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For whom are internet-based occupational mental health interventions effective? Moderators of internet-based problem-solving training outcome

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ABSTRACT

Internet-based problem-solving training (IPST) effectively reduces depressive symptoms in employees. Yet, it is unknown which employees benefit most from this particular treatment. The study aimed to identify predictors and moderators of treatment outcome in IPST offered to employees with depressive symptoms. Within a randomized controlled trial (N = 150), designed to test the effectiveness of IPST, variables that predict and moderate the effects of IPST when compared with a waitlist control group (WLC) were explored. The outcome was change in depression severity, assessed using the Center for Epidemiological Studies Depression Scale (CES-D). Both depression severity and other psychopathological symptoms and potential predictors/moderators were assessed as self-reports at baseline (t1) and in follow-up assessments after seven weeks (t2), three months (t3) and six months (t4). Higher depression severity at baseline predicted improvement in depressive symptomology in follow-up assessments after seven weeks, and three- and six months. Depression severity moderated the effectiveness of IPST assessed at six-month follow-up. Simple slope analyses revealed that the long-term effectiveness of the intervention was more pronounced among participants with high (CES-D range: 33–44, M = 37.0, SD = 3.2) and moderate (CES-D range: 14–32, M = 23.1, SD = 5.6) depression baseline scores, compared to participants displaying low depression baseline scores (CES-D range: 5–13, M = 9.0, SD = 2.2). No indication was found that participants presenting low depression severity at baseline significantly benefitted from IPST in the long-term. IPST might be appropriate for employees with a wide range of different characteristics. While there appears to be no reason to exclude employees with severe depression from Internet-based occupational mental health interventions, for employees low in depression severity, watchful waiting or potentially no intervention should be considered. These findings may not apply to other low-intensity interventions and/or target groups.

1. Introduction

Occupational stress is a risk factor for mental health problems, such as depression (Stansfeld and Candy, 2006). Even though depression is both preventable and treatable at the workplace (Corbière et al., 2009; Tan et al., 2014) and positive effects of psychological interventions on work-productivity have been found (Wang et al., 2007), the majority of affected individuals remain untreated (American Psychological Association, 2013; Goldberg and Steury, 2001). Consequently, depression is highly prevalent in working populations, with a 12-month prevalence rate of 7.1% for men and 6.2% for women (Andrea et al., 2004; Blackmore et al., 2007; Shields, 2006; Wang et al., 2010a,b). Moreover, the disease not only causes a considerable burden for individuals, society, and employers (Mathers and Loncar, 2006; Wittchen et al., 2011), but also incurs costs due to productivity loss and absenteeism (Lerner and Henke, 2008; Wang et al., 2010a).

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1.1. Internet-based interventions

A possible solution for the current treatment gap is offered by the emergence of effective Internet-based interventions in the treatment of depressive symptoms (Richards and Richardson, 2012). Internet-based interventions are well suited for the workplace, because (1) they are easily accessible at any time and place, (2) anonymity is assured when employees want to avoid stigmatization or self-disclosure in group settings, (3) participants can work at their own pace and review materials as often as they want, and (4) such interventions may reach affected employees earlier than traditional mental health services, hence preventing the onset of more severe mental health problems. Finally (5), Internet-based interventions are easily scalable, implying that only a small increase in therapeutic resources is required to reach a greater proportion of the suitable population using these interventions (Ebert et al., 2014a; Heber et al., 2013).

Internet-based interventions have been shown to be feasible for the prevention and treatment of depression at the workplace (Geraedts et al., 2014a). Yet, results concerning the effectiveness are still conflicting. While a recent randomized controlled trial demonstrated that an Internet-based problem solving training (IPST) directed at employees was effective in reducing symptoms of depression (Ebert et al., 2014b), another trial did not find any additional benefits of IPST compared to care-as-usual for employees with mild depressive symptoms (Geraedts et al., 2014b; Geraedts et al., 2014c).

To date, there are no indications of which individual characteristics determine the effectiveness of IPST with respect to depression at the workplace. However, identifying factors that determine the effect of treatment outcome is of important clinical value for several reasons. First, appropriate populations can be recognized. Second, interventions can be adjusted to the precise needs of the individual. Third, by recognizing certain subpopulations, distinct causal mechanisms or progression of the disease can eventually be perceived. Fourth, health care resources can be assigned on an evidence-based level (Kraemer et al., 2002).

1.2. Predictors and moderators of (Internet-based) interventions

A variable that predicts outcome regardless of the treatment intervention is called a predictor; a variable that identifies for whom and under what conditions treatments have different effects is called moderator (Kraemer et al., 2002). To date, few studies have explored the participant characteristics that determine the effectiveness of Internet-based interventions for depressed individuals (Donker et al., 2013; Ebert et al., 2013; Warmerdam et al., 2013).

One of these studies compared the response to online cognitive behavioural therapy (CBT) for depression to a waitlist control group (Button et al., 2012). The authors found that higher pre-treatment depression severity was associated with a greater benefit in treatment. Furthermore, separated/widowed/divorced patients benefitted most from the intervention, whereas patients with a higher number of recent adverse life stressors were associated with a poorer treatment outcome. Another study that explored predictors and moderators of response to Internet-based CBT and IPST found higher baseline depression and higher education as predictors of improvement (Warmerdam et al., 2013). However, these authors found none of the variables explored in the study to moderate the differential effectiveness of the two treatments. Additional research that compared the effects of Internet-based to group-based face-to-face CBT for patients with sub-threshold depression (Spek et al., 2008) found high scores on neuroticism to predict a poorer treatment outcome, whereas higher depression scores at baseline, being female, and a higher education level were predictors of improvement. De Graaf et al. (2010) investigated pre-treatment and short-term improvement variables as predictors/moderators of outcome of unsupported computer-based CBT, usual primary care (TAU), and computer-based CBT combined with TAU for depression. They found that low pre-treatment illness severity, short-term improvement on clinical variables, and current employment predicted improvement, irrespective of treatment.

All in all, up to this point findings on the potential characteristics that predict outcome and/or determine the effectiveness of Internet-based therapy in comparison to a control group are relatively scarce and inconsistent. Most studies explored CBT outcome, whereas remarkably little research has been carried out with respect to PST. In addition, to the best of our knowledge, no study has examined which employees might or might not benefit from this specific kind of treatment and delivery.

1.3. Purpose and hypotheses of the study

The study explored both predictors and moderators for IPST treatment response in depressed employees. This was done by performing secondary analysis on the data of a randomized controlled study that examined the efficacy of IPST for employees in the educational sector (teachers) with depressive symptoms (Ebert et al., 2014b). An exploratory approach including a vast number of possible baseline variables was employed in order to maximize the generation of hypotheses to be tested specifically in future studies (Kraemer et al., 2002). According to Kraemer et al. (2002) hypothesis-generating analyses are important because the hypotheses tested in hypothesis-testing studies are frequently weak. Moreover, the design of hypothesis-testing studies is often based on erroneous assumptions rather than being grounded in the empirical and thus often lacks the power to identify treatment effects. Hence, the results of exploratory studies would be able to function as general guides to make ideal decisions for future randomized clinical trials (RCT). The selection of predictors and moderators was based upon (a) evidence of former studies exploring predictors/moderators of outcome in face-to-face CT (Hamilton and Dobson, 2002), (b) evidence of former studies exploring predictors/moderators of outcome in Internet-based intervention studies (Button et al., 2012; de Graaf et al., 2010; Donker et al., 2013; Spek et al., 2008; Warmerdam et al., 2013), and (c) theoretical assumptions based on working-related or intervention characteristics. Thus, the final list of potential predictors and moderators explored in the current study included: *Demographics*: age, sex, weekly working hours, experience with therapy/training; *Clinical Pre-treatment Characteristics*: depression severity, emotional exhaustion; and *Motivational Variables*: general self-efficacy. The primary research questions of the study were: (1) Do any of the included baseline characteristics predict/moderate the effectiveness of IPST in comparison to a waitlist control group? (2) In the case of predicting/moderating effects, do employees characterized by 'unfavourable scores' on identified moderators still profit from IPST?

2. Method

2.1. Study design

Secondary analyses were conducted based on the data of a randomized controlled trial examining the effectiveness of IPST in reducing depressive symptoms in teachers in comparison to a waitlist control group (WLC) (N = 150) (Ebert et al., 2014b). Study outcomes were measured using self-report data at baseline (t1), and in follow-up assessments after seven weeks (t2), three months (t3), and six months (t4). The primary outcome was depressive symptoms (CES-D) (Radloff, 1977; German version: Hautzinger et al., 2012). The study found evidence that IPST reduced depressive symptoms, measured at post-treatment, in teachers compared to waitlist-subjects (Cohen's d = 0.59). Enduring effects of IPST were also reported after three (between-group effect size: d = 0.37) and six months (between-group effect size: d = 0.38). For more elaboration

of the study design as well as results of the effectiveness, see Ebert et al. (2014b).

2.2. Participants and recruitment

Participants in the study were teachers recruited in various ways in Germany from April 2012 until January 2013. The researchers contacted educational-psychology organizations, posted their intervention in teacher forums, and advertised the study at several conferences on the health of teachers. The main inclusion criterion was a score of 16 or higher on the Center for Epidemiologic Studies Depression Scale (CES-D). Apart from the CES-D, no other psychopathological symptoms were assessed at screening. Moreover, access to a computer with an Internet connection was prerequisite. Participants who gave full written informed consent were randomly assigned to either an IPST or WLC group. Participant enrolment and flow throughout the study are reported in detail in Fig. 1.

2.3. Intervention

2.3.1. Internet-based problem-solving training (IPST)

The IPST intervention is based on an empirically evaluated Dutch online-based intervention 'Alles onder controle' (Everything under control) (van Straten et al., 2008; Warmerdam et al., 2008). The intervention was translated from Dutch into German and adapted in order to fit to the teacher population. The intervention is composed of five lessons and includes components of behavioural activation with respect to substantial values in life, problem-solving approaches, and rumination techniques.

In total, the intervention consisted of three steps. Firstly, participants described what seriously mattered to them. Secondly, current worries and problems were written down. These problems were then broken up into three categories: (1) unimportant problems, (2) solvable problems, and (3) unsolvable problems. Thirdly, for each of the three types of problems, a different strategy was planned to either solve the

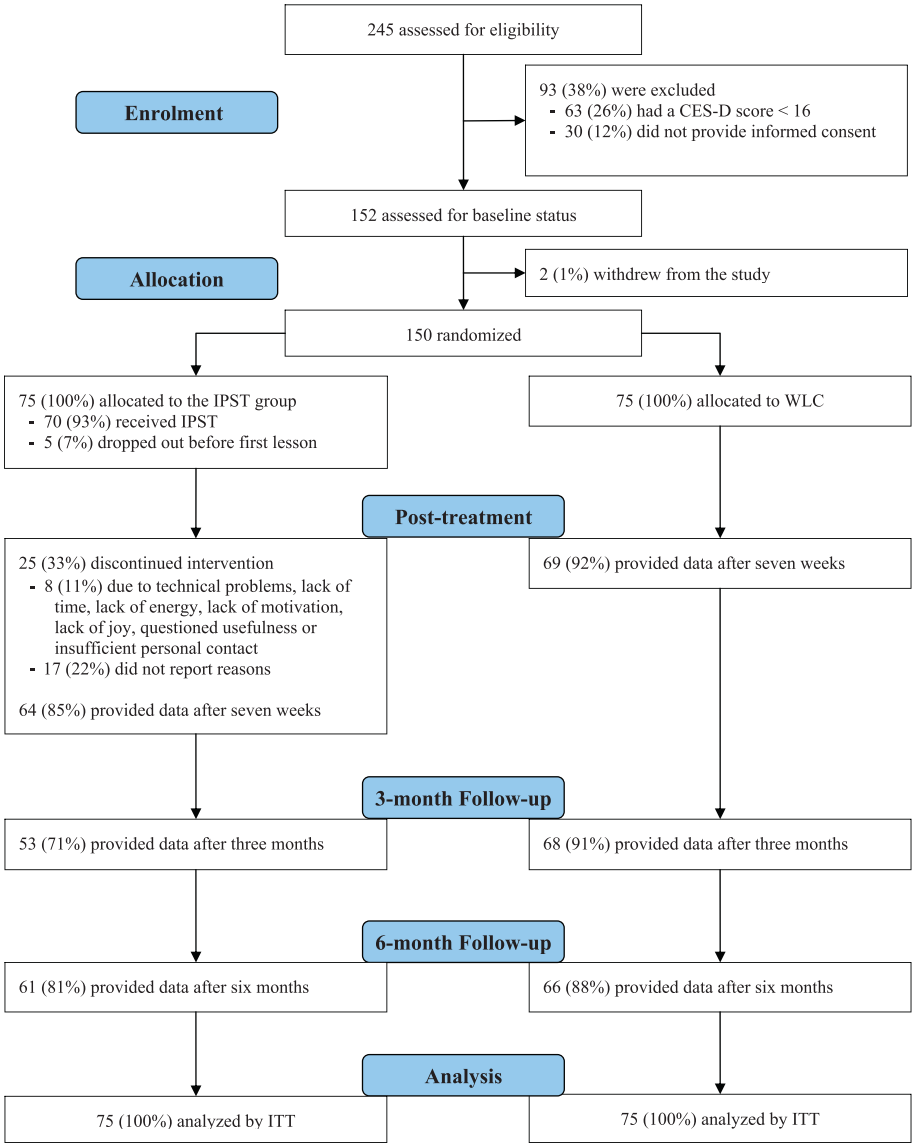

Fig. 1. Participant flow and study drop-out at each stage of the study.

problems or deal with the unimportant and unsolvable ones. The solvable problems were approached by a six-step procedure: defining the problem, collecting possible solutions, choosing the optimal solution, making a plan for carrying out the solution, and evaluating success. Within two days, participants obtained personalized written feedback from an eCoach (psychologists and trained master's level psychology students) on the exercises they had completed. Average time spent per person was approximately 2–2.5 h. Guidance was conceptualized according to a theoretical model for providing guidance in eHealth interventions (Mohr et al., 2011).

2.3.2. Waitlist control (WLC)

Teachers on the waiting list received no treatment but gained access to IPST six months after randomization.

2.4. Measures

2.4.1. Primary outcome measure

2.4.1.1. Depressive symptoms. The primary outcome measure for the effectiveness trial was change in depressive symptoms from baseline (t1) to post-treatment (t2) and three- (t3) and six-month (t4) follow-ups. Depressive symptoms were measured with the Center for Epidemiological Studies Depression Scale (CES-D). The CES-D is commonly used to identify people with depressive symptomatology. It is a self-reporting questionnaire that consists of 20 items. The CES-D total score varies between 0 and 60. Subjects rate the frequency of symptoms during the past week on a 3-point Likert-type scale (0 = *rarely or none of the time present (less than 1 day)*, 3 = *most of the time present (5–7 days)*) (e.g., 'During the past week I felt sad.'). Higher scores indicate greater depression severity. A score of 22 or higher reflects a clinically significant level of depressive symptoms in the German version of the CES-D (Hautzinger et al., 2012). It has been demonstrated that the scale is valid, sensitive to change (Cuijpers et al., 2008), and highly consistent in several German samples (Hautzinger et al., 2012). In the current study, the scale had a high level of internal consistency, as determined by a Cronbach's alpha of $\alpha = .88$.

2.4.2. Predictors and moderators

Altogether, seven baseline characteristics were included in the study: age, sex, weekly working hours, experience with therapy/training, depression severity, emotional exhaustion, and general self-efficacy. Information on age, sex, weekly working hours and experience with therapy/training was collected as part of the self-report assessment prior to randomization. *Weekly working hours* was defined as weekly hours spent on average for lessons, preparation, post processing, further training, and other work-related activities. *Experience with therapy/training* was divided into either (1) received help in the form of psychotherapy, psychosocial-oriented stress training or Internet-training before or (2) no experience with psychotherapy or Internet-training thus far.

2.4.2.1. Emotional exhaustion. The Maslach Burnout Inventory for people working in human services (MBI-D) (Büssing and Perrar, 1992) consists of 21 items and evaluates burnout syndromes on three aspects: emotional exhaustion (nine items), personal accomplishment (seven items), and depersonalization (five items). For the current purposes, only the emotional exhaustion (EE) scale was used and adapted to the teaching population in order to determine the presence and severity of burnout. The participant is asked to evaluate statements on a 7-point Likert-type scale (0 = *it never happens to me*, 7 = *it happens to me every day*) (e.g., 'I feel frustrated by my job'). Scores on the EE scale range from 9 to 54. Higher scores indicate a higher risk of burnout. The reliability and validity of this inventory are adequate (Iwanicki and Schwab, 1981). Internal consistency for the emotional exhaustion scale was high ($\alpha = .85$).

2.4.2.2. General self-efficacy. To assess self-efficacy the 10-item General Self-efficacy Scale developed by Schwarzer and Jerusalem (1995) was used. This scale assesses a general sense of perceived self-efficacy with the goal to predict ability to cope with daily hassles as well as ability to adapt after experiencing all kinds of stressful life events. The participant is asked to evaluate statements on a 4-point Likert-type scale (0 = *not at all true*, 4 = *exactly true*) (e.g., 'I can usually handle whatever comes my way'). A higher score denotes more self-efficacy. The scale demonstrates good reliability and validity (Hinz et al., 2006). In the present study, the scale had high internal consistency, as determined by a Cronbach's alpha of $\alpha = .85$.

2.5. Statistical analyses

Initially, potential group differences in baseline characteristics were evaluated with chi-square difference tests for categorical variables and t-tests for continuous variables. All analyses were performed on an intention-to-treat-sample. Hence, all participants who were randomly assigned to the two conditions were included. Missing data was imputed using expectation maximization (EM) algorithms to produce maximum likelihood estimates (SPPS). This method has proven to be particularly robust with respect to missing data (Musil et al., 2002).

To assess the effect of each baseline characteristic on changes in depressive symptoms (i.e., $t_{baseline} - t_{post\text{-}treatment}$; $t_{baseline} - t_{3months}$; $t_{baseline} - t_{6months}$), separate multiple regression models for each measurement occasion were constructed. Each model included three variables: the main effect of the baseline variable, the main effect of the treatment condition (intervention group = 1, control group = 2), and the interaction of baseline variable * treatment condition. All models were corrected for the depression score assessed at screening (measured shortly before baseline inquiry). Analyses yielding a significant baseline variable * treatment condition interaction effect on the outcome indicated that the baseline variable was a moderator. Analyses yielding a significant main effect of only the baseline variable indicated that the baseline variable was a predictor (Kraemer et al., 2002). In this exploratory analysis baseline variables were screened to determine those with evidence of a univariate association with the outcome. While baseline variables with $p > .20$ were dropped from further consideration, all others were selected for inclusion in the final multivariate analysis. Thus, after exploratory analyses, the relative contribution of a significant predictor or moderator was assessed with a multiple regression including all variables with $p < .20$, controlling for depression score at screening and treatment group. Finally, only variables that were identified in the final multivariate analysis with a significance level of a two-sided $p < .05$ were regarded as significant predictors/moderators.

Moreover, to assess the effect of relevant lower-order effects, follow-up simple slope analyses for possible significant interaction effects were conducted. Here, the slope and the significance of the intervention main effect are evaluated for conditional values (mean, one standard deviation below, and one standard deviation above the mean) of the moderator (Cohen et al., 2003).

Effect sizes for a significant moderator were calculated based on comparing the effect of control versus intervention condition. Outcome was change in depressive symptoms, with participants being grouped for each category of the moderator. Cohen's d was calculated by standardizing the difference between baseline and follow-up by the pooled standard deviation of baseline scores. Effect sizes ≥ 0.8 are assumed to be large, effect sizes between 0.5 and 0.8 are moderate, and effect sizes between 0.2 and 0.5 are assumed to be small (Cohen, 1988).

For interpretation purposes, continuous variables (i.e., age, depression severity, self-efficacy, emotional exhaustion) were standardized. Thus, regression coefficients refer to participants with average scores on the presumed predictor/moderator. All analyses were performed with SPSS 20.

3. Results

3.1. Participants

The sample consisted of 150 participants who had an average age at baseline of 47.1 years (SD = 8.2). 125 females were included in the sample (83.3%). On average, participants worked 42.0 h per week (SD = 14.6). The mean score of the participants on the CES-D at baseline was 22.9 (SD = 9.2), indicating that participants were on average mildly to moderately depressed before treatment. Interestingly, a paired-sample *t*-test showed that there was a statistically significant drop in depression severity between screening (M = 27.8, SD = 7.2) and baseline measure, $t(149) = 7.503$, $p < .01$. The mean time difference between screening and baseline assessment was M = 27.3 (SD = 21.2) days. Thus, participants across both groups presented far fewer depressive symptoms at pre-treatment than at screening. Table 1 shows descriptive data for all variables at baseline. No differences were found between the intervention and the control group on any of the pre-treatment variables. Table 2 reports descriptive statistics for the dependent variable 'depression severity' on all four measurement occasions. It clearly points out the decline in depressive symptoms across measurement occasions.

3.2. Predictors and moderators of treatment outcome

3.2.1. Change from baseline to post-treatment

Exploratory results revealed the following predictors and moderators to show a univariate relation of $p < .20$ on treatment outcome measured at post-treatment ($t_{baseline} - t_{post\text{-}treatment}$): depression severity ($p < .01$) and emotional exhaustion ($p = .08$) as potential predictors and depression severity as a possible moderator ($p = .07$) (see Table 3).

Thus, the final multivariate model consisted of two predictors (depression severity and emotional exhaustion) and one moderator (depression severity) (see Table 4). However, in the multivariate model, only baseline depression severity has proven to be a statistically significant predictor of outcome in depression severity ($p < .01$). No evidence was found that emotional exhaustion predicted change in depressive symptomology between pre-treatment and post-treatment ($p = .68$). Even though there was definitely a trend towards depression severity also altering the effectiveness of IPST vs. the waitlist control group, this did not prove to be statistically significant ($p = .07$).

In summary, it can be stated that particularly employees with higher scores on depressive symptoms at baseline can be associated with illness improvement between pre-treatment and post-treatment. This applies to all employees, irrespective of the intervention. Additionally, receiving IPST can be considered as more effective (measured at post-treatment) than being on a waiting list, irrespective of age, sex, weekly working hours, experience with therapy/training, depression severity, emotional exhaustion, and general self-efficacy.

Table 1
Pre-treatment characteristics: means (standard deviations) and percentages.

Characteristic	IPST (n = 75)	WLC (n = 75)
Age, mean ± SD, years[a]	46.4 ± 9.2	47.8 ± 7.3
Females, (%)	62 (82.7%)	63 (84.0%)
Weekly working hours[b]	42.3 ± 13.8	41.8 ± 15.6
Experience with therapy/training, (%)[c]	32 (55.2%)	37 (56.1%)
Depression severity, mean ± SD	22.9 ± 9.2	22.8 ± 9.1
General self-efficacy, mean ± SD	25.1 ± 4.6	25 ± 4.5
Emotional exhaustion, mean ± SD	38.4 ± 7.4	39.0 ± 6.5

Note. All differences between conditions were non-significant.
[a] Due to missing data, some means/counts refer to a subsample with N = 125.
[b] Due to missing data, some means/counts refer to a subsample with N = 145.
[c] Due to missing data, some means/counts refer to a subsample with N = 124.

Table 2
Descriptive statistics for primary trial main outcome 'depression severity'.

		IPST (n = 75)		WLC (n = 75)	
		M	SD	M	SD
T1	Pre-treatment	22.9	9.2	22.8	9.1
T2	Post-treatment	15.3	7.9	21.3	8.0
T3	3-month follow-up	13.4	10.2	19.7	13.0
T4	6-month follow-up	15.5	9.8	19.9	9.8

3.2.2. Change from baseline to three-month follow-up

The same procedure was conducted for the analyses concerning treatment outcome at three-month follow-up. Concretely, exploratory results found the following variables to show a univariate relation of $p < .20$ on treatment outcome measured at three-month follow-up ($t_{baseline} - t_{3months}$): depression severity ($p < .01$) and emotional exhaustion ($p < .05$) as predictors, and a trend towards depression severity being a moderator ($p = .06$) (see Table 5).

Thus, for the change in depression severity between pre-treatment and three-month follow-up, the final multivariate model consisted of the same three variables as for the change between pre-treatment and post-treatment. Consequently, depression severity and emotional exhaustion were included as potential predictors and depression severity as a potential moderator in the final model (see Table 7). Yet, only depression severity as a predictor has proven to be statistically significant ($p < .01$). Emotional exhaustion at pre-treatment did not predict change between pre-treatment and three-month follow-up ($p = .77$). Although there was a trend towards depression severity altering the effectiveness of IPST vs. the control group, no evidence was found that this effect was statistically significant ($p = .07$).

Consequently, IPST can be considered as an effective treatment for employees with regard to three-month follow-up, irrespective of the characteristics age, sex, weekly working hours, experience with therapy/training, depression severity, emotional exhaustion, and general self-efficacy. Moreover, it was found that in particular employees with higher depression severity at baseline change for the better between pre-treatment and three-month follow-up. This applies no matter whether they received the intervention or not.

3.2.3. Change from baseline to six-month follow-up

With respect to the change between pre-treatment and six-month follow-up ($t_{baseline} - t_{6months}$), exploratory results found the following variables to show a univariate relation of $p < .20$: depression severity ($p < .01$) and emotional exhaustion ($p = .12$) as potential predictors and depression severity as a possible moderator ($p < .05$) (see Table 6).

Table 3
Univariate analysis: results from separate multiple regression analyses for change from baseline to post-treatment.

Baseline characteristic	Main effect				Interaction: baseline variable × treatment condition			
	B[a]	SE_B[b]	β[c]	p	B[a]	SE_B[b]	β[c]	p
Age	.004	.271	.003	.99	.142	.181	.192	.43
Sex	−.716	.679	−.245	.29	.392	.433	.295	.37
Weekly working hours	−.212	.272	−.193	.44	.131	.167	.194	.43
Experience with therapy/training	.148	.590	.066	.80	−.100	.367	−.076	.79
Depression severity	.965	.222	.884	<.001	−.251	.138	−.363	.07
Emotional exhaustion	.429	.246	.393	.08	−.175	.161	−.243	.28
General self-efficacy	−.202	.252	−.185	.43	.199	.161	.285	.22

[a] Unstandardized regression coefficient.
[b] Standard error of the coefficient.
[c] Standardized coefficient.

Table 4
Multivariate analysis of predictors/moderators meeting the significance criterion ($p < .20$) for change from baseline to post-treatment.

	B[a]	SE_B[b]	β[c]	95% CI	p
Predictor					
Depression severity	.986	.228	.903	.534 to 1.438	<.001
Emotional exhaustion	−.032	.078	−.029	−.186 to .122	.68
Moderator					
Depression severity	−.256	.139	−.370	−.531 to .018	.07

[a] Unstandardized regression coefficient.
[b] Standard error of the coefficient.
[c] Standardized coefficient.

Consequently, the final multivariate model consisted of the same three variables as for the change between pre-treatment and post-treatment and pre-treatment and three-month follow-up: depression severity and emotional exhaustion as possible predictors and depression severity as a potential moderator (see Table 7). While there was no evidence that emotional exhaustion predicted outcome ($p = .44$), depression severity significantly did so ($p < .01$). Moreover, depression severity significantly altered the effectiveness of IPST vs. the control group ($p = 0.3$). Thus, it can be concluded that employees with higher depression severity at baseline that received IPST significantly changed for the better in the time interval between pre-treatment and six-month follow-up. Apart from that, IPST is effective, irrespective of the characteristics age, sex, weekly working hours, experience with therapy/training, emotional exhaustion, and general self-efficacy.

To evaluate whether participants with lower depression severity at baseline still profit from IPST, simple slope analyses were conducted. Therefore, three subgroups were created. The first group consisted of participants displaying 'low depression severity' at pre-treatment (mean − 1 SD; CES-D range: 5–13, M = 9.0, SD = 2.2). The second group consisted of participants displaying 'moderate depression severity' at pre-treatment (mean; CES-D range: 14–32, M = 23.1, SD = 5.6), and the third group consisted of participants displaying 'high depression severity' at pre-treatment (mean + 1 SD; CES-D range: 33–44, M = 37.0, SD = 3.2). Fig. 2 illustrates that participants in both groups presenting low depression severity at pre-treatment did not essentially change over time in depression severity. Nevertheless, there was an obvious decline in depression severity for employees with moderate and high depression severity at baseline in the intervention group. Simple slope analyses revealed that while participants with higher (mean + 1 SD) and moderate (mean) scores on depression severity significantly benefitted from the treatment (simple slope high depression severity: $B = .77$, $SE\ B = .19$, $p = <.001$, d = 0.52; simple slope moderate depression severity: $B = .48$, $SE\ B = .135$, $p = <.001$, d = 0.53), participants with lower scores on depression severity at baseline (mean − 1 SD) did not benefit from iPST ($B = .20$, $SE\ B = .19$, $p = .30$, d = 0.29).

Table 5
Univariate analysis: results from separate multiple regression analyses for change from baseline to three-month follow-up.

Baseline characteristic	Main effect				Interaction: baseline variable × treatment condition			
	B[a]	SE_B[b]	β[c]	p	B[a]	SE_B[b]	β[c]	p
Age	.322	.278	.296	.25	−.098	.185	−.136	.60
Sex	−.137	.694	−.048	.84	−.028	.443	−.021	.95
Weekly working hours	−.002	.280	−.001	.99	−.004	.172	−.006	.98
Experience with therapy/training	.119	.594	.055	.84	−.158	.370	−.125	.67
Depression severity	.984	.229	.912	<.001	−.269	.142	−.394	.06
Emotional exhaustion	.501	.248	.464	.05	−.194	.163	−.272	.24
General self-efficacy	−.029	.257	−.026	.91	−.088	.164	−.127	.59

[a] Unstandardized regression coefficient.
[b] Standard error of the coefficient.
[c] Standardized coefficient.

Table 6
Univariate analysis: results from separate multiple regression analyses for change from baseline to six-month follow-up.

Baseline characteristic	Main effect				Interaction: baseline variable × treatment condition			
	B[a]	SE_B[b]	β[c]	p	B[a]	SE_B[b]	β[c]	p
Age	.298	.254	.305	.24	−.102	.170	−.158	.55
Sex	−.271	.643	−.102	.68	.029	.411	−.024	.94
Weekly working hours	−.144	.259	−.143	.58	.144	.159	.184	.48
Experience with therapy/training	.146	.546	−.074	.79	.033	.340	.029	.92
Depression severity	.923	.217	.931	<.001	−.286	.135	−.455	.04
Emotional exhaustion	.372	.234	.375	.12	−.172	.153	−.263	.27
General self-efficacy	−.097	.241	−.098	.69	.014	.154	.022	.93

[a] Unstandardized regression coefficient.
[b] Standard error of the coefficient.
[c] Standardized coefficient.

4. Discussion

To the best of our knowledge this is the first study that aimed to identify predictors and moderators for IPST treatment response in depressed employees. Evidence was found that pre-treatment depression severity predicted change in depression severity outcome, irrespective of the allocated condition, across all measurement occasions. Employees displaying higher depression severity before treatment showed a greater reduction in depressive symptoms over time than employees with lower depression severity before treatment. Furthermore, depression severity at baseline significantly determined the effectiveness of IPST for employees in the long-term. Specifically, employees with higher depression severity at baseline that received IPST exhibited a significantly greater amount of improvement in the time span between pre-treatment and six-month follow-up than employees displaying lower symptom severity at baseline. The baseline variables age, sex, weekly working hours, experience with therapy/training, emotional exhaustion, and general self-efficacy neither predicted outcome nor moderated the effectiveness of IPST in comparison to a WLC. No indication was found that participants presenting low depression severity at baseline substantially benefitted, at least in the long-term, from IPST.

The finding that higher pre-treatment depression was associated with a higher likelihood of improvement across both groups seems plausible and is consistent with other research (Ruwaard et al., 2009; Spek et al., 2008; Warmerdam et al., 2013). Greater severity leaves more room for improvement and thus significant change in reduction of depressive symptoms. Moreover, it has been demonstrated that

Table 7
Multivariate analysis of predictors/moderators meeting the significance criterion ($p < .20$) at three- and six-month follow-ups.

	3-month follow-up				6-month follow-up			
	B[a]	SE_B[b]	β[c]	p	B[a]	SE_B[b]	β[c]	p
Predictor								
Depression severity	.968	.236	.897	<.001	.961	.223	.969	<.001
Emotional exhaustion	.23	.080	.022	.77	−.059	.076	−.059	.44
Moderator								
Depression severity	−.266	.143	−.389	.07	−.295	.136	−.469	.03

[a] Unstandardized regression coefficient.
[b] Standard error of the coefficient.
[c] Standardized coefficient.

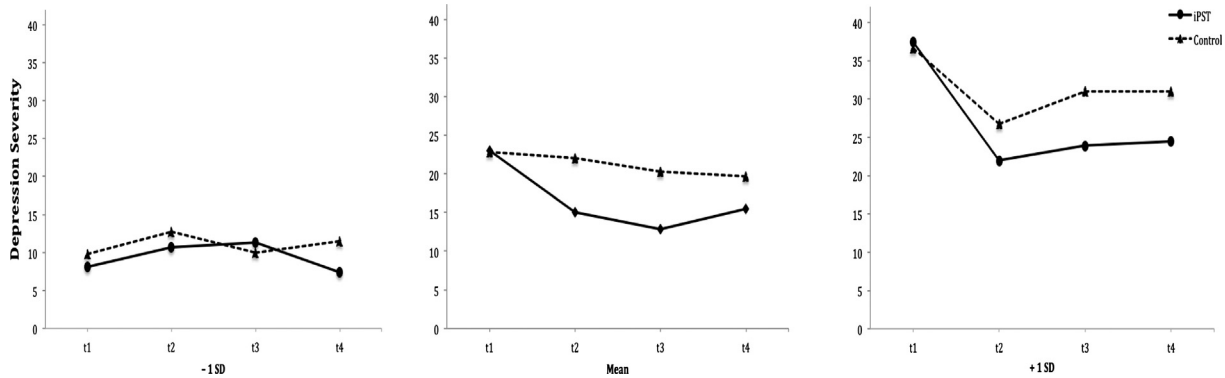

Fig. 2. Illustrative course of symptom change for significant moderator 'depression severity'. *Note.* Estimated course of change in depression severity between pretreatment (t1), and follow-up assessments after seven weeks (t2), three months (t3), and six months (t4) based on simple slope analyses for the conditional pre-treatment depression severity values mean − 1 SD vs mean vs mean + 1 SD.

even if untreated, depressive symptoms will improve (Lynch et al., 2004; Posternak and Miller, 2001). Posternak and Miller (2001) estimated that approximately 20% of participants assigned to a waiting list experience spontaneous remission during a 4–8 week period.

The finding that employees with more pronounced symptoms before treatment benefitted more from IPST than employees displaying lower symptom severity contradicts what has been widely believed and practiced. Individuals with more severe depression were often thought of as being less suitable for low-intensity interventions such as IPST. This is mainly because it has often been assumed that individuals with greater depression severity find it more difficult to follow low-intensity interventions. These interventions demand a lot of self-discipline, because there is no strong feeling of commitment as it is the case in face-to-face interventions, where regular appointments with a psychotherapist are made. Additionally, severely depressed employees might have more difficulty adhering to treatment because of a greater feeling of hopelessness and a greater lack of motivation that can generally be associated with having a depressive episode (American Psychiatric Association, 2000). Nevertheless, our results are in line with a recent meta-analysis that found that participants with more severe depression before treatment benefitted as much from low intensity interventions as less severely depressed individuals (Bower et al., 2013). Thus, as long as individuals are willing to participate, it seems as if evidence is accumulating that low-intensity interventions might provide a suitable solution even for individuals with more severe depressive symptoms.

As opposed to individuals with severe symptoms, individuals with comparatively few depressive symptoms were expected to be particularly suitable for low-intensity interventions. Yet, the current data suggests just the opposite. There are several explanations for the finding that employees initially low in depression severity did not profit from IPST. First, the present study aimed to reach affected employees at an early disease stage. Participants classified as having low level depression (CES-D score between 5 and 13, M = 9.0, SD = 2.2) presented hardly any depressive symptoms at all. Because less severity leaves less room for improvement, it might be that this group simply could not improve substantially. Nevertheless, it could be assumed that IPST would prevent further deterioration of symptoms (van Zoonen et al., 2014). However, neither participants in the intervention group nor participants in the control group deteriorated substantially. Hence, no indication of a preventive effect of the treatment was found. Second, the study at hand found a significant decline in depression severity between screening and baseline across groups (decline from M = 24.67 to M = 9.04 in the group classified as being low depressed). It might be assumed that participants did not actually profit from IPST, but from the fact that they were going to receive it. Thereby, in line with the former argument, the scores of participants classified as the low depression severity group were already too low in order to find significant effects once the actual intervention took place. Third, it might be that IPST is simply not effective for this particular subgroup. This is in line with research indicating that (therapist-delivered) online CBT is less effective in less depressed patients (Button et al., 2012; Kessler et al., 2009). Accordingly, in a meta-analysis Bower et al. (2013) even found that initially mild depressive symptoms were associated with lower effect sizes in low-intensity interventions when compared to effects for individuals with at least moderate symptoms. However, there is a chance that although participants initially low in depressive symptoms did not change with respect to depressive symptoms, other effects might take place that have not been measured in the current study. Because IPST is a relatively easy approach, once learnt, employees can make use of the acquired problem-solving skills and coping techniques in the future. In this way, IPST might work as a 'buffer', in order to prevent depression onset (van Zoonen et al., 2014). With this in mind, future studies should try to examine long-term effects of IPST with respect to the prevention of depression onset in patients scoring initially low in depression severity (Buntrock et al., 2014). Fourth, a recent systematic review found a mean standardized effect of d = 0.16 for worker-directed preventive interventions directed at the whole target population (universal prevention) (Tan et al., 2014). In the present study, the effect size for this subgroup was d = 0.29. Hence, it might well be that the current study was underpowered to detect an existing effect in the subgroup displaying low depression severity at baseline.

4.1. Limitations and future research

Several limitations should be considered. First of all, the analyses in this study were mainly exploratory, with patients not being randomized based on potential moderators of interest. Hence, findings should be treated with caution until replicated in other samples. Yet, a growing body of methodologists recognizes the importance of exploratory analyses in order to promote empirically founded hypotheses to be tested in future studies before clinical application (Kraemer et al., 2002). Secondly, the sample size was relatively small and only powered to detect medium sized effects in the primary effectiveness analyses. Thus, the power to detect significant findings for potential moderator variables, with subpopulations of small sizes, was not sufficient. Thirdly, the probability of chance capitalization associated with multiple testing should be considered (Cohen et al., 2003). However, given the exploratory approach of the present study, we decided in line with Kraemer et al. (2002) not to adjust for multiple testing procedures. Fourthly, it

is important to mention that employees in the educational sector (teachers) are remarkably educated. In addition, participants had to have good computer skills to follow the Internet treatment. Accordingly, the sample consisted most likely of more educated employees than the general working population. Interestingly, by aiming to identify characteristics that predict treatment outcome of group and Internet-based CBT, Spek et al. (2008) noted not only that a higher educational level was related to a better treatment outcome, but also that participants with lower education dropped out before intervention more often than people with higher education did. Consequently, it might have been that less educated employees would have had more difficulties in following and profiting from IPST. Thus, the present findings may not generalize to other working populations. For that reason, future studies should aim to replicate the findings including other types of occupation. In addition, our participants were mainly female and middle-aged. This makes it difficult to estimate the predictive value of gender and age and limits generalization to the whole working population. Fifthly, we decided to create three groups for depression severity, based on the mean and one SD above or below the mean as it is common when probing simple slopes for interaction effects (Hayes and Matthes, 2009). Consequently, these ranges are based on the mean scores of the current study and may not generalize to other studies. Lastly, definitely not all possible predicting/moderating variables were captured in the current study; for example, number of previous episodes, education level, and dysfunctional attitudes, or other work-related factors, such as low-effort reward imbalance and lack of control over decision at work, could have also predicted outcome or moderated the effects of IPST (Bockting et al., 2006; Donker et al., 2013; Spek et al., 2008; Warmerdam et al., 2013). Future studies should aim to consider these variables as well as long-term effects with respect to depression onset (van Zoonen et al., 2014).

4.2. Theoretical and clinical implications

Although the current findings should be treated with caution when adding them to previous research, IPST seems to be effective for employees differing in various characteristics. This low-intensity intervention seems to be particularly effective for employees with higher depression severity before treatment and can thus be considered as a first-line treatment of depression at the workplace for individuals suffering from at least moderate symptoms of depression.

The present study contributes to previous literature by providing further evidence that low-intensity interventions may also be effective for more severely depressed individuals. Hence, as long as participants are motivated, there seems to be no reason to exclude more severely depressed individuals from Internet-based occupational mental health interventions. There is yet insufficient evidence for the effectiveness of IPST in individuals scoring low (under 13 points on the CES-D) on depression severity at baseline. Thus, future studies are needed that evaluate the effects of IPST in this specific target group. Having said this, it is by now unclear what the best approach is for employees motivated to engage in Internet-based mental health interventions, but displaying only low symptom scores. In case results of the present study should be replicated, watchful waiting (a term used to describe a period in which the patient is closely monitored by the healthcare provider, yet no specific treatment is given) might be considered as first-line intervention in occupational health care. Nevertheless, if individuals are motivated to engage in a psychological intervention even with low depression scores at baseline, there might be other valuable effects not measured in the present study that could be relevant for the long-term course of mental health symptoms. Thus, future studies should evaluate the effects of interventions, such as IPST, with respect to the onset of depression (Buntrock et al., 2014). Furthermore, potential negative effects, especially for patients not profiting from IPST, such as a reduced motivation to engage in psychological interventions in the future, should be assessed (Ebert et al., 2014c; Rozental et al., 2014). Moreover, it is important to mention that the impact of Internet-based interventions not only depends on the effectiveness of the intervention. It is also essential that the intended target group participates in these interventions. Hence, future studies should evaluate strategies to increase the utilization of Internet-interventions (Baumeister et al., 2014a; Baumeister et al., 2014b; Bennett and Glasgow, 2009).

5. Conclusion

Findings from the current study suggest that IPST was effective in reducing depressive symptoms among employees differing in several characteristics. For now, current results suggest that Internet-based occupational mental health interventions could usefully be offered to employees suffering from more pronounced depression severity. For employees low in depression severity, watchful waiting, or potentially no intervention, should be considered. Certainly, these findings may not apply to other low-intensity interventions and/or working populations until replicated.

Competing interest

The authors declare that they have no competing interest.

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