to 6.94)	22.52	−0.20	−2.87 (−12.13 to 6.38)
At 6 months	27	15.11	17.55	35	13.37	25.09	0.7820	1.74 (−9.11 to 12.59)	22.14	0.08	1.78 (−7.94 to 11.51)
EQ-5D VAS											
Post intervention	30	10.17	13.46	37	3.24	11.09	0.0156[c]	6.92 (0.79 to 13.05)[c]	12.21	0.57	6.03 (1.07 to 10.99)[e]
At 1 month	29	10.79	12.67	35	4.80	11.39	0.0558[d]	5.99 (−0.10 to 12.08)[d]	11.99	0.50	4.93 (−0.86 to 10.71)[b]
At 3 months	29	5.72	18.68	37	5.49	17.48	0.9254	0.24 (−8.78 to 9.25)	18.02	0.01	−1.08 (−8.52 to 6.35)
At 6 months	27	8.33	17.26	37	4.62	18.17	0.3504	3.71 (−5.23 to 12.66)	17.80	0.21	1.80 (−5.47 to 9.06)

EQ-5D VAS, EuroQol visual analog scale; IG, intervention group; PSQ, Perceived Stress Questionnaire; TICS-SSCS, Screening Scale of Chronic Stress of the Trier Inventory for Chronic Stress; WHO-5, World Health Organization 5-Item Well-Being Index. [a] Between-group ANCOVA adjusted for baseline values (group C as reference). [b] *p* value for between-group ANCOVA <0.1. [c] *p* value for ANOVA, *p* value for *t* test for comparison of differences between groups <0.05. [d] *p* value for ANOVA, *p* value for *t* test for comparison of differences between groups <0.1. [e] *p* value for between-group ANCOVA <0.05.

Primary Outcomes – PSQ and TICS-SSCS

Participants of the IG improved in PSQ over the study period, reaching main improvements of on average −13.45 points at 6 months. Group B likewise improved, but showed the largest improvement at 1-month follow-up and declined again until 6-month follow-up. Group C too showed improvement in PSQ, but to a lesser extent, and remained rather stable over time. ANOVA revealed no significant differences in change from baseline between the three groups. Compared to group B, the IG showed slightly less improvements in PSQ 1 month after intervention, but at 6 months the IG presented better results than group B (−4.18 points) with an effect size of −0.26. ANCOVA revealed a group difference of −5.39, yet group differences did not reach statistical significance. The improvement of the IG was larger than that of group C at all time points, with the largest difference at 6 months (−6.18 points) and an effect size of −0.35; ANCOVA revealed a group difference of even −7.11, but group differences did not reach statistical significance.

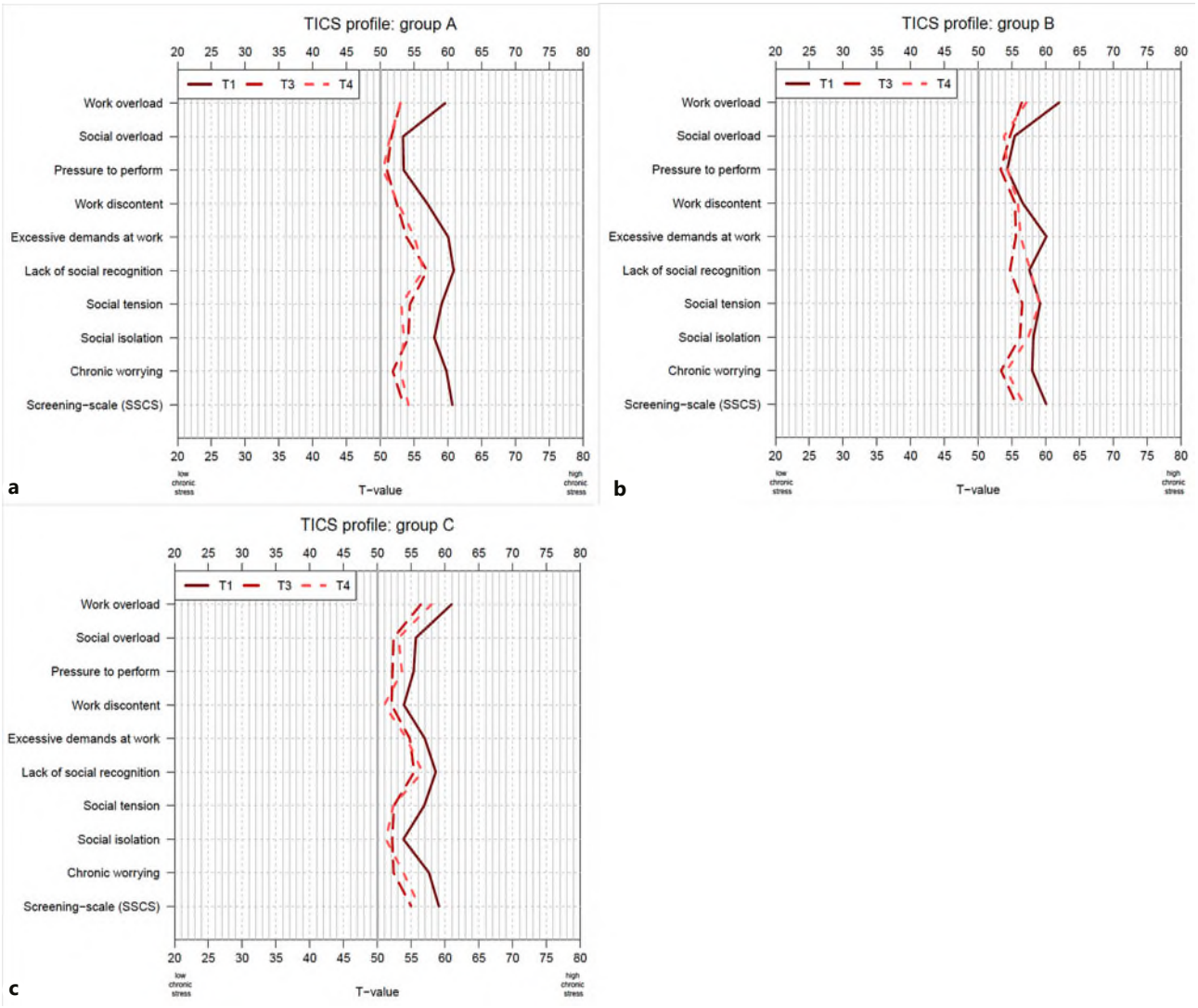

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Fig. 2. Changes in the TICS subscales over time points for the intervention group (group A) (**a**) and control groups B and C (**b**, **c**). SSCS, Screening Scale of Chronic Stress; T1, baseline; T3, 3-month follow-up; T4, 6-month follow-up; TICS, Trier Inventory for Chronic Stress.

Regarding TICS-SSCS, the IG improved and stabilized improvement of about −6 points over time. Group B showed less improvement and ended up with −2.75 points at 6-month follow-up, as did group C, whose participants were −2.53 points better at the end of follow-up. ANOVA revealed significant differences (p = 0.0490) between the three groups at 6-month follow-up. Compared to group B, the IG presented better results in TICS-SSCS after 3 and 6 months and barely missed statistical significance at 6-month follow-up (p = 0.0669). We found a moderate to large effect size of −0.51, and ANCOVA revealed a group difference of −3.44 (p = 0.0805). Compared to group C, the IG developed better with the largest difference at 6 months (−3.91 points, p = 0.0572) and an effect size of −0.50. ANCOVA revealed a group difference of −3.48 (p = 0.0607).

The IG benefited in chronic stress among all nine subscales of the entire TICS (Fig. 2). Compared to group C, IG participants were particularly better able to cope with "work overload" (e.g., "I have too many tasks to perform") and with "excessive demands at work" (e.g., "Although I try, I do not fulfil my duties").

Secondary Outcomes – WHO-5 and EQ-5D VAS

The IG improved in WHO-5 after the intervention, had a main average improvement of 16.83 points 1 month after attending the program, and was able to stabilize this level with 15.11 points at 6-month follow-up. Group B also improved, but showed the best development of 18.07 points post intervention and declined up to 6-month follow-up. Group C improved less in WHO-5 until 1-month

follow-up, but demonstrated a change from baseline of 13.37 points at the end of the study period. ANOVA revealed no significant differences in change from baseline between the three groups. Compared to group B, the IG showed less improvements in WHO-5 post intervention, yet again, at 6 months the IG demonstrated better results than group B (4.39 points) with a small effect size of 0.25; ANCOVA revealed a group difference of 5.88, but group differences did not reach statistical significance. When compared to group C, the IG differed most at 1-month follow-up (7.46 points), with an effect size of 0.34. While controlling for baseline (ANCOVA), we found a statistically significant group difference of 7.82 post intervention and a nonsignificant group difference of 7.97 after 1 month.

Among the participants of the IG, we observed an improvement of around 10 points in EQ-5D health state up to 1-month follow-up, which slightly declined until the end of the study period. Group B stated best improvements (13.52 points) post intervention, which also declined until 6-month follow-up. Group C showed a moderate but stable improvement in EQ-5D VAS over time, ending up with a plus of 4.63 points at 6-month follow-up. Post-intervention ANOVA revealed significant differences (p = 0.0156) between the three groups and almost significant differences (p = 0.0558) at 1-month follow-up. We found no significant differences in change from baseline for the IG compared to group B. When compared to group C, the IG developed better with the largest differences post intervention (6.92 points, p = 0.0276) and at 1-month follow-up (5.99 points, p = 0.0536) and moderate to large effect sizes of 0.57 and 0.50. ANCOVA revealed a significant group difference of 6.03 (p = 0.0177) only post intervention.

Discussion

This study reports on the evaluation of a 1-week multimodal prevention program for slowing down and stress reduction carried out in the Bavarian health resort of Bad Reichenhall. We studied the effects of a multimodal prevention program on subjectively experienced stress, well-being, and current health status. Change from baseline in primary and secondary outcomes was analyzed and compared between an IG and two control groups.

Compared to healthy adults [9, 18], we noticed among the study participants at baseline remarkably higher average scores in our main study outcome – subjectively experienced stress, which is not surprising as we only included individuals with an above-average stress level according to Hapke et al. [9]. Our population mainly consisted of women (74%), with an average age of 48 years and half of them having a university degree. This corresponds to population-based studies published by Lindblom et al. [25] and Ahola et al. [26] in which higher levels of burnout and exhaustion were associated with being female [26], being middle-aged [25, 26], and having either a high level of education or no education [25].

Compared to baseline, participants of the multimodal prevention program experienced a considerable decrease in perceived stress and all aspects of chronic stress, which they were able to keep almost unchanged over the course of follow-up.

In our study, we integrated group B ("vacation group") to control for a potential stress-lowering effect solely resulting from a recreational stay at the health resort. As stated by Strauss-Blasche et al. [27], the main factors moderating recuperation during vacation are having free time for oneself, exercising, sleeping well, and making new acquaintances. Thus, it is not surprising that we found among the vacation group positive effects in all outcomes immediately after the 1-week stay and within 1 month; regarding self-rated health and well-being the immediate effects even exceeded the effects we observed in the IG. This short-lasting improvement is well known as "vacation effect" and our findings are in line with those of de Bloom et al. [14] and Strauss-Blasche et al. [27], who reported a short-term vacation-related recuperation that continues about 2 weeks after having returned to work. Within the vacationers, after 1-month follow-up we likewise noticed a steadily decline of improvement in well-being and subjectively experienced stress. In contrast, the IG mostly maintained the enhanced level in these study outcomes at 6-month follow-up.

Surprisingly, the participants of control group C ("home group") demonstrated better outcomes than expected. This may be due to the phenomenon that individuals change their behavior in being aware that they participate in an evaluation or observation. McCarney et al. [28] stated that such an observer effect, also referred to as the Hawthorne effect, occurs as study participants create positive effects for themselves while participating in a trial.

Even though we did not observe large overall effects of the intervention compared to both control groups, the results of our RCT indicate that a short-term multimodal prevention program appears to set a positive trend towards less perceived and chronic stress among its participants. Stier-Jarmer et al. [29] published the results of a RCT in which they investigated the effects of a 3-week prevention program on stress relief among persons with early burnout. The authors demonstrated that a 3-week intervention consisting of traditional elements of health-resort medicine combined with stress management education significantly reduced experienced stress and emotional exhaustion over time [29]. Regarding our results, one has to consider that the participants of our study

learned and practiced the health-promoting components of the prevention program for 1 week only. Thus, we assume that stronger effects could have been observed if the intervention had lasted longer.

Further, it is well known in health psychology that prevention programs aiming to reduce stress require an educative component as participants of these programs usually have little knowledge concerning risk factors or existing associations between personal behavior and disease development [30]. The educational component, applied daily in a 2-h health coaching session within the multimodal prevention program, was a new approach that had not been tested in advance. Regarding all other elements of the prevention program, such as physical activity [31, 32], body-mind medicine and relaxation units [33], or balneotherapeutic elements [34], health-promoting and stress-reducing effects have already been demonstrated. Thus, it is unclear whether a previously approved educational component would have yielded larger effect sizes among the IG, especially since we know from personal feedback that some of the participants considered single topics being addressed in the health coaching session as inappropriate.

When developing the program, we decided to introduce a range of health-promoting elements targeting body and mind, assuming that participants afterwards would integrate some of the elements they enjoyed or had positive experiences in their everyday life. Considering our results based on the findings described by Richardson and Rothstein [12], it is worth thinking about potentially reducing the number of components and in return deepen some elements, such as cognitive-behavioral intervention. In their meta-analysis, Richardson and Rothstein [12] found decreasing effect sizes while adding more components to a cognitive-behavioral intervention. In addition, they reported that multimodal interventions were less effective compared to cognitive-behavioral intervention [12]. In a systematic review on the effectiveness of health promotion interventions for nurses published by Stanulewicz et al. [35], out of 136 studies included, 66 measured stress outcome. The authors also showed that interventions using multimodal approaches were not successful in improving measures of stress. In contrast, among studies on burnout and compassion fatigue, multicomponent interventions were successful in improving burnout measures [35]. In a RCT including individuals with risk of burnout or incipient burnout syndrome published by Stier-Jarmer et al. [29], a 3-week multimodal intervention – combining stress management interventions with relaxation techniques, physical exercises, and moor applications – revealed large effect sizes on perceived stress and emotional exhaustion. Thus, as the literature provides contrasting results regarding the effects of multimodal interventions, future research on the mechanism of effects of prevention programs seems to be desirable.

As indicated by Faltermaier [36], participation is one key element of successful health promotion and prevention. In general, we are convinced that the experience of belonging to a group with all participants being actively involved in a structured program favorably contributed to the positive trends we observed within the IG. However, from conversations we had subsequent to the intervention, we assume that single participants would have benefited more from an individual discussion with the health coach rather than discussing quite private issues in group sessions. Furthermore, people joining groups B and C were not "forced" to spend a certain amount of time in a group of people they did not know before, so we do not know whether any potential interpersonal issues within the IG possibly limited positive experiences among the participants.

Some limitations need to be mentioned. First, as we did not use other than self-reported data, we cannot rule out a potentially existing reporting bias. Second, due to organizational reasons, we had to split the entire IG as well as the vacation group into three subgroups each. Thus, there were seasonal variations (summer time/fall) regarding the 1-week stay at the health resort between the different subgroups and we did not control for potential seasonal effects on our studied outcomes [37]. Third, during recruitment we neither asked whether study applicants already had suffered from burnout syndrome nor controlled for depressive symptoms within the potential study population. In hindsight, we have to acknowledge that in some cases a preventive intervention was not the appropriate step.

Conclusion

Even though we did not observe large overall effects of the intervention compared to both control groups, our results indicate that even a short-term multimodal prevention program for slowing down and stress reduction appears to set a positive trend towards less perceived and chronic stress over time. The participants seem to benefit in the long run from building up capabilities to identify possible stressors and to handle them appropriately.

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Statement of Ethics

The ethics committee of the Ludwig Maximilian University approved the study and all the procedures followed were in accordance with the ethical standards of the responsible committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

S. Kus, D. Frisch, and A. Schuh were involved in the conception and design of the study. S. Kus and G. Immich were responsible for recruitment, data collection, and documentation during intervention and follow-up. C. Oberhauser and S. Kus performed the statistical analysis. S. Kus and G. Immich drafted the manuscript. All authors interpreted and discussed the data, commented on the manuscript, and approved the final and submitted version.

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