Health Psychology
2015, Vol. 34, Supplement, 1240–1251

0278-6133/15/$12.00 http://dx.doi.org/10.1037/hea0000277

Restoring Depleted Resources: Efficacy and Mechanisms of Change of an Internet-Based Unguided Recovery Training for Better Sleep and Psychological Detachment From Work

David D. Ebert
Friedrich-Alexander University and Harvard University

Matthias Berking
Friedrich-Alexander University

Hanne Thiart
Leuphana University

Heleen Riper
Leuphana University and Vrije Universiteit Amsterdam

Johannes A. C. Laferton
Harvard University

Pim Cuijpers
Leuphana University and Vrije Universiteit Amsterdam

Bernhard Sieland and Dirk Lehr
Leuphana University

Objective: This randomized controlled trial evaluated the efficacy of an Internet-based intervention, which aimed to improve recovery from work-related strain in teachers with sleeping problems and work-related rumination. In addition, mechanisms of change were also investigated. ***Methods:*** A sample of 128 teachers with elevated symptoms of insomnia (Insomnia Severity Index [ISI] $\geq$ 15) and work-related rumination (Cognitive Irritation Scale $\geq$ 15) was assigned to either an Internet-based recovery training (intervention condition [IC]) or to a waitlist control condition (CC). The IC consisted of 6 Internet-based sessions that aimed to promote healthy restorative behavior. Self-report data were assessed at baseline and again after 8 weeks. Additionally, a sleep diary was used starting 1 week before baseline and ending 1 week after postassessment. The primary outcome was insomnia severity. Secondary outcomes included perseverative cognitions (i.e., work-related rumination and worrying), a range of recovery measures and depression. An extended 6-month follow-up was assessed in the IC only. A serial multiple mediator analysis was carried out to investigate mechanisms of change. ***Results:*** IC participants displayed a significantly greater reduction in insomnia severity (d = 1.37, 95% confidence interval: 0.99–1.77) than did participants of the CC. The IC was also superior with regard to changes in all investigated secondary outcomes. Effects were maintained until a naturalistic 6-month follow-up. Effects on insomnia severity were mediated by both a reduction in perseverative cognitions and sleep effort. Additionally, a greater increase in number of recovery activities per week was found to be associated with lower perseverative cognitions that in turn led to a greater reduction in insomnia severity. ***Conclusions:*** This study provides evidence for the efficacy of an unguided, Internet-based occupational recovery training and provided first evidence for a number of assumed mechanisms of change.

Keywords: insomnia, work stress, prevention, Internet-based self-help, mediators

Supplemental materials: http://dx.doi.org/10.1037/hea0000277.supp

David D. Ebert, Department of Clinical Psychology and Psychotherapy, Friedrich-Alexander University, and Harvard Medical School, Harvard University; Matthias Berking, Department of Clinical Psychology and Psychotherapy, Friedrich-Alexander University; Hanne Thiart, Division of Online Health Training, Innovation Incubator, Leuphana University; Heleen Riper, Division of Online Health Training, Innovation Incubator, Leuphana University, and Department of Clinical Psychology and Institute for Health and Care Research, Vrije Universiteit Amsterdam; Johannes A. C. Laferton, Harvard Medical School, Harvard University; Pim Cuijpers, Division of Online Health Training, Innovation Incubator, Leuphana University; Department of Clinical Psychology and Institute for Health and Care Research, Vrije Universiteit Amsterdam; Bernhard Sieland and Dirk Lehr, Division of Online Health Training, Innovation Incubator, Leuphana University.

This 2015 special supplemental issue of *Health Psychology* is supported by funding from the National Institutes of Health (NIH) Office of Behavioral and Social Sciences Research (OBSSR) to support the dissemination of research on eHealth and mHealth interventions, methods, and implications in the practice of health psychology. Trial registration: World Health Organization International Clinical Trial Registry No. DRKS00004984. David D. Ebert, Matthias Berking, Hanne Thiart, Bernhard Sieland, and Dirk Lehr are stockholders of Institut für Online-Gesundheitstrainings GmbH (Institute for Trainings Online), a research institute that implements evidence-based online trainings in routine mental health care.

Correspondence concerning this article should be addressed to David D. Ebert, Harvard Medical School, Harvard University, 180 Longwood, Boston, MA. E-mail: david.ebert@fau.de

Occupational stress is a common phenomenon associated with a range of severely negative health consequences (Bhui, Dinos, Stansfeld, & White, 2012). Successful recovery from work-related strain, defined as the restoration of depleted resources after work, is considered to be important in order to protect from the negative consequences of occupational stress and to maintain good health (Zijlstra & Sonnentag, 2006). Two processes can be considered especially important for effective recovery: sleep and psychological detachment from work.

Sleep is considered the most basic and important psychological and somatic recovery process. A number of longitudinal studies (Åkerstedt, Nordin, Alfredsson, Westerholm, & Kecklund, 2012; Åkerstedt et al., 2012; De Lange et al., 2009; Jansson & Linton, 2006; Linton, 2004; Pereira & Elfering, 2014) provide evidence for the negative effects of stress on the development and persistence of sleep problems. Prevalence rates for current insomnia range from 11.4% (Ursin, Baste, & Moen, 2009) to 23% (Kessler et al., 2011). Sleep problems are associated with lower affective well-being (Kompier, Taris, & van Veldhoven, 2012), increased risk of depression (Baglioni et al., 2011), and lower occupational performance (Kessler et al., 2011). There is also increasing evidence that low sleep quality and sleep deprivation affect reactivity to stressors (Vandekerckhove & Cluydts, 2010) and lower the psychological threshold for the perception of stress from cognitive demands (Minkel et al., 2012), which may lead to a downward spiral between the effects of work stress and sleep impairment.

Another necessary process for effective recovery from work-related strain is considered to be the effective psychological detachment from work at the end of the working day (Sonnentag, 2012). The failure to unwind from work, in its intensive forms called *work-related perseverative cognitions* (i.e., worrying and rumination), has not only been shown to predict lower work performance, fatigue, and depression (Dalgaard et al., 2014; Willert, Thulstrup, Hertz, & Bonde, 2010), but also shown in longitudinal studies (Pereira, Meier, & Elfering, 2013; Vahle-Hinz, Bamberg, Dettmers, Friedrich, & Keller, 2014) to be associated with sleeping problems.

Studies on the indirect effects of occupational stress, perseverative cognitions, and sleep found that sleep quality mediates the relationship between rumination and fatigue (Querstret & Cropley, 2013), and there is increasing evidence that indicates that the inability to stop worrying about work during free time may be an important mechanism in the relationship between work stress and sleeping problems (Berset et al., 2011; Pereira & Elfering, 2014; Radstaak et al., 2014). For example, Berset and colleagues found that work-related rumination fully mediated the association between stress at work and self-reported sleep quality. It has also been found that worry mediated the effect of daily stressors on heart rate variability during waking and the subsequent nocturnal sleep period (Brosschot et al., 2007). A recent diary study showed that psychological detachment from work partially mediated the effect of stressors at work on ambulatory actigraphy-assessed sleep onset latency and sleep duration (Pereira & Elfering, 2014).

There is ample evidence for the successful treatment of clinical primary insomnia with cognitive–behavioral therapy (CBT; Ellis & Barclay, 2014), but studies that include participants with subthreshold insomnia complaints have had findings of lower effect sizes (Koffel, Koffel, & Gehrman, 2014). Research on interventions targeting impaired sleep (i.e., without a clinical diagnosis of insomnia) in stressed employees, however, is scarce and tends to yield mixed results (Willert et al., 2010; Dalgaard et al., 2014; Suzuki et al., 2008).

Considering (a) the extensive evidence on the association of stress and poor psychological detachment from work on impaired sleep, (b) their adverse consequences, and (c) evidence that interventions for employees with work-related mental health problems are often less effective when they do not take work-related aspects into account (Blonk, Brenninkmeijer, Lagerveld, & Houtman, 2006; Nieuwenhuijsen et al., 2014), the limited amount of intervention research on combined interventions that target recovery by improving effective psychological detachment from work and sleep is surprising.

Our own group recently developed an intervention (GET.ON Recovery) that aims to improve recovery from work-related strain by applying cognitive–behavioral and metacognitive techniques for insomnia and perseverative cognitions (Querstret & Cropley, 2013) and by promoting healthy restorative behavior such as recreational activities and boundary tactics (Kreiner, Hollensbe, & Sheep, 2009). The intervention was developed in an Internet-based guided self-help format in order to address potential limitations of face-to-face psychological occupational health interventions that include restricted availability, reach, high costs, and threshold to utilize (Ebert et al., 2014a; Junge et al., 2015). In a randomized controlled trial with 128 employees that experienced work-related rumination and sleeping problems, we found the intervention to be effective in reducing insomnia severity and fostering mental detachment from work (Thiart, Lehr, Ebert, Berking, & Riper, 2015). However, given the novelty of the approach, replication is clearly indicated before a widespread dissemination can be considered. Moreover, the study evaluated only an intervention that included substantial professional support (of up to 3 hr total per participant). Although it is less resource-intensive than most individual CBT interventions, it is still time consuming. Because costs of Internet-based interventions, after initial development, are substantially linked to professional guidance time, this clearly limits the possible reach of the intervention and consequently its potential to reduce the negative consequences of occupational strain at the population level. However, a number of studies on unguided Internet- and computer-based stress management interventions did not find any significant effects (Billings, Cook, Hendrickson, & Dove, 2008; Wiegand et al., 2010). It remains yet unclear whether an unguided intervention could be effective in enhancing recovery from work-related strain, and thus evaluating the unguided intervention delivery format appears promising.

Moreover, there is yet no evidence on whether the multicomponent intervention GET.ON Recovery works according to its proposed mechanisms. The intervention was developed on the basis of theoretical assumptions and above reviewed empirical evidence on the prospective and reciprocal association of (work-related) perseverative cognitions, sleep, and adverse health consequences. It is assumed that a better psychological detachment from work and improved sleep both have direct positive effects on health and well-being. Moreover, it is also assumed that by targeting perseverative cognitions, sleep is also

indirectly improved. In line with the cognitive model of insomnia, "the attention-intention-effort pathway" (Espie, Broomfield, MacMahon, Macphee, & Taylor, 2006), it is hypothesized that normal and automatic sleep processes become disrupted when individuals explicitly intend to sleep and engage in efforts to produce sleep. Sleep effort has been suggested to be an important mechanism in the psychological treatment of insomnia complaints (Espie, Broomfield, MacMahon, Macphee, & Taylor, 2006). However, it has to the best of our knowledge not yet been tested empirically (Schwartz & Carney, 2012). Thus, it is further assumed that a reduction in sleep effort is associated with a reduction of insomnia complaints. On the basis of the principles of health behavior change specified in the Health Action Process Approach (Schwarzer, 2008), the training also aims to increase the number of recreational activities, thereby fostering positive emotions that are considered to be important to broaden and build resources. It is assumed that an increase in recreational activities is associated with better mental detachment from work, and that this in turn leads to a reduction of sleeping problems. Finally, it is also assumed that an increase in recreational activities is associated with greater mental well-being, both through direct effects as well as through indirect effects via enhancing mental detachment from work.

This study aimed at strengthening the evidence base for Internet-based recovery interventions by investigating the effectiveness of an unguided recovery intervention in teachers with heightened levels of work-related rumination and impaired sleep. Moreover we aimed to investigate a number of assumed mechanisms of change.

Method

Design

A two-armed randomized controlled trial (RCT) was conducted between May 2013 and November 2014 to compare unguided iRECT (GET.ON Recovery, intervention condition [IC]) to a wait-list control condition (CC). We included 128 teachers in order to be able to detect an effect size of $d = 0.50$ at posttreatment based on a power ($1 - \beta$) of 0.80 in a two-tailed test with $\alpha = .05$. The intervention was evaluated in a sample of teachers (1) because teachers are often considered to be highly affected by work-related stress (Lehr, Hillert, & Keller, 2009); (2) to strengthen the internal validity of the study; and (3) because teachers usually have low boundaries between work and private life and thus face the risk for an insufficient psychological detachment from work. Assessments took place at baseline (T1) and posttreatment (8 weeks, T2; Figure 1). We also assessed an extended 6-month follow-up (6-MFU) in the IC. This study was approved by the University of Marburg ethics committee (no. 2014-20K).

Participants and Procedure

Participants were recruited using e-mail distribution lists to schools sent by the Ministry of Education in the German state of Nordrhein-Westfalen. People who applied for study participation received a letter online with detailed information about the study procedures and were asked to provide an e-mail address to participate. Applicants were asked to complete online screening questionnaires including a 7-day sleep diary. Participants meeting all of the inclusion and none of the exclusion criteria were randomly allocated to study conditions using an automated computer-based random integer generator (randlist). Inclusion criteria were (a) primary, secondary, or vocational school teachers, (b) over the age of 18, (c) currently employed, (d) experiencing insomnia symptoms as measured by a score of $\geq$15 on the Insomnia Severity Index (ISI; (Bastien, Vallières, & Morin, 2001), (e) experiencing low levels of psychological detachment from work (i.e., work-related rumination) as measured by a score of $\geq$15 on the Cognitive Irritation subscale of the Irritation Scale (IS; Mohr, Müller, & Rigotti, 2007), and (f) access to the Internet. Subjects that were receiving psychological help for their sleep problems or showing suicidal ideation (Beck Depression Inventory—II, Item 9, $>$1) were excluded from participation. People who took sleep medication were not excluded from the study, but were requested to keep their medication constant during the study period. We chose a score of $>$15 on the ISI because this indicates elevated levels of insomnia complaints (Morin, 1993) and a cut-off of $\geq$15 on the IS because this indicates an above-average level of rumination (Mohr et al., 2007).

Intervention

The Internet-based recovery training (GET.ON Recovery; detailed description in the work of Thiart et al., 2013) consists of six sessions. The sessions focus on the following: Session 1: psychoeducation on recovery from work-caused stress (i.e., interconnection between sleep, psychological detachment, and the utilization of recreational activities) and sleep hygiene; Session 2: stimulus control and sleep restriction; Session 3: boundary tactics (i.e., practical behaviors that help to distinguish work and private life and thus foster psychological detachment from work (Kreiner et al., 2009) and a gratitude journal before going to sleep that aims to focus the participant's attention on pleasant experiences and divert from fixation on ruminative thoughts (Emmons & McCullough, 2003); Session 4: psychoeducation on work-related rumination and worrying, their effects on sleep, and strategies to overcome such perseverative cognitions; Session 5: metacognitive techniques (Wells et al., 2009; i.e., detached mindfulness and attention training in order to cope with perseverative cognitions; and Session 6: future plans, in which participants reflect on strategies that they tried that were helpful and which they want to continue to apply in future daily routines. Each session can be completed in approximately 45 to 60 min. Sessions are interconnected, meaning that once a specific technique is introduced, participants are continuously asked to review their progress with the application of the techniques and set specific goals for the next week. In every session, participants actively plan the implementation of recreational activities into daily life according to the behavioral-activation approach. Additionally, participants are asked to choose at least one new exercise to apply throughout the forthcoming week. We advised participants to complete one session per week. Sessions consist of articles, exercises, and testimonials, and include interactive elements such as audio and video clips. The training is adaptive because the content is tailored to the specific needs of the individual participant by continuously asking participants to choose among various response options. Subsequent content is then modified depending on the participant's response. Participants were encouraged to keep a daily online recovery diary including items on total sleep time, time in bed, work-related rumi-

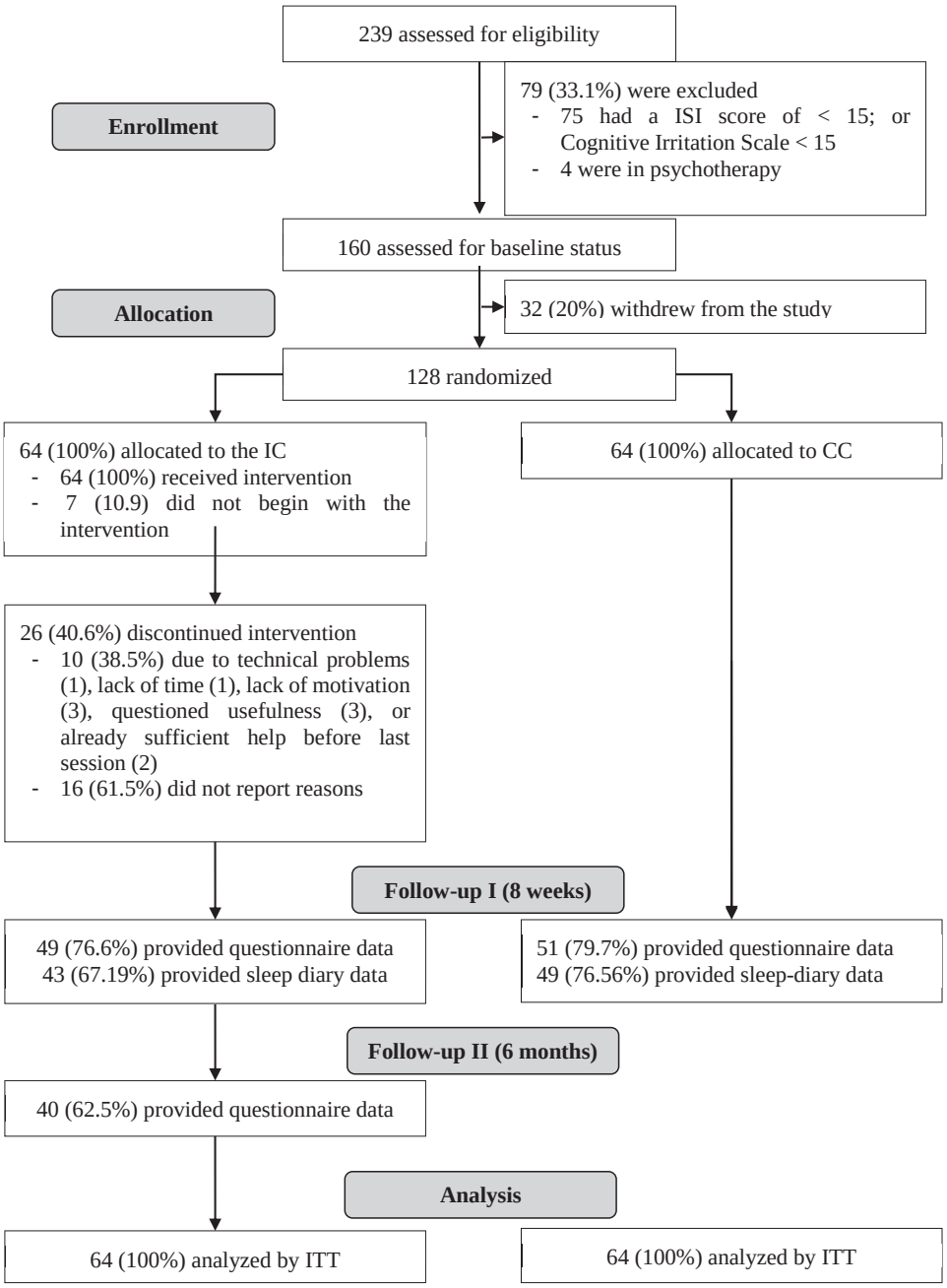

Figure 1. Flow of study participants. ISI = Insomnia Severity Index; IC = intervention condition; CC = control condition; ITT = intention-to-treat procedures.

nation in the evenings, and frequency of recreational activities. Participants who did not want to log in to the Website on a daily basis were provided with a paper-and-pencil diary. The version evaluated in the present study was fully automated, and participants did not receive any support beyond that which was provided in a technical support hotline (e-mail, phone). Development of the intervention took place at the Leuphana University Lueneburg. An advisory panel consisting of experts from occupational mental health, clinical psychology, software development, and E-Mental Health was involved in the development. The initial program draft was pilot-tested in the target population and revised on the basis of user feedback. The software architecture was provided by Minddistrict GmbH.

Measures

Primary outcome measure. Insomnia severity was measured with the ISI (Bastien et al., 2001). This instrument has seven items that are answered on a 5-point Likert scale (e.g., "To what extent

do you consider your sleep problem to interfere with your daily functioning currently?"). The total score ranges from 0 to 28. Internal consistency was $\alpha = .86$ in the present study.

Secondary outcome measures. In further secondary analyses, the effect of the intervention on additional outcomes was explored. The specific instrument used, number of items, range of items, reliabilities found at T2 in this study, some examples of instrument questions, and citations are listed parenthetically. Higher scores usually indicate better recovery except for depression, rumination, worrying, and sleep quality. There were 11 total additional secondary outcomes included. These were as follows: (1) depression (Center for Epidemiological Studies' Depression Scale; 20 items ranging 0–3, with total range 0 to 60; $\alpha = .90$; e.g., "I felt that everything I did was an effort" (Hautzinger & Bailer, 1993); (2) work-related strain/rumination (Cognitive Irritation Scale [CI]; 3 items ranging 0–7, with total range 3–28; $\alpha = .91$; e.g., "Even at home I have to think about problems at work"; higher scores indicate greater rumination; Mohr, Rigotti, & Müller, 2007); (3) worrying (Penn State Worry Questionnaire, Ultra Brief Version, past week [PSWQ-PW]; 3 items ranging 0–6, with total range 0–18; $\alpha = .84$; e.g., "Once I started worrying, I could not stop"; Stöber, 2002); (4) recovery experiences (Recovery Experience Questionnaire; 16 items ranging 1 to 5; with 4 subscales: *psychological detachment from work*, $\alpha = .89$, e.g., "During time after work, I don't think of my work at all"; *relaxation*, $\alpha = .91$, e.g., "During time after work, I kick back and relax"; *mastery*, $\alpha = .86$, e.g., "During time after work, I do things that are challenging"; *control*, $\alpha = .91$, e.g., "During time after work, I decide myself what I do"; Sonnentag & Fritz, 2007); (5) frequency of recovery activities per week (Recreation Experience and Activity Questionnaire; 21 items ranging from 0 [*never*] to 4 [*at least 4 times per week*], with total range 0–84; $\alpha = .86$; Lehr, 2015); (6) recuperation in sleep (Recuperation in Sleep subscale; 7 items ranging 1–5; $\alpha = .91$; e.g., "How relaxed did you feel upon waking up?"; Görtelmeyer, 2011); (7) sleep quality (Pittsburgh Sleep Quality Index; 1 item ranging 1–4; e.g., "During the past month, how would you rate your sleep quality overall?"; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989); (8) sleep effort (Glasgow Sleep Effort Scale [GSES]; 7 items ranging 0–2; $\alpha = .76$; e.g., "I worry about not sleeping if I cannot sleep"); (9) sleep efficiency (assessed with an online sleep diary used each day for 7 days before baseline and 7 days after T2. In the diary, participants recorded the time at which they left their beds each morning, their previous evening's bedtime, and their total hours of sleep. Sleep efficiency was computed using this diary data with the following formula days: total hours of sleep/[evening's bedtime—time out of bed in the morning]); (10) days with insomnia (days with a sleep efficiency below 80% were classified as a day with insomnia); and finally (11) user satisfaction (Client Satisfaction Questionnaire [CSQ-8], adapted to the online-context; 8 items ranging 1–4, with total range 0–32; $\alpha = .94$; e.g., "I would recommend this training to a friend in need of similar help"; Attkisson & Zwick, 1982).

Statistical Analysis

All analyses were conducted according to the Consolidated Standards of Reporting Trials (CONSORT) statement using intention-to-treat procedures (ITT). Analyses were performed with IBM SPSS version 22. A significance level of .05 (two-sided) was used for all outcome variables.

Multiple imputation with 100 estimates per missing value was used to handle missing data. Little's overall test of randomness indicated missing data completely at random ($\chi^2 = 21.64$, $df = 644$, $p = 1.0$), and therefore multiple imputations of missing data could be conducted. The assumed superiority of iRECT when compared to CC was tested with regard to (a) change in primary and secondary outcomes from baseline (T1) to postintervention (T2), (b) amount of participants with reliable change in the primary outcome, and (c) amount of participants who reach a nearly symptom-free state. Differences in change from baseline to posttreatment between the IC and CC were assessed using analysis of covariance with baseline levels as covariates. Within- and between-groups Cohen's *d* and its 95% confidence intervals (CIs) were calculated as a measure of effect size on the basis of differences between baseline and follow-up scores, standardized by the pooled standard deviation of the change scores.

Reliable change. To determine the numbers of participants achieving a reliably positive outcome, we coded participants as responders or nonresponders according to the widely used Reliable Change Index (RCI; Jacobson & Truax, 1991). Accordingly, participants were considered responders if their ISI-10 score differed by more than −5.01 points from baseline to postassessment (RCI score = 1.96).

Symptom-free status. Following the suggestion from Morin (Bastien et al., 2001), we can classify participants as symptom-free if their score falls below 8 on the ISI. We also calculated odds ratios and the number needed to treat (NNT), which indicates the number of participants that have to be treated to generate one additional positive outcome.

Stability of treatment effects. We also examined the stability of gains in the IC in order to investigate whether maintenance strategies following intervention discontinuation are indicated.

Mediators. A number of assumed mechanisms of change of this multicomponent intervention were tested with a serial multiple mediator model with age and sex as covariates. Such models allow for the simultaneous consideration of multiple mechanisms and provide the possibility to compare effect sizes of indirect effects through different mediators. We hypothesized that (1) the intervention effect on the primary outcome, change in insomnia severity, is mediated by a change in perseverative cognitions (i.e., worry) (Group [GR]→PSWQ→ISI); (2) there is an indirect effect from the intervention over sleep effort on change in insomnia severity (GR→GSES→ISI); and (3) that the effect of the intervention on the increase in recreational activities is associated with reduced perseverative cognitions, and that this in turn leads to a reduction of sleeping problems (GR→ReaQ→PSWQ→ISI). Supplemental Figure 1 displays a graphical representation of the hypothesized associations. The sample size limited us in the estimation of more complex models, such as also considering direct and indirect effects on depression as one relevant long-term consequence of work-related strain. We used the PROCESS macro for SPSS (v. 2.13.1) with bias corrected bootstrapping (1000) to obtain 95% CIs for testing the total indirect effect and the specific indirect effects. Bias corrected bootstrapping has been found to perform better with regard to power than do alternatives for testing on indirect effects (Fritz & Mackinnon, 2007), and it requires no assumptions regarding the shape of the sampling distribution of the

indirect effect. An indirect effect was considered significant if the 95% CI for the coefficient estimate did not include zero.

Results

Participants

The enrollment and flow of participants throughout the study is summarized in Figure 1. Table 1 presents the baseline characteristics of the study participants. The total sample consisted of 128 teachers with an average age of 48.5 years ($SD = 9.9$). Ninety-five were female (74.2%), and the average work experience was 21 years ($SD = 11.2$). Only 15 (11.7%) had participated in any traditional mental health promotion training before. Table 2 shows descriptive data for all outcome variables on each assessment point. At baseline, the mean score for the primary outcome, insomnia severity, was 18.27 ($SD = 2.78$) for the IC group and 17.70 ($SD = 2.82$) for the CC group, indicating high levels of insomnia severity for both groups. Participants that provided data at follow-ups did not differ ($p > .10$) from those that dropped out of the study on any baseline values of the assessed outcome variables. However, participants with missing values were likely to be older ($p = .40$, $t = 2.12$) and male over female ($\chi^2 = 4.3$, $p < .05$).

Primary Outcome Analyses—Insomnia Severity

The IC showed a significantly greater improvement on the primary outcome from baseline to posttest, $F(1, 125) = 60.86$, $p < .001$, compared to the CC (see Table 3). The effect size, according to Cohen's criteria, was large ($d = 1.37$; 95% CI: 0.99–1.77). At posttest, significantly more participants of the IC were classified as responders ($n = 50$, 79.69%) compared to the CC ($n = 13$, 21.88%; $\chi^2 = 42.79$; $p < .001$), with an odds ratio of 14.01 (95% CI: 5.90–32.77) and an NNT of 1.73 (95% CI: 1.39–2.29). Also, significantly more participants in the IC ($n = 16$, 25%) achieved a symptom-free state compared to the CC ($n = 3$, 4.69%; $\chi^2 = 10.45$, $p < .001$; OR = 6.78, 95% CI: 1.87–24.62) with an NNT of 4.93 (95% CI: 3.12–11.76).

Secondary Outcome Analyses

Table 3 presents the results of the secondary outcomes. Significant effects in favor of the IC were found for all outcomes. The majority of effect sizes were moderate to large, ranging between $d = 0.26$ (*95% CI*: 0.09–0.61) for days with insomnia to $d = 1.37$ (*95% CI*: 0.80–1.56) for psychological detachment from work.

Six-Month Outcome and Maintenance of Gains

A repeated-measures analysis of variance (see Table 3) showed significant, medium, and large within-group effects from baseline to a naturalistic 6-MFU in the IC for most outcomes ($d = 0.75$–1.88). Effects on recovery control and mastery were significant, but effect sizes were only small to medium. There were no substantial negative changes from posttreatment to the 6-MFU, indicating that effects were stable over time.

Complete Case Analysis

Complete case analysis (without imputation of missing data) closely corroborated the ITT analysis, as most effects found in the ITT analysis were also significant and of similar size in the completer analysis. Similarly to the ITT analysis, large effect sizes were observed for baseline to posttreatment ($d = 1.25$; 95% CI: 0.82–1.68) and for baseline to 6-MFU changes ($d = 2.12$; 95% CI: 1.57–2.67) in insomnia severity. The effect sizes for secondary outcomes were moderate to large, ranging from 0.44 (95% CI: 0.05–0.83) for recreational activities to 1.42 (95% CI: 0.98–1.86) for psychological detachment. Six-month effect sizes ranged from 0.63 (95% CI: 1.12–0.14) for relaxation to 2.12 (95% CI: 1.57–2.67) for insomnia severity. Only the 6-month effect on recovery mastery was not significant 0.18 (95% CI: −0.30–0.66).

Intervention Usage and User Satisfaction

Of the 64 individuals who were assigned to the IC, 7 (10.9%) participants dropped out before Session 1 of the intervention. Session 1 was completed by 57 (89.1%), Session 2 by 50 (78.1%), Session 3 by 47 (73.4%), Session 4 by 44 (68.8%), Session 5 by 35 (54.7%), and all sessions by 31 (48.4%) participants. On average, participants completed 4.13 modules ($SD = 2.24$), which is 68.83% of the intervention. Linear regression indicated that participants who completed more treatment modules achieved a greater decrease in the primary outcome, insomnia severity ($b = -1.09$, $SE = .38$, $p = .007$, 95% CI: −1.86 to −0.32). The regression coefficient suggested that with each extra module com-

Table 1
Demographic Characteristics: Means/Counts, Standard Deviations/Percentages at Baseline

Demographic	All[a]				IC[b]				CC[c]			
	N	%	*M*	*SD*	*N*	%	*M*	*SD*	*N*	%	*M*	*SD*
Age	—	—	48.5	9.9	—	—	48.4	9.9	—	—	46.0	10.6
Ethnicity Caucasian	128	100			64	100			64	100		
Years of occupational experience	—	—	21.0	11.2	—	—	20.4	10.4	—	—	18.6	11.4
Females	95	74.2	—	—	45	70.3	—	—	50	78.1	—	—
Married/partnership	106	82.8	—	—	53	82.9	—	—	53	82.8	—	—
Primary school teacher (vs. secondary school)	39	30.5			23	35.9			16	25.0		
On sick leave	3	2.3			2	3.1			1	1.6		
Experiences with occupational mental health trainings	15	11.7	—	—	7	10.9	—	—	8	12.5	—	—
Experiences with psychotherapy	63	49.2	—	—	31	48.4	—	—	32	50.0	—	—

Note. IC = intervention condition; CC = control condition.
[a] $N = 128$. [b] $n = 64$. [c] $n = 64$.

Table 2
Means and Standard Deviations of Outcome Variables at All Assessments (Intention-to-Treat Sample)

	Baseline (T1)				Posttreatment (T2)				6-MFU (T3)	
	IC		CC		IC		CC		IC	
Outcome variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Sleep										
Insomnia severity	18.27	2.78	17.70	2.82	9.73	4.33	15.07	4.05	8.82	4.23
Sleep efficiency	.78	.09	.79	.08	.84	.07	.81	.06	[a]	
Recuperation in sleep	2.48	.62	2.30	.59	3.18	.69	2.45	.54	2.48	.62
Sleep quality	3.05	.42	3.03	.44	2.20	.48	2.76	.50	[a]	
Sleep effort	6.13	2.41	6.48	2.66	5.87	2.64	3.72	1.87	[a]	
Days with insomnia	3.42	2.15	3.16	1.85	2.49	1.56	2.89	1.57	[a]	
Perseverative cognitions										
Work-related rumination	17.94	2.68	18.77	2.14	12.64	4.65	17.02	3.39	12.91	4.03
Worrying	10.27	4.27	10.77	3.67	5.87	3.18	8.44	3.79	6.57	3.10
Recovery experiences										
Recovery control	3.07	.95	2.94	.82	3.50	.78	2.95	.84	3.33	.82
Recovery mastery	2.61	.83	2.44	.81	2.87	.70	2.46	.70	2.88	.78
Psychological detachment	1.89	.65	1.92	.59	2.80	.70	1.90	.61	2.70	.77
Relaxation	2.75	.75	2.66	.70	3.37	.78	2.77	.72	3.25	.82
Recreational activities	49.61	10.06	49.16	10.37	57.10	10.25	52.45	11.95	[a]	
Mental health										
Depression	21.13	7.61	22.65	7.08	13.17	6.85	19.22	13.17	12.81	7.28

Note. IC = intervention condition; CC = control condition; T1 = baseline; T2 = postintervention; T3 = 6-month follow-up.
[a] Not assessed at T3.

pleted, the drop in insomnia severity from baseline to posttreatment was greater by 1.09 points on the ISI. However, there was only a trend toward significance for the prediction of baseline to 6-MFU changes ($b = -1.09$, $SE = .62$, $p = .08$, 95% CI: −2.36–0.17). Mean time spent for completing all modules per participant was 205 min ($SD = 94.20$, range: 15–450). Adherence to specific exercises to be carried out in daily life was assessed by asking participants in the session following the one in which this

Table 3
ANCOVA Results For Differences in Change From Baseline to Posttreatment Between Intervention and Control Conditions and Baseline to 6-Month Follow-Up Changes in Intervention Condition (Intention-to-Treat Sample)

	Differences in change between IC and CC from baseline to posttreatment (T1 − T2)		Baseline to 6-month follow- up changes (T1 − T3) in IC	
Outcome	ANCOVA[a] F_{df}	Cohen's d[b] (95% CI)	ANOVA[c] F_{df}	Cohen's d[d] (95% CI)
Sleep				
Insomnia severity	$60.86_{1,125}^{***}$	1.37 (.99–1.77)	$225.24_{1,63}^{***}$	1.88 (1.47–2.28)
Sleep efficiency	$12.42_{1,125}^{**}$	.46 (.27–.98)	[e]	
Recuperation in sleep	$54.09_{1,125}^{***}$	1.18 (.92–1.68)	$86.65_{1,63}^{***}$	1.16 (.85–1.48)
Sleep quality	$41.07_{1,125}^{***}$	1.13 (.76–1.51)	[e]	
Sleep effort	$22.32_{1,125}^{***}$	.84 (.48–1.20)	[e]	
Days with insomnia	$5.14_{1,125}^{*}$	.26 (−.09–.61)	[e]	
Perseverative cognitions				
Work-related rumination	$36.03_{1,125}^{***}$	1.06 (.69–1.43)	$114.64_{1,63}^{***}$	1.34 (1.00–1.68)
Worrying	$17.45_{1,125}^{***}$	.74 (.38–1.10)	$45.68_{1,63}^{***}$	.84 (.56–1.13)
Recovery experiences				
Recovery control	$18.63_{1,125}^{***}$	.76 (.40–1.12)	$7.83_{1,63}^{**}$	.35 (.10–.60)
Recovery mastery	$14.18_{1,125}^{***}$	.67 (.31–1.02)	$12.48_{1,63}^{***}$	.44 (.18–.70)
Psychological detachment	$95.07_{1,125}^{***}$	1.72 (1.32–2.13)	$47.91_{1,63}^{***}$	.87 (.58–1.15)
Relaxation	$28.56_{1,125}^{***}$	.95 (.58–1.31)	$36.19_{1,63}^{***}$	.75 (.47–1.03)
Recreational activities	$6.79_{1,125}^{**}$	.46 (.11–.82)	[e]	
Mental health				
Depression	$22.98_{1,125}^{***}$	.85 (.49–1.21)	$48.80_{1,63}^{***}$	.87 (.59–1.16)

Note. ANCOVA = analysis of covariance; IC = intervention condition; CC = control condition; T1 = baseline; T2 = postintervention; T3 = 6-month follow-up; CI = confidence interval; ANOVA = analysis of variance.
[a] ANOVA with baseline score as covariate. [b] Effect size for difference in change from baseline to posttest standardized by the pooled standard deviation of the change scores. [c] Repeated-measures ANOVA. [d] IC within-group effect size. [e] Not assessed at 6-month follow-up.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

specific exercise was the core focus. It was asked whether they carried out the planned exercises completely, partly, or not at all. In Session two, 50.88% ($n = 29$) of the intervention starters ($n = 57$) indicated that they implemented recreational activities in their daily life in the planned frequency, 35.09% ($n = 20$) indicated that they achieved to implement them only partly, and 1.75 ($n = 1$) indicated that they did not at all implement additional recreational activities. The respective numbers for the implementation of recreational activities in daily life between Sessions two and three were 35.09% ($n = 20$), 47.37% ($n = 27$), and 0% ($n = 0$). With regard to carrying out sleep restriction between Sessions two and three, 63.16% ($n = 36$) indicated in Session three to have succeeded in doing it most of the days, whereas 17.54% ($n = 10$) indicated that they succeeded seldom or not at all. In Session four, in which participants were able to choose among different optional exercises, 17.54% ($n = 10$) chose the exercise "my strengths," which is a reflection of which skills participants would theoretically need in a stress situation and how these skills and competencies were already present in the past; 42.11% ($n = 24$) chose "cognitive restructuring of sleep related dysfunctional thoughts," and 12% ($n = 7$) chose the "worry chair," which is a paradox intervention in which participants write a daily worry diary at a fixed "worry time" on a "worry chair." In Session five, 35.09% ($n = 20$) indicated that they carried out the chosen exercise daily or most of the days, and 19.30% ($n = 11$) carried it out only seldom or not at all. User satisfaction was very high: mean score on the CSQ-8 ($n = 49$) was 26.98 ($SD = 5.12$, range 10–32). Forty-four (89.8%) said they would recommend the training to a friend in need (Item 4, answers of "probably yes" or "definitely yes").

Mechanisms of Change

The multiple serial mediation model and all respective coefficients of the model are presented in Figure 2. Below, we describe the results for the tests of the indirect effects. Results for each of the partial chains within the model are presented in Figure 2. The total indirect effect (sum of the specific indirect effects) is significant ($\beta = -1.43$, $SE = .47$, 95% CI: -2.63 to -0.71), and the direct effect of the intervention on insomnia reduction stayed significant even after the inclusion of the mediators in the model ($\beta = -4.75$, $SE = .83$, 95% CI: -6.39 to -3.10). This indicates evidence for a partial mediation. As hypothesized, there were significant indirect effects of the intervention over the reduction in perseverative cognitions (Hypothesis 1: GR→PSWQ→ISI: $\beta = -0.52$, $SE = .31$, 95% CI: -1.28 to -0.12) and through sleep effort (Hypothesis 2: GR→GSES→ISI: $\beta = -0.54$, $SE = .32$, 95% CI: -1.44 to -0.07) on insomnia reduction. Moreover, in line with Hypothesis 3 (GR→ReaQ→PSWQ→ISI), the frequency of recreational activities was not directly related to insomnia ($\beta = -.05$, $p = .32$), but there was a significant indirect three-way pathway: The increase in recreational activities was associated with reduced perseverative cognitions, and this in turn was associated with the reduction of sleeping problems ($\beta = -0.11$, $SE = .07$, 95% CI: -0.41 to -0.02). No other indirect effects were observed. The effect size of the mediation pathways through perseverative cognitions only (GR→PSWQ→IS) were found to be significantly larger than the effects of the three-way mediation pathway (GR→ReaQ→PSWQ→ISI: $\beta = 0.42$, $SE = .29$, 95% CI: 0.03–1.25). No significant differences in the size of effects were observed between the other indirect effects.

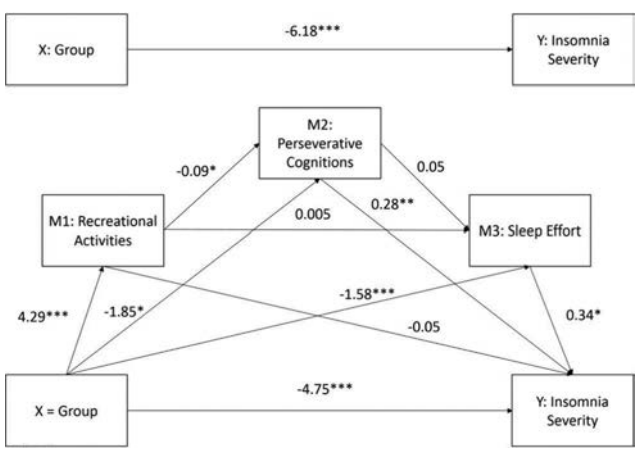

Figure 2. Standardized regression coefficients of the total direct effect and of the Multiple Serial Mediation Model. Group: intervention versus control group; recreational activities: Recreation Experience and Activity Questionnaire; perseverative cognitions: Penn State Worry Questionnaire; sleep effort: Glasgow Sleep Effort Scale; insomnia severity: Insomnia Severity Index. * $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

This randomized controlled trial evaluated the effects of an unguided Internet-based recovery training, which aims to teach employees health restorative behavior. Results support the effectiveness of the intervention on recovery activity and experiences (psychological detachment, mastery, control, number of recreational activities), sleep (insomnia severity, sleep efficiency, sleep quality, recuperation in sleep), perseverative cognitions (worrying, rumination), and mental health–related (depression) outcomes. An extended 6-MFU indicated that the effects remained stable over the long term. A greater number of treatment modules completed was associated with greater change in the primary outcome. Perseverative cognitions and sleep effort have been confirmed as relevant mechanism of change in insomnia severity, and the effect of recreational activities on insomnia was found to affect insomnia severity through its effects on perseverative cognitions.

The size of the effects found are somewhat surprising, because it has been previously found that Internet-based self-help interventions without guidance tend to be far less effective than interventions that include some sort of professional support (Baumeister, Reichler, Munzinger, & Lin, 2014). However, there do exist a few examples of target conditions such as alcohol abuse (Riper et al., 2014) in which differences between guided and unguided interventions were not detected, although these findings were only of a correlational nature. Nevertheless, the large effects demonstrated in the present trial may indicate that guidance is not necessary for this specific type of intervention in this specific target population in order to achieve clinically meaningful results. In fact, there are other studies on insomnia interventions that found large effects without applying intensive guidance (Espie et al., 2012; Ritterband et al., 2009), although these trials included at least some minimal personal contact, either through a face-to-face diagnostic session

or a coach that moderated an online forum. In addition, other unguided Internet-based insomnia treatments found much lower effect sizes or nonsignificant effects compared to control groups (Riley, Mihm, Behar, & Morin, 2010; Suzuki et al., 2008), and a recent direct comparison of guided and unguided insomnia treatment found the guided treatment to be superior (Lancee, van den Bout, Sorbi, & van Straten, 2013). Nevertheless, even if unguided interventions do yield lower effects in direct comparisons, their potential on the population level may be greater, because unguided interventions have a wider reach and more participants can be treated for the same costs (Ebert et al., 2014b). On the other hand, it may be the case that employees will be less willing to participate in an intervention if no support is given, which would result in lower overall effects in the target population. Thus, future studies should compare the acceptability, effectiveness, and cost-effectiveness of guided and unguided recovery trainings.

To the best of our knowledge, the only other study to date that investigated an intervention to improve recovery from work-related strain by fostering psychological detachment from work and sleep evaluated a face-to-face occupational health group training in a quasi-experimental nonrandomized control group design (Hahn, Binnewies, Sonnentag, & Mojza, 2011). The authors of this pioneering study found small- to medium-sized effects for sleep quality ($d = 0.43$), medium-to-large effects for recovery relaxation ($d = 0.61$) and mastery ($d = 0.70$), large effects for psychological detachment ($d = 0.99$), and no significant effects on burnout.

Interestingly, the intervention's effects on depressive symptoms ($d = 0.85$) were as large as those found in treatments for major depression (Cuijpers, Huibers, Ebert, Koole, & Andersson, 2013). This may indicate the special potential in targeting both psychological detachment and insomnia complaints together in this target condition in order to reduce long-term mental health consequences of work-related rumination and impaired sleep. Given that both impaired sleep (Baglioni et al., 2011), and perseverative cognitions (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008) have been shown to be longitudinally predictive of depression and that rumination is considered to be an antecedent of insomnia (Vahle-Hinz et al., 2014), there could be a high potential in such recovery interventions to prevent the onset of depressive disorders.

To the best of our knowledge, the present study is the first that showed that the effect of a psychological intervention on impaired sleep is mediated by perseverative cognitions, such as worry. This finding is in line with research indicating that the inability to stop worrying about work during free time may be an important mechanism in the relationship between work stress and sleeping problems (Berset et al., 2011; Pereira & Elfering, 2014; Radstaak et al., 2014). Most psychological interventions that aim to improve sleep also target cognitions, but these interventions usually target dysfunctional sleep-related and not general perseverative cognitions. The present results indicate that targeting perseverative cognitions also positively influences insomnia complaints, and thus may be a valuable target in interventions that aim to improve sleep. Whether the effect of perseverative cognitions on sleep can be explained through an increased general cognitive arousal, as hyperarousal models of insomnia would suggest (Riemann et al., 2010), or through other mechanisms needs to be explored in future studies.

Reduced sleep effort has been suggested to be one of the core mechanisms of psychological interventions for sleep (Espie et al., 2006; Schwartz & Carney, 2012). However, the present trial is the first that provided empirical evidence for this assumption.

This study has the following limitations. First, the results should be viewed in the context of the studied population, which comprised a sample of highly educated, mostly female teachers. The findings may only be valid for populations with comparable demographics and job-related characteristics (e.g., high education, low boundaries between work and private life). Second, the elaborate study inclusion process typically used for an RCT (i.e., completion of two self-report assessments, sending of informed consent) may have led to the self-selected inclusion of individuals who may be more motivated than one could expect outside of a research context. As a result, the results may not be generalizable to unguided interventions without a similar inclusion process. Third, the 6-MFU was only assessed in the IC and not in the CC. Although results show that achieved changes in the IC were stable over time, we cannot rule out the possibility that the CC could have also improved over time, and that the superiority of the recovery training could be diminished over time. However, a previous study evaluating a therapist-supported intervention format found that this was not the case (Thiart et al., 2015), and untreated sleeping problems usually persist over time (Morin et al., 2009). Fourth, there was considerable attrition. Although this is common in Internet-based intervention studies, especially with long-term follow-up (Eysenbach, 2005), and we applied state-of-the-art methods to handle missing data (Schafer & Graham, 2002), we cannot completely rule out a potential bias caused by missing data. Fifth, sleep efficiency was assessed using a daily sleep diary. Future studies should measure sleep parameters based on actigraphy in order to objectively measure sleep efficiency. Sixth, we did not assess whether the participants differed at baseline or follow-up in terms of proportion that took sleep medication, and we did not control for it in the statistical analysis. Thus, we are unable to rule out whether this may have biased the results. Seventh, the sample size did not allow us to examine more complex mediation mechanisms. Therefore, although the serial multiple mediator analysis confirmed core assumptions about the change mechanisms on insomnia severity, several questions remain unclear. For example, the intervention was developed under the assumption that targeting perseverative cognitions, sleep, and recreational activities also affect mental health and well-being, both directly and indirectly. Moreover, one needs to keep in mind that the current mediation analyses were based on only two time points. In order to draw conclusions with regard to the causality of the assumed mechanism, future longitudinal studies with repeated assessments of putative mediators are needed. Eighth, it remains unclear which elements of this multicomponent intervention were the most successful in contributing to the effect of the intervention and which elements are not as effective.

In conclusion, our data suggest that recovery trainings focusing on psychological detachment from work and sleep can result in substantial benefits for teachers. This study further adds to the growing evidence that Internet-based self-help interventions have a high potential for delivering occupational health interventions and suggests that guidance from health care professionals is not necessarily required to achieve clinically meaningful results.

References

Åkerstedt, T., Nordin, M., Alfredsson, L., Westerholm, P., & Kecklund, G. (2012). Predicting changes in sleep complaints from baseline values and changes in work demands, work control, and work preoccupation—The WOLF-project. *Sleep Medicine, 13,* 73–80. http://dx.doi.org/10.1016/j.sleep.2011.04.015

Åkerstedt, T., Orsini, N., Petersen, H., Axelsson, J., Lekander, M., & Kecklund, G. (2012). Predicting sleep quality from stress and prior sleep—A study of day-to-day covariation across six weeks. *Sleep Medicine, 13,* 674–679. http://dx.doi.org/10.1016/j.sleep.2011.12.013

Attkisson, C. C., & Zwick, R. (1982). The client satisfaction questionnaire. Psychometric properties and correlations with service utilization and psychotherapy outcome. *Evaluation and Program Planning, 5,* 233–237. http://dx.doi.org/10.1016/0149-7189(82)90074-X

Baglioni, C., Battagliese, G., Feige, B., Spiegelhalder, K., Nissen, C., Voderholzer, U., . . . Riemann, D. (2011). Insomnia as a predictor of depression: A meta-analytic evaluation of longitudinal epidemiological studies. *Journal of Affective Disorders, 135,* 10–19.

Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Medicine, 2,* 297–307. http://dx.doi.org/10.1016/S1389-9457(00)00065-4

Baumeister, H., Reichler, L., Munzinger, M., & Lin, J. (2014). The impact of guidance on Internet-based mental health interventions. *Internet Interventions, 1,* 205–215.

Berset, M., Elfering, A., Lüthy, S., Lüthi, S., & Semmer, N. (2011). Work stressors and impaired sleep: Rumination as a mediator. *Stress and Health, 27,* e71–e82. http://dx.doi.org/10.1002/smi.1337

Bhui, K. S., Dinos, S., Stansfeld, S. A., & White, P. D. (2012). A synthesis of the evidence for managing stress at work: A review of the reviews reporting on anxiety, depression, and absenteeism. *Journal of Environmental and Public Health, 2012,* Article ID 515874. http://dx.doi.org/10.1155/2012/515874

Billings, D. W., Cook, R. F., Hendrickson, A., & Dove, D. C. (2008). A web-based approach to managing stress and mood disorders in the workforce. *Journal of Occupational and Environmental Medicine, 50,* 960–968. http://dx.doi.org/10.1097/JOM.0b013e31816c435b

Blonk, R. W. B., Brenninkmeijer, V., Lagerveld, S. E., & Houtman, I. L. D. (2006). Return to work: A comparison of two cognitive behavioural interventions in cases of work-related psychological complaints among the self-employed. *Work & Stress, 20,* 129–144. http://dx.doi.org/10.1080/02678370600856615

Brosschot, J., Van Dijk, E., & Thayer, J. (2007). Daily worry is related to low heart rate variability during waking and the subsequent nocturnal sleep period. *International Journal of Psychophysiology, 63,* 39–47.

Buysse, D. J., Reynolds, C. F. III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193–213. http://dx.doi.org/10.1016/0165-1781(89)90047-4

Cuijpers, P., Huibers, M., Ebert, D. D., Koole, S. L., & Andersson, G. (2013). How much psychotherapy is needed to treat depression? A metaregression analysis. *Journal of Affective Disorders, 149,* 1–13. http://dx.doi.org/10.1016/j.jad.2013.02.030

Dalgaard, L., Eskildsen, A., Carstensen, O., Willert, M. V., Andersen, J. H., & Glasscock, D. J. (2014). Changes in self-reported sleep and cognitive failures: A randomized control trial of a stress management intervention. *Scandinavian Journal of Work, Environment & Health, 40,* 569–581. http://dx.doi.org/10.5271/sjweh.3460

De Lange, A. H., Kompier, M. A. J., Taris, T. W., Geurts, S. A. E., Beckers, D. G. J., Houtman, I. L. D., & Bongers, P. M. (2009). A hard day's night: A longitudinal study on the relationships among job demands and job control, sleep quality and fatigue. *Journal of Sleep Research, 18,* 374–383. http://dx.doi.org/10.1111/j.1365-2869.2009.00735.x

Ebert, D. D., Lehr, D., Boß, L., Riper, H., Cuijpers, P., Andersson, G., . . . Berking, M. (2014a). Efficacy of an Internet-based problem-solving training for teachers: Results of a randomized controlled trial. *Scandinavian Journal of Work, Environment & Health, 40,* 582–596. http://dx.doi.org/10.5271/sjweh.3449

Ebert, D. D., Lehr, D., Smit, F., Zarski, A.-C., Riper, H., Heber, E., . . . Berking, M. (2014b). Efficacy and cost-effectiveness of minimal guided and unguided internet-based mobile supported stress-management in employees with occupational stress: A three-armed randomised controlled trial. *BMC Public Health, 14,* 807. http://dx.doi.org/10.1186/1471-2458-14-807

Ellis, J., & Barclay, N. (2014). Cognitive behavior therapy for insomnia: State of the science or a stated science? *Sleep medicine, 15,* 849–850. http://dx.doi.org/10.1016/j.sleep.2014.04.008

Emmons, R. A., & McCullough, M. E. (2003). Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. *Journal of Personality and Social Psychology, 84,* 377–389. http://dx.doi.org/10.1037/0022-3514.84.2.377

Espie, C. A., Broomfield, N. M., MacMahon, K. M. A., Macphee, L. M., & Taylor, L. M. (2006). The attention-intention-effort pathway in the development of psychophysiologic insomnia: A theoretical review. *Sleep Medicine Reviews, 10,* 215–245. http://dx.doi.org/10.1016/j.smrv.2006.03.002

Espie, C. A., Kyle, S. D., Williams, C., Ong, J. C., Douglas, N. J., Hames, P., & Brown, J. S. (2012). A randomized, placebo-controlled trial of online cognitive behavioral therapy for chronic insomnia disorder delivered via an automated media-rich web application. *Sleep, 35,* 769–781.

Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research, 7*(1), e11. http://dx.doi.org/10.2196/jmir.7.1.e11

Fritz, M. S., & Mackinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18,* 233–239. http://dx.doi.org/10.1111/j.1467-9280.2007.01882.x

Görtelmeyer, R. (2011). *Schlaffragebogen A und B - Revidierte Fassung Assessment of Sleep* [*Standardized Sleep Inventory for the SF-A/R and SF-B/R—revised version*]. Göttingen, Germany: Hogrefe.

Hahn, V. C., Binnewies, C., Sonnentag, S., & Mojza, E. J. (2011). Learning how to recover from job stress: Effects of a recovery training program on recovery, recovery-related self-efficacy, and well-being. *Journal of Occupational Health Psychology, 16,* 202–216. http://dx.doi.org/10.1037/a0022169

Hautzinger, M., & Bailer, M. (1993). *Allgemeine Depressions Skala* [Manual]. Göttingen, Germany: Beltz Test GmbH.

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59,* 12–19. http://dx.doi.org/10.1037/0022-006X.59.1.12

Jansson, M., & Linton, S. J. (2006). Psychosocial work stressors in the development and maintenance of insomnia: A prospective study. *Journal of Occupational Health Psychology, 11,* 241–248. http://dx.doi.org/10.1037/1076-8998.11.3.241

Junge, M. N., Lehr, D., Bockting, C., Berking, M., Riper, H., Cuijpers, P., & Ebert, D. D. (2015). For whom are internet-based occupational mental health interventions effective? Moderators of internet-based problem-solving training outcome. *Internet Interventions, 2,* 39–47.

Kessler, R. C., Berglund, P. A., Coulouvrat, C., Hajak, G., Roth, T., Shahly, V., . . . Walsh, J. K. (2011). Insomnia and the performance of US workers: Results from the America insomnia survey. *Sleep, 34,* 1161–1171.

Koffel, E. A., Koffel, J. B., & Gehrman, P. R. (2014). A meta-analysis of group cognitive behavioral therapy for insomnia. *Sleep Medicine Reviews*. Advance online publication. http://dx.doi.org/10.1016/j.smrv.2014.05.001

Kompier, M. A. J., Taris, T. W., & van Veldhoven, M. (2012). Tossing and turning—Insomnia in relation to occupational stress, rumination, fatigue, and well-being. *Scandinavian Journal of Work, Environment & Health, 38,* 238–246. http://dx.doi.org/10.5271/sjweh.3263

Kreiner, G. E., Hollensbe, E. C., & Sheep, M. L. (2009). Balancing borders and bridges: Negotiating the work–home interface via boundary work tactics. *Academy of Management Journal, 52,* 704–730. http://dx.doi.org/10.5465/AMJ.2009.43669916

Lancee, J., van den Bout, J., Sorbi, M. J., & van Straten, A. (2013). Motivational support provided via email improves the effectiveness of Internet-delivered self-help treatment for insomnia: A randomized trial. *Behaviour Research and Therapy, 51,* 797–805. http://dx.doi.org/10.1016/j.brat.2013.09.004

Lehr, D. (2015). Recreation Experience and Activity Questionnaire (ReaQ). In S. Koch, D. Lehr, & A. Hillert (eds.), *Burnout und chronischer beruflicher Stress* [*Burnout and chronic work-related stress*]. Göttingen: Hogrefe.

Lehr, D., Hillert, A., & Keller, S. (2009). What can balance the effort? Associations between effort–reward imbalance, overcommitment, and affective disorders in German teachers. *International Journal of Occupational and Environmental Health, 15,* 374–384. http://dx.doi.org/10.1179/oeh.2009.15.4.374

Linton, S. J. (2004). Does work stress predict insomnia? A prospective study. *British Journal of Health Psychology, 9,* 127–136. http://dx.doi.org/10.1348/135910704773891005

Minkel, J. D., Banks, S., Htaik, O., Moreta, M. C., Jones, C. W., McGlinchey, E. L., . . . Dinges, D. F. (2012). Sleep deprivation and stressors: Evidence for elevated negative affect in response to mild stressors when sleep deprived. *Emotion, 12,* 1015–1020. http://dx.doi.org/10.1037/a0026871

Mohr, G., Rigotti, T., & Müller, A. (2007). *S - Irritations-Skala zur Erfassung arbeitsbezogener Beanspruchungsfolgen* [*Irritation Scale for the assessment of psychological strain in work contexts*]. Göttingen, Germany: Hogrefe.

Morin, C. (1993). *Insomnia. Psychological Assessment and Management*. New York, NY: The Guildford Press.

Morin, C. M., Bélanger, L., LeBlanc, M., Ivers, H., Savard, J., Espie, C. A., . . . Grégoire, J.-P. (2009). The natural history of insomnia: A population-based 3-year longitudinal study. *Archives of Internal Medicine, 169,* 447–453. http://dx.doi.org/10.1001/archinternmed.2008.610

Nieuwenhuijsen, K., Faber, B., Verbeek, J. H., Neumeyer-Gromen, A., Hees, H. L., Verhoeven, A. C., . . . Bültmann, U. (2014). Interventions to improve return to work in depressed people. *Cochrane Database of Systematic Reviews, 12,* CD006237.

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3,* 400–424. http://dx.doi.org/10.1111/j.1745-6924.2008.00088.x

Pereira, D., & Elfering, A. (2014). Social stressors at work and sleep during weekends: The mediating role of psychological detachment. *Journal of Occupational Health Psychology, 19,* 85–95. http://dx.doi.org/10.1037/a0034928

Pereira, D., Meier, L. L., & Elfering, A. (2013). Short-term effects of social exclusion at work and worries on sleep. *Stress and Health, 29,* 240–252. http://dx.doi.org/10.1002/smi.2461

Querstret, D., & Cropley, M. (2013). Assessing treatments used to reduce rumination and/or worry: A systematic review. *Clinical Psychology Review, 33,* 996–1009. http://dx.doi.org/10.1016/j.cpr.2013.08.004

Radstaak, M., Geurts, S. A. E., Beckers, D. G. J., Brosschot, J. F., & Kompier, M. A. (2014). Work stressors, perseverative cognition and objective sleep quality: A longitudinal study among Dutch Helicopter Emergency Medical Service (HEMS) pilots. *Journal of Occupational Health, 56,* 469–477. http://dx.doi.org/10.1539/joh.14-0118-OA

Riemann, D., Spiegelhalder, K., Feige, B., Voderholzer, U., Berger, M., Perlis, M., & Nissen, C. (2010). The hyperarousal model of insomnia: A review of the concept and its evidence. *Sleep Medicine Reviews, 14,* 19–31. http://dx.doi.org/10.1016/j.smrv.2009.04.002

Riley, W. T., Mihm, P., Behar, A., & Morin, C. M. (2010). A computer device to deliver behavioral interventions for insomnia. *Behavioral Sleep Medicine, 8,* 2–15. http://dx.doi.org/10.1080/15402000903425314

Riper, H., Blankers, M., Hadiwijaya, H., Cunningham, J., Clarke, S., Wiers, R., . . . Cuijpers, P. (2014). Effectiveness of guided and unguided low-intensity Internet interventions for adult alcohol misuse: A meta-analysis. *PLoS ONE, 9*(6), e99912. http://dx.doi.org/10.1371/journal.pone.0099912

Ritterband, L. M., Thorndike, F. P., Gonder-Frederick, L. A., Magee, J. C., Bailey, E. T., Saylor, D. K., & Morin, C. M. (2009). Efficacy of an Internet-based behavioral intervention for adults with insomnia. *Archives of General Psychiatry, 66,* 692–698. http://dx.doi.org/10.1001/archgenpsychiatry.2009.66

Schafer, J. L, & Graham, J. W. (2002) Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147–177. http://dx.doi.org/10.1037//1082-989X.7.2.147

Schwartz, D. R., & Carney, C. E. (2012). Mediators of cognitive–behavioral therapy for insomnia: A review of randomized controlled trials and secondary analysis studies. *Clinical Psychology Review, 32,* 664–675. http://dx.doi.org/10.1016/j.cpr.2012.06.006

Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology, 57,* 1–29. http://dx.doi.org/10.1111/j.1464-0597.2007.00325.x

Sonnentag, S. (2012). Detachment from work during leisure time: The benefits of mentally disengaging from work. *Current Directions in Psychological Science, 21,* 114–118. http://dx.doi.org/10.1177/0963721411434979

Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: Development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology, 12,* 204–221. http://dx.doi.org/10.1037/1076-8998.12.3.204

Stöber, J. (2002). PSWQ–PW: Penn State Worry Questionnaire—Past Week. In E. Brähler, J. Schumacher, & B. Strauβ (Eds.), *Diagnostische Verfahren in der Psychotherapie* (pp. 291–294). Göttingen, Germany.

Suzuki, E., Tsuchiya, M., Hirokawa, K., Taniguchi, T., Mitsuhashi, T., & Kawakami, N. (2008). Evaluation of an Internet-based self-help program for better quality of sleep among Japanese workers: A randomized controlled trial. *Journal of Occupational Health, 50,* 387–399.

Thiart, H., Lehr, D., Ebert, D. D., Berking, M., & Riper, H. (2015). Log in and breathe out: Internet-based recovery training for sleepless employees with work-related strain—Results of a randomized controlled trial. *Scandinavian Journal of Work, Environment & Health, 41,* 164–174.

Thiart, H., Lehr, D., Ebert, D. D., Sieland, B., Berking, M., & Riper, H. (2013). Log in and breathe out: Efficacy and cost-effectiveness of an online sleep training for teachers affected by work-related strain—Study protocol for a randomized controlled trial. *Trials, 14,* 169. http://dx.doi.org/10.1186/1745-6215-14-169

Ursin, R., Baste, V., & Moen, B. E. (2009). Sleep duration and sleep-related problems in different occupations in the Hordaland Health Study. *Scandinavian Journal of Work, Environment & Health, 35,* 193–202. http://dx.doi.org/10.5271/sjweh.1325

Vahle-Hinz, T., Bamberg, E., Dettmers, J., Friedrich, N., & Keller, M. (2014). Effects of work stress on work-related rumination, restful sleep, and nocturnal heart rate variability experienced on workdays and weekends. *Journal of Occupational Health Psychology, 19,* 217–230. http://dx.doi.org/10.1037/a0036009

Vandekerckhove, M., & Cluydts, R. (2010). The emotional brain and sleep: An intimate relationship. *Sleep Medicine Reviews, 14,* 219–226. http://dx.doi.org/10.1016/j.smrv.2010.01.002

Wells, A., Fisher, P., Myers, S., Wheatley, J., Patel, T., & Brewin, C. R. (2009). Metacognitive therapy in recurrent and persistent depression: A multiple-baseline study of a new treatment. *Cognitive Therapy and Research, 33,* 291–300. http://dx.doi.org/10.1007/s10608-007-9178-2

Wiegand, B., Luedtke, K., Friscia, D., Nair, M., Aleles, M., & McCloskey, R. (2010). Efficacy of a comprehensive program for reducing stress in women: A prospective, randomized trial. *Current Medical Research and Opinion, 26,* 991–1002. http://dx.doi.org/10.1185/03007991003688193

Willert, M., Thulstrup, A., Hertz, J., & Bonde, J. (2010). Sleep and cognitive failures improved by a three-month stress management intervention. *International Journal of Stress Management, 17,* 193–213.

Zijlstra, F. R. H., & Sonnentag, S. (2006). Psychological perspectives on recovery from work. *European Journal of Work and Organizational Psychology, 15,* 129–138. http://dx.doi.org/10.1080/13594320500513855

Received January 23, 2015
Revision received May 29, 2015
Accepted July 18, 2015 ■