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Standardized Web-Based Cognitive Behavioural Therapy of Mild to Moderate Depression: A Randomized Controlled Trial with a Long-Term Follow-Up

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Abstract. Depression is common but undertreated. Web-based self-help provides a widely accessible treatment alternative for mild to moderate depression. However, the lack of therapist guidance may limit its efficacy. The authors assess the efficacy of therapist-guided web-based cognitive behavioural treatment (web-CBT) of mild to moderate depression. Fifty-four individuals with chronic, moderate depression participated in a randomized wait-list controlled trial, with an 18-month follow-up (immediate treatment: $n = 36$, wait-list control: $n = 18$). Primary outcome measures were the Beck Depression Inventory (BDI-IA) and the Depression scale of the Symptom Checklist-90-Revised (SCL-90-R. DEP). Secondary outcome measures were the Depression Anxiety Stress Scales and the Well-Being Questionnaire. Five participants (9%) dropped out. Intention-to-treat analyses of covariance revealed that participants in the treatment condition improved significantly more than those in the wait-list control condition ($.011 < p < .015$). With regard to the primary measures, between-group effects (*d*) were 0.7 for the BDI-IA and 1.1 for the SCL-90-R DEP. Posttest SCL-90-R DEP scores indicated recovery of 49% of the participants in the treatment group compared with 6% in the control group (odds ratio = 14.5; $p < .004$). On average, the effects were stable up to 18 months ($n = 39$), although medication was a strong predictor of relapse. The results demonstrate the efficacy of web-CBT for mild to moderate depression and the importance of therapist guidance in psychological interventions. *Key words: adult; cognitive behaviour therapy/methods; computer-assisted protocol-directed therapy; controlled clinical trials, randomized; depression/psychology/therapy; follow-up studies; Internet intervention; online therapy; prediction of treatment; psychotherapy/brief treatment outcome.*

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Although depression is common, costly, and a considerable source of personal suffering and diminished quality of life (Üstün, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004; Wang, Simon, & Kessler, 2003), it often goes untreated. Effective treatments are available; however, only one third of those affected gain access to these treatments (Collins, Westra, Dozois, & Burns, 2004). This suggests that evidence-based treatment for depression remains poorly accessible. It is, therefore, important to develop alternative avenues to disseminate such treatment.

Computerized and Internet-based cognitive behaviour therapy (CBT) provides a viable and cost-effective treatment alternative for a range of mental health conditions, including, depression (Emmelkamp, 2005; Griffiths & Christensen, 2006; Kaltenthaler et al., 2006; Riper et al., 2007; Wantland, Portillo,

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Holzemer, Slaughter, & McGhee, 2004). Meta-reviews of Internet-based programs targeting depression revealed small to moderate mean effect sizes, ranging from .27 (Spek, 2007) to .59 (Barak, Hen, Boniel-Nissim, & Shapira, 2008) to .66 (Riper et al., 2007). However, these reviews also revealed significant heterogeneity in efficacy among studies. In a more qualitative review, Andersson (2006) concluded that differences between the studies preclude a single, pooled effect size.

Therapist support appears to be a significant moderator of the efficacy of Internet-based therapy. Palmqvist, Carlbring, and Andersson (2007) found a strong correlation ($\rho = .75$) between the amount of therapist guidance and treatment efficacy. In Spek's (2007) meta-analysis, the mean effect size of programs with therapist input is large ($d = 1.0$ vs. .24 for programs without therapist support). However, there is a clear need for more research, because this review included only 12 trials, Of these, five trials included therapist support and only one targeted depression (Andersson et al., 2005).

On the basis of principles of online therapy applied earlier for the treatment of posttraumatic stress (Lange, Rietdijk, et al., 2003) and work-related stress (Ruwaard, Lange, Bouwman, Broeksteeg, & Schrieken, 2007), we developed a standardized, therapist-guided, web-based treatment of depression. Like most computer-aided psychological interventions of depression, the treatment is highly structured and comprises a balanced sequence of cognitive behavioural interventions. However, in contrast to most programs, this intervention includes scheduled therapist guidance. The treatment protocol specifies the timing, nature, and frequency of therapist feedback. In this respect, the treatment is similar to the program studied by Andersson et al. (2005). However, there are clear strategic differences. Andersson et al. (2005) aimed to provide guided self-help. In contrast, we aimed to transform manualized face-to-face CBT into an Internet intervention. As such, the treatment includes more frequent therapist feedback. Further, our program includes explicit techniques that serve to support the therapists in providing the treatment.

We present the treatment and results of a randomized controlled trial in which we compared the effects of this treatment with those of a wait-list control condition. In addition, we report the results of an 18-month follow-up study. In light of previous research (Andersson, Bergström, Holländare, Ekselius, & Carlbring, 2004; Spek, 2007), we examined several predictors of treatment outcome, including baseline depression intensity, gender, educational level, number of depressive episodes, and medication. We hypothesized that, in comparison to the wait-list condition, the treatment would reduce depressive symptoms more and the improvements would be sustained over time.

Web-based CBT: treatment elements

The treatment involves strategies from cognitive therapy (CT) and behavioural activation (Beck, Rush, Shaw, & Emery, 1979; Lewinsohn, Biglan, & Zeiss, 1976). In the cognitive interventions, clients learn to recognize maladaptive, negative thoughts and to substitute these for more realistic, constructive thoughts. In the behavioural interventions, clients are encouraged to engage in behaviours that elicit positive reinforcement, avoid negative reinforcement from the environment, and generally enhance feelings of self-respect (Cuijpers, Van Straten, & Warmerdam, 2007; Hopko, Lejuez, Ruggiero, & Eifert, 2003).

Similar to manualized face-to-face CBT, the treatment comprises a balanced set of homework assignments and scheduled therapeutic sessions in which assignments are explained and adapted to the needs of the client. In web-based CBT, the homework assignments are based on web pages, which implement a personal interactive workbook. At regular intervals, therapists use the contents of this workbook to post feedback and further instructions. The therapist and the client do not communicate in real time (e.g. online chat, MSN messenger). Similar to e-mail, communication between the therapist and the client is asynchronous. This provides the therapists with the opportunity to reflect on their feedback or to discuss complex cases with colleagues or a supervisor.

Treatment integrity is enhanced by a computerized manual that specifies each step of treatment. This manual governs the order, nature, and contents of the assignments

and the timing of therapist feedback. Furthermore, the manual provides default feedback templates, which the therapists personalize to their clients. The templates contain explicit instructions to the therapist (e.g. to start the feedback with a summary of the client's accomplishments followed by a compliment). In addition, the templates provide feedback snippets for various scenarios. Ideally, clients may complete an assignment as intended and with satisfying results. However, when this is not the case, the templates provide the therapist with suggestions on how to deal with these situations.

A full treatment requires approximately 11 weeks to complete, although the schedule allows clients to adjust the pace to their own situation. The manual defines eight treatment phases, with 86 client assignments and 21 feedback/instruction texts. Clients need about 2 to 4 hr per week to complete the assignments, and therapists need about 20 to 40 min to formulate their feedback. Hence, the treatment takes between 22 to 44 hr of client time and about 7 to 14 hr of therapist time.

Phase 1. Inducing awareness: writing

The first phase consists of two writing assignments (Lepore & Smyth, 2002). Clients make an inventory of how and when they experience depressive moods and try to determine the immediate causes of these moods. In the first essay, they are asked to describe in detail an event that elicits their depressive symptoms. In the second essay, they are asked to reflect on the first essay by relating possible past and present events to their negative feelings and thoughts. After each essay, therapists provide advice, support, and specific commentary.

Phase 2. Inducing awareness: monitoring

Following Phase 1, mood monitoring is applied to enhance awareness. On 5 days, at three fixed time points, participants rate their mood on a scale ranging from 1 to 10 and provide a short description of the situation. These records provide clients and therapists with insight into the mood fluctuations during the day and high-impact events, thoughts, and emotions. In the feedback, provided after the second and fifth days, therapists emphasize the positive experiences reported by the clients (e.g. "You are not always feeling bad"). In addition, the therapists explain that there are ways to counter the negative experiences (e.g. "This may change").

Phase 3. Structuring activities

Building on the previous phase, clients are encouraged to structure their activities. For 1 week, they schedule their daily activities and evaluate their success in following this schedule. They are taught how to use their insight in possible daily mood fluctuations by scheduling positive activities at difficult moments. To this end, clients compile a list of pleasant activities. In addition, the therapists suggest several health-promoting activities. Clients receive detailed psychoeducation and instruction concerning relaxation and breathing exercises (Öst, 1987), physical activities (Bosscher, 1993), and sleep hygiene strategies (Morin, 1993).

Phase 4. Cognitive restructuring: challenging negative thoughts

Phase 4 targets maladaptive, negative thinking. First, clients simply record negative thinking and its triggering events. Next, they learn to identify automatic, dysfunctional thinking in their notes (e.g. black-and-white thinking, overgeneralization, catastrophic thinking, self-blaming, and neglect of positive aspects). Finally, clients adopt a critical approach toward the maladaptive thoughts by formulating alternative interpretations of the triggering events.

Phase 5. Cognitive restructuring: putting negative thoughts to the test in behavioural experiments

In Phase 5, clients reformulate their negative thoughts into so-called "If…then" hypotheses (e.g. "If I express my feeling, then they will make fun of me"). Next, the therapists help to create behavioural experiments in which these hypotheses are tested. Two such experiments are designed, executed, and evaluated. The therapists ensure that the experiments are practicable and realistic.

Phase 6. Positive self-verbalization

Phase 6 targets clients' self-esteem. For 1 week, they focus on their positive qualities by using the technique of positive self-verbalization

(Lange, Richard, Gest, De Vries, & Lodder, 1998). First, they write an essay on their positive qualities. Next, they summarize on a small card their most powerful statements. The clients are encouraged to read aloud the contents of this card several times a day.

Phase 7. Social skills: interacting with others

A depressive mood and a negative self-image result in diminished contact with others, which may, in turn, initiate a negative spiral through the lack of positive interaction. In Phase 7, clients break this spiral with two behavioural exercises. In the first, they compile a list of positive characteristics of an influential person (e.g. a wife or husband, a good friend), communicate this list to this person in a scheduled, face-to-face meeting, and report the outcome of this meeting to the therapist. In the second experiment, clients compile a list of ways in which they can convey positive messages toward people in their surroundings, including family, friends, and colleagues. Again, these strategies are put into practice, and the therapist is informed of the results.

Phase 8. Relapse prevention: the "tool kit"

In this last phase, clients reflect on symptoms that might signal relapse in the future. They compose a personal "relapse prevention tool kit," a personal account of the techniques that helped them most during therapy. They are encouraged to print the tool kit, and keep it for future reference.

Method

Design

The efficacy study comprised a randomized wait-list controlled pre–post trial. Participants were randomly assigned to two groups. One group started the 11-week treatment immediately (experimental), while the other started after 11 weeks (wait-list control). Eighteen months after the start of the trial, a follow-up study was conducted among participants who completed therapy to assess treatment effects in the long term.

Participants

Enrollment. The recruitment procedure, which targeted people from the general population with mild to moderate depression, started with the publication of an article in a national Dutch newspaper announcing the study. The article referred readers to a website, which provided psychoeducation regarding depression and its treatment, explained the purpose and design of the study, and contained an application form.

Screening. Respondents were screened by means of web-administered self-report questionnaires. The following exclusion criteria were applied: a score lower than 10 (no depression) or higher than 29 (severe depression) on the Beck Depression Inventory (BDI IA: Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; Beck et al., 1979), age under 18 years, heightened risk of dissociation or psychosis, suicidal ideation, drug and alcohol abuse, use of neuroleptic medication, unstable dosages of other psychiatric medication, concurrent psychotherapy, high anxiety levels, or a prevailing posttraumatic stress or panic disorder. Finally, eligible respondents were required to download, print, and return a signed informed consent form. Respondents with severe depression (BDI-IA > 29) were referred to a concurrent clinical trial of a face-to-face treatment for severe depression (Dekker et al., 2007). Other excluded respondents were referred to their general practitioners or received information concerning mental health centres in their vicinity.

Risk of dissociation was assessed using the five-item Somatoform Dissociation Questionnaire (Nijenhuis, Spinhoven, Van Dyck, Van der Hart, & Vanderlinden, 1997), using a cut-off score of 8. Respondents who scored above this cut-off also completed the longer, more specific Dissociation-Questionnaire (Nijenhuis, Spinhoven, Van Dyck, Van der Hart, & Vanderlinden, 1998).

Risk of psychosis was attributed to respondents who scored above the cut-off value of 5 on the Hallucination scale of the Screening Device for Psychotic Disorder (Lange, Schrieken, Blankers, Van de Ven, & Slot, 2000). Suicidal ideation was measured using an inventory similar to that of Joiner et al. (2003). Respondents with suicidal plans or a history of recent suicide attempts (within the past 3 years) were excluded. High anxiety

levels were detected using the Anxiety subscale of the Depression Anxiety Stress Scales (DASS-42 [Lovibond & Lovibond, 1995]; described in the Outcome Measures section). Prevailing posttraumatic stress or panic disorder was inferred in respondents who scored higher than 36 on the revised Impact of Events Scale (Weiss & Marmar, 1996; cut-off 36: Neal et al., 1994) or higher than 8 on the self-rated version of the Panic Disorder Severity Scale (Houck, Spiegel, Shear, & Rucci, 2002). Medication usage was assessed through open-ended questions concerning the use, including dosage, of prescription and nonprescription medicine.

Randomization. One month after the publication of the newspaper article, participants were randomly assigned to the groups by means of a random number generator. Participants were assigned to the treatment group and the control group in a 2:1 ratio. Unbalanced randomization was considered a defensible ethical compromise between the interests of the participants and that of the study: the treatment under study was built on evidence-based principles but was not readily available to the public, and the alternative for treatment was the wait-list (Avins, 1998; Edwards & Braunholtz, 2000).

Procedure

Setting. The trial included no face-to-face contact between the participants and any mental health professional. Participants and therapists were given an account to a private password-protected website. They used a common web-browser (e.g. Microsoft Internet Explorer or Firefox) to follow the complete therapeutic procedure, including the completion of the questionnaires and the therapeutic assignments.

Privacy. Several procedures were in place to secure the privacy of the participants. First, only the therapist and the participant were given access to individual treatments. Also, the website included a webmail system, which allowed participants to contact their therapist outside the treatment regimen. Thus, participants who shared an e-mail account with others (e.g. family members) did not have to use this shared account during treatment. Furthermore, the web server was located at a professional Internet host, protected by a firewall, and remotely administered through an encrypted communication channel. All communication with the website was encrypted with the Hypertext Transfer Protocol over Secure Socket Layer.

Therapists. Eighteen therapists participated: 12 (67%) graduate-level clinical psychologists and six (33%) therapists of the JellinekMentrum Mental Health Care Organization Amsterdam. The therapists were supervised by a licensed clinical psychologist specialized in Web-CBT. E-contact among the therapists and the supervisor was encouraged. In addition, weekly face-to-face supervision group sessions were held.

All therapists were trained in administering web-CBT. The therapists learned how to personalize the feedback, avoid pitfalls of electronic, text-based communication (e.g. Brennan & Ohaeri, 1999), and make use of the asynchronous communication to enhance the quality of the feedback.

Posttest and follow-up. Immediately after treatment, participants completed the posttest measurements on the website. These included the outcome questionnaires and an evaluation questionnaire. Eighteen months after treatment, those who completed treatment were invited by e-mail to complete the follow-up measures on the website. This group included members of the control group, who followed treatment after the 11-week waiting period.

Outcome measures

The primary outcome measures were the BDI-IA (Beck et al., 1979) and the Depression subscale of the Symptom Checklist-90-Revised (SCL-90-R, Derogatis, 1977). Secondary measures were the DASS-42 (Lovibond & Lovibond, 1995) and the short-form Well-being Questionnaire (W-BQ12; Bradley, 2000). With the exception of the W-BQ12, for each measure, higher scores indicate less favourable conditions. For the W-BQ12, higher scores indicate better levels of functioning.

BDI-IA. This self-rate instrument assesses (changes in) the intensity of depression. It comprises 21 items, scored by means of a 4-point Likert scale ranging from 0 to 3, yielding a total score between 0 and 63. It has good psychometrical properties, which have been confirmed in the Dutch population (Bouman, Luteijn, Albersnagel, & Van der

Ploeg, 1985). It has an internal consistency coefficient of $\alpha = .86$, a 1-month test–retest reliability of $r = .82$, and it correlates ($r = .72$) with clinical ratings of depression (Beck, Steer, & Garbin, 1988). In this study, we used the commonly applied clinical cut-off of $c = 10$ (Beck et al., 1961; National Institute for Clinical Excellence, 2004; Oliver & Simmons, 1984).

SCL-90-R Depression Scale. This scale comprises 16 items, which are scored on a 5-point Likert scale (0–4), indicating the rate of occurrence of depressive symptoms over the past week. The scale has good internal consistency ($\alpha = .90$) and good convergent and discriminant validity (Arrindell & Ettema, 2003; Schmitz, Kruse, Heckrath, Alberti, & Tress, 1999). For this study, a cut-off score of 25 was used (Aben, Verhey, Lousberg, Lodder, & Honig, 2002; sensitivity: 88%, specificity: 61%). Of relevance to the present study is that computerized versions of the SCL-90-R are comparable to the paper-and-pencil version (Schmitz, Hartkamp, Brinschwitz, Michalek, & Tress, 2000; Vallejo, Jordan, Diaz, Comeche, & Ortega, 2007).

DASS-42. This scale measures negative affect by assessing the severity of symptoms of depression (DASS Depression), anxiety (DASS Anxiety), and mental stress (DASS Stress). It comprises 42 items, 14 per subscale, that relate to the experience of symptoms in the past week. The items are rated on a 4- point Likert scale ranging from 0 (*Did not apply to me*) to 3 (*Applied to me very much or most of the time*). All subscales of the Dutch adaptation are characterized by good internal consistencies (Cronbach's $\alpha = .94$–$.97$) and satisfactory 1-month test–retest reliabilities (Depression: $r = .75$, Anxiety: $r = .89$, Stress: $r = .79$; De Beurs, Van Dyck, Marquenie, Lange, & Blonk, 2001; Nieuwenhuijsen, De Boer, Verbeek, Blonk, & Van Dijk, 2003).

W-BQI2. The 12-item W-BQ (Dutch version: Pouwer, Snoek, Van der Ploeg, Ader, & Heine, 2000) is a measure of psychological well-being. It comprises three subscales measuring negative well-being, positive well-being, and energy. Each subscale contains four items scored on a 4-point Likert scale, ranging from 0 (*never*) to 3 (*always*). The total score, used in this study, is derived by summing the subscale scores after inverting the Negative Well-Being subscale score. This yields scores between 0 and 36. The W-BQ12 was administered at baseline and posttest, but not at follow-up, to reduce the response burden.

Methods of analysis

Intention-to-treat. The analyses were conducted on an intention-to-treat basis. Dropouts, who did not complete the posttest measurements, were assumed to have gained nothing. Their pretest scores served as posttest scores.

Statistical significance. Two-tailed analyses of covariance (ANCOVAs), using pretest scores as a covariate, were conducted to test the difference in means of the two groups at posttest. The assumptions of ANCOVA were tested and found to be satisfied. The homogeneity of the regression coefficients in the two groups was confirmed by nonsignificant interactions between the covariates (pretest scores) and experimental condition. Further, the distributions of the outcome variables were approximately normal (in the case of the DASS Anxiety scores, normality was achieved by means of a square root transformation), and the variance across the groups was homogeneous.

To balance Type I and Type II errors, we controlled for multiple testing by controlling the False Discovery Rate (Benjamini & Yekutieli, 2001). In this procedure, p values are ordered ascendingly and then evaluated sequentially against ascending critical alpha levels, according to the formula

$$\alpha_i = (\alpha/m)^* i,$$

where i denotes the rank of the ordered p values and m denotes the number of tests. Alternatively, ordered p values, multiplied by m/i, can be evaluated against the nominal α significance level, which is the approach taken in this article.

Effect size. To express the magnitude of the effects, mean gain scores on the outcome measures were standardized to Cohen's d (Cohen, 1988), representing the number of standard deviations separating the two means. Point estimates and 95% confidence intervals of d were determined following a procedure described in detail by Robey (2004). In this procedure, effect sizes are calculated using the

pooled standard deviation (of the pretest and posttest scores), and confidence intervals are approximated from the central *t* distribution.

Clinical relevance. We tested the higher probability of statistically reliable individual recovery after treatment compared with the control group with two-sided Fisher's exact tests ($\alpha = .05$) and expressed this difference as odds ratios (OR; Hillis & Woolson, 2002). First, we used the reliable change index to test the significance of individual change (Jacobson & Truax, 1991; "no change" and "deterioration" were pooled into a single "unimproved" category). Next, recovery was defined as reliable change from a pretest score above the (published) clinical cut-off to a posttest score below the cut-off. Therefore, participants scoring below cut-off at pretest were excluded from the recovery analysis.

Follow-up. Pretreatment to follow-up data of those who participated in the follow-up were analyzed using repeated measures analyses of variance, with time of measurement as a three-level within-subject factor (pretest/posttest/follow-up). Differences between the means at the times of measurement were tested for significance using simple contrasts and *p*-value adjustments to control the false discovery rate within each measure.

Mediating factors. To assess the strength of outcome predictors, we examined the correlation of several predictor variables with the change scores of the BDI-IA (pretest–posttest; pretest–follow-up). Additionally, the predictors were examined through multiple regression analyses.

Results

Randomized controlled trial

Enrollment and screening. In response to the newspaper article, 231 respondents applied for treatment, of whom 80 (34%) subsequently withdrew. Of the 151 participants who completed the screening, 97 (64%) were excluded, and 54 (36%) were included (cf. Figure 1). As shown in Table 1, excluded respondents scored less favourably on the BDI-IA, $t(148) = 5.8$, $p < .001$, and the other outcome measures, in accordance with the exclusion protocol. In addition, excluded respondents were younger, $t(149) = 3.3$, $p = .001$, and less educated, $\chi^2(1, N = 143) = 4.9$, $p = .03$.

Sample. The included sample ($N = 54$) comprised 37 women (69%) and 17 men (31%). On average, they were middle-aged ($M = 42$ years, $SD = 10$, range = 18–71 years), unmarried (56%), and highly educated (65% completed tertiary education). They reported a median of four depressive episodes (interquartile range = 7.5, range = 0–50) over a median of 12 years (interquartile range = 14, range = 2–36 years). The median duration of the longest episode was 16 weeks (interquartile range = 45). Sixty per cent ($n = 32$) had received previous treatment for depression, and 19% ($n = 10$) applied for treatment while taking a stable dosage of an antidepressant.

The participants were randomly assigned to immediate treatment ($n = 36$ participants; 67%) or to the wait-list control condition ($n = 18$; 33%). With these groups sizes, the power of the study to detect a large ($d = .8$) between-group effect was approximately 75% for the strongest effect (evaluated at $\alpha = .05/6 = .008$). To check the randomization, *t* tests and chi-square tests were conducted with respect to the outcome measures, gender, age, marital status, education, duration of symptoms, and medication status. No significant differences were found (cf. Table 1).

Drop-out. Five participants (9%) dropped out of the study: three in the treatment group (8%) and two in the control group (11%; see Figure 1). Given the small number of drop-outs, predictors of drop-out were not subject to analysis.

Treatment duration. The treatment group took longer than the planned 11 weeks to complete treatment (*mdn* = 16 weeks), and completed the posttest later than the control group (13 weeks). This resulted in interpretative difficulties, because the control group did not fully control for spontaneous improvement. There were no indications that longer treatments were more effective: Correcting for pretreatment scores, treatment duration did not correlate with posttest scores ($-.10 < pr < .13$). Nevertheless, to account for the discrepancy, the scores of the control group were extrapolated to 16 weeks. Because there were just two measurements, the only option for post hoc statistical correction was to assume linear change. Given improvements in the control group, this correction deflated the treatment efficacy estimate and, therefore, resulted in a conservative evaluation.

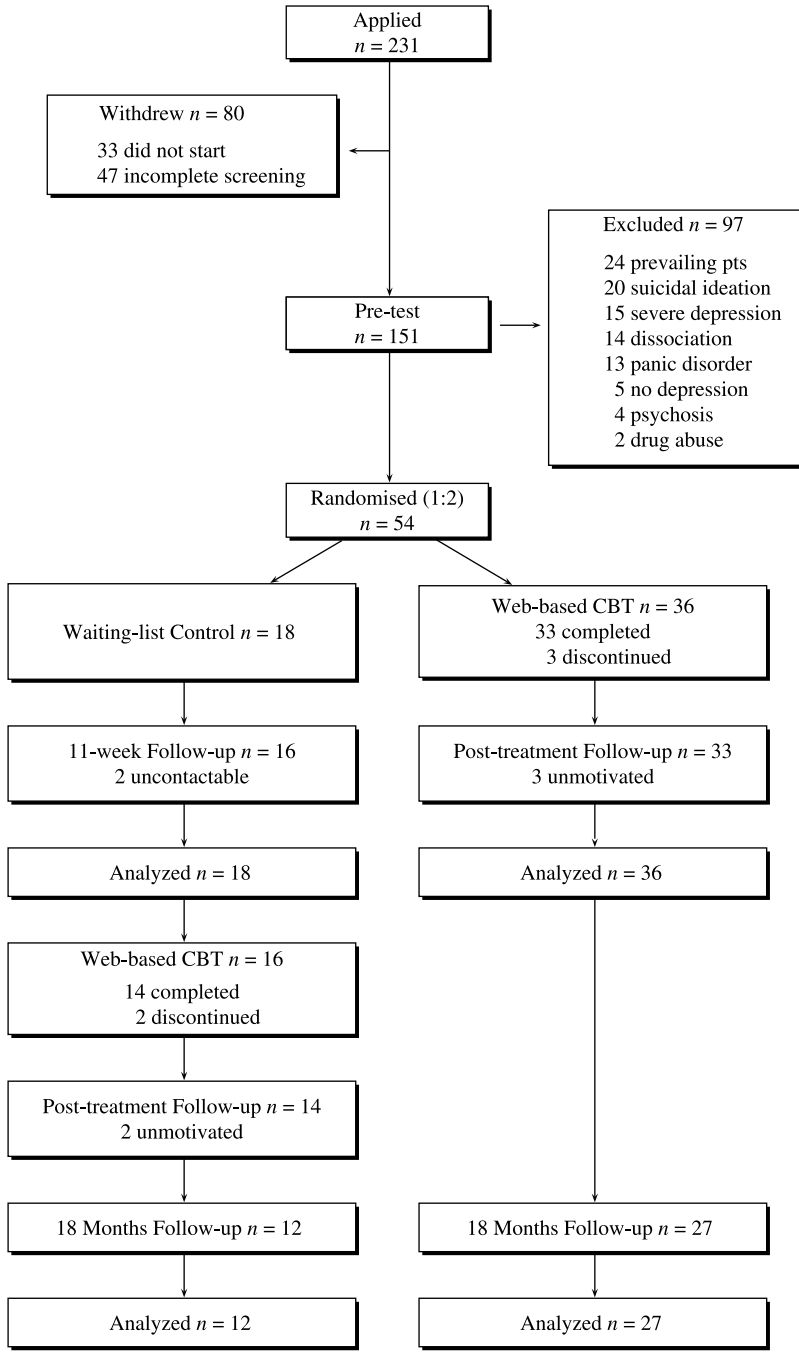

Figure 1. Participant flow. (CBT = cognitive behavioural therapy.)

Table 1. *Characteristics of participants and excluded respondents*

Characteristic	Control ($n = 18$)	Treatment ($n = 6$)	Excluded ($n = 97$)
Demographic			
Gender: female	10 (56%)	27 (75%)	76 (78%)
Age ($M \pm SD$)	42 ± 9	42 ± 10	35 ± 12
Education: tertiary	12 (67%)	23 (64%)	44 (45%)
Marital status: married	4 (22%)	10 (28%)	30 (31%)
Unmarried	11 (61%)	19 (53%)	54 (56%)
Divorced/widowed	3 (17%)	7 (19%)	13 (13%)
Symptoms			
Duration of symptoms (years; *mdn* IQR)	15 (16)	10 (12)	11 (16)
Multiple depressive episodes	13 (72%)	25 (69%)	76 (78%)
No. depressive episodes (*mdn* IQR)	4 (7)	5 (6)	3 (3)
Longest episode (weeks; *mdn* IQR)	16 (33)	22 (44)	24 (39)
Treatment			
Prior treatment	12 (67%)	20 (56%)	60 (61%)
Pharmacotherapy	8 (44%)	11 (30%)	47 (48%)
Psychotherapy	10 (56%)	16 (44%)	42 (43%)
Antidepressant[a] at pretest	3 (17%)	7 (20%)	—

Note. *Values represent subsample size and percentage unless otherwise noted. IQR = interquartile range.*
[a]*All excluded respondents were excluded before baseline medication usage was recorded. Therefore, the cells in the columns of the excluded group are empty. Further, baseline medication of one participant in the treatment group was unknown at the time of analysis.*

Statistical signicance. Table 2 shows the results in the intention-to-treat sample. Despite improvements in the control group, the improvement in the treatment group was significantly greater, with regard to the primary outcome measures (adjusted $p < .0l2$; Figure 2A), DASS Anxiety and WBQ12 ($p < .015$). With regard to DASS Stress and DASS Depression, the differential improvements between the two groups were not significant, although marginally so ($p < .07$).

Effect size. Table 2 also shows the magnitude of the effects. Compared with no treatment, the primary depression measures revealed a large pooled effect size of treatment of $d = .9$. Large between-group effects were also found with respect to the secondary measures. With regard to DASS, the pooled effect was $d = .8$, and with regard to W-BQ it was $d = 1.0$ (cf. Table 2).

Clinical relevance. Table 3 shows the recovery rates in the two experimental groups. The odds ratios (OR > 2.1) indicated more reliable individual recovery in the treatment group compared with the wait-list control group. However, this difference was only significant with regard to SCL-90-R DEP (OR = 14.5; adjusted $p < .0043$).

Pooled outcome and long-term follow-up

Participants. After the 11-week waiting period, 16 of 18 participants in the control group embarked on the web-based treatment. To enhance the precision of the assessment of participant satisfaction and predictors of outcome, data from both groups were pooled ($N = 52$), using the second (pretreatment) assessment of the control group as the pretest.

Drop-out. In total, 47 participants (90%) completed treatment and five (10%) dropped out. Visual inspection of the mean outcome scores suggested that dropout was unrelated to baseline symptom severity. However, given the small number of drop-outs, predictors of drop-out were not analysed.

Follow-up attrition. Eighteen months after the start of the trial, the participants who had completed the treatment were invited for the long-term follow-up. Thirty-nine participants (83%) responded. Baseline depression severity was unrelated to follow-up participation, $p < .l3$.

Outcome. Table 4 shows the results among the trial completers ($n = 39$). The growth curves of the depression scores (illustrated by Figure 2B) indicated significant linear and quadratic time effects, $F(1, 38) = 21.7–47.6$, $p < .001$. On average, participants improved

Table 2. *Web-CBT versus wait-list control (intention-to-treat analysis*[a]*)*

	Pre		Post		Effect size		ANCOVA	
Measure	*M*	*SD*	*M*	*SD*	*d*	CI 95%	*F*(1, 51)	*p* [b]
BDI-IA								
Treatment	19.7	5.5	9.8	6.5	.7	±.6	7.6	.012
Control	21.3	5.3	15.6	7.6				
SCL-90-R Depression								
Treatment	39.9	8.6	26.7	8.1	1.1	±.7	10.9	.011
Control	38.1	7.5	34.4	10.5				
DASS Depression								
Treatment	20.6	8.4	7.6	6.9	.5	±.7	3.4	.070
Control	20.8	8.1	11.8	9.8				
DASS Anxiety								
Treatment	6.9	4.7	2.8	2.8	1.0	±.6	8.0	.013
Control	6.1	4.2	6.3	6.6				
DASS Stress								
Treatment	18.1	8.6	9.2	7.1	.8	±.7	4.1	.057
Control	15.5	7.9	13.3	8.8				
W-BQ12								
Treatment	14.6	2.6	19.9	4.4	1.0	±.6	8.6	.015
Control	15.3	3.0	16.8	4.7				

Note. *Higher scores indicate less favourable conditions, except for W-BQ12, where higher scores indicate higher levels of functioning. BDI-IA = Beck Depression Inventory; SCL-90-R DEP = Symptom Checklist-90-Revised Depression scale; DASS = Depression Anxiety Stress Scales; W-BQ12 = Well-Being Questionnaire; CI = confidence interval; ANCOVA = analysis of covariance.*
[a]*Pretest scores of drop-outs were carried forward to the posttest.* [b]*Listed* p *values are adjusted for multiple testing.*

significantly from pretest to posttest ($p < .001$; pooled $d = 1.4$) and maintained their improvements up to the 18-month follow-up with marginal changes from posttreatment (pretest to follow-up: $p < .001$; posttest to follow-up: $p < .13$). The same pattern emerged with respect to DASS Stress (posttest to follow- up: $p < .l2$) and DASS Anxiety (posttest to follow-up: $p < .13$).

As indicated by posttest BDI-IA scores of 36 trial completers scoring above cut-off at pretest, 17 (47%) reliably recovered from depression. At follow-up, again 17 (47%) of the participants had recovered. Of the 17 who recovered at posttest, 13 (76%) maintained this improvement up to 18 months.

Participant satisfaction. Immediately after treatment, participants evaluated the overall

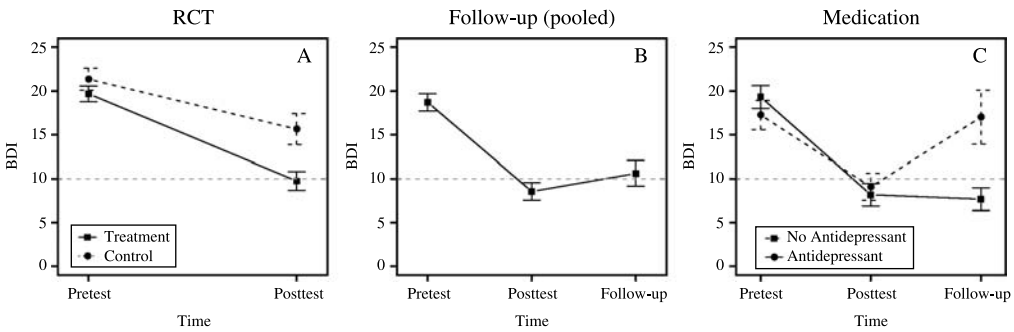

Figure 2. Effects of web-based cognitve behavioural therapy as measured by the Beck Depressicn Inventory (BDI) in comparison to a wait-list control group (A), from pretest to the 18-month follow-up (B), and as moderated by medication (C). The error bars repsesent ± 1 SE. The dashed horizontal line represents the clinical cut-off (10). (RCT = randomized controlled trial.)

Table 3. *Clinical relevance: reliable recovery (intention-to-treat analysis[a])*

	Pretest		Posttest		Fisher exact test	
Measure	*n*	%	*n*	%	OR	*p* [b]
BDI-IA						
Treatment	36	100%	16	44%	2.1	.375
Control	18	100%	5	28%		
SCL-90-R Depression						
Treatment	35	97%	17	49%	14.5	.004
Control	17	94%	1	6%		

Note. *Cut-off: BDI* $\leq$ *= 10; SCL-90-R Depression* $\leq$ *= 25. OR = odds ratio (of recovery for treatment group compared with that for control group); BDI-IA = Beck Depression Inventory; SCL-90-R = Symptom Checklist-90-Revised.*

[a] *Pretest scores of drop-outs were carried forward to the posttest.* [b] *Listed* p *values are adjusted for multiple testing.*

value of the treatment on a scale ranging from 1 to 10, with an average of 7.7 ($SD = 1.2$). They rated their relationship with their therapist as pleasant (88%) and personal (75%) and stated that the relationship had grown during treatment (57%). Most participants (89%) indicated that they had not missed face-to-face contact.

Predictors of outcome. As shown in Table 5, baseline BDI-IA scores correlated positively with posttreatment improvements. Further, the use of an antidepressant (either during or after treatment) correlated negatively with long-term improvements (see Figure 2C). None of the other variables significantly predicted the improvements. Examination through multiple regression produced similar results.

Baseline medication status correlated negatively with long-term improvements. Although the effect was absent at posttest, taking an antidepressant during treatment ($n = 6$), was associated with a less favourable outcome at 18 months. At follow-up, the severity of depression in the antidepressant group was equal to baseline severity of depression.

Between the posttest and the 18-month follow-up, 16 (41%) of the 39 participants received additional treatment (psychotherapy only: $n = 7$; medication only: $n = 1$; both: $n = 8$). Although the overall association was not significant, participants receiving additional treatment showed a considerable higher level of symptoms at follow-up ($r_{pb} = -.29$). Further examination showed that participants who started taking medication after treatment clearly displayed more severe symptoms at follow-up compared with those who did not ($M = 16.8$ vs. 8.0), $t(36) = 3.0$, $p = .005$. Again, at pretest and posttest, the two groups reported similar depression levels.

When medication usage both during and after treatment was considered, there was a significant medication effect ($r_{pb} = -.52$, $p < .001$). Figure 2C illustrates the effect. On

Table 4. *Pooled outcome of web-CBT at pretest, posttest, and after 18 months (N = 39)*

				Pre-post ES		Pre-FU ES	
Measure	Pretest	Posttest	Follow-up	*d*	CI 95%	*d*	CI 95%
BDI-IA	18.5 (6.6)	8.6 (6.1)	10.6 (9.0)	1.6	±.4	1.0	±.4
SCL-90-R							
Depression	39.2 (10.0)	25.5 (7.8)	29.6 (13.4)	1.5	±.4	0.8	±.4
DASS							
Depression	18.6 (9.6)	5.8 (6.4)	9.2 (10.3)	1.6	±.4	0.9	±.5
Anxiety	6.9 (5.6)	2.2 (2.6)	3.3 (4.8)	1.1	±.4	0.7	±.4
Stress	17.1 (9.2)	8.2 (6.8)	9.8 (8.1)	1.1	±.4	0.8	±.4

Note. *Values represent means (and standard deviations). BDI-IA = Beck Depression Inventory; SCL-90-R = Symptom Checklist-90-Revised; DASS = Depression Anxiety Stress Scales; ES = effect size; CI = confidence interval.*

Table 5. *Predictors of reduction of depressive symptoms after web-based cognitive behavioural therapy*[a]

Measure	Posttest *r*	Follow-up *r*
Pretest depression severity	.68***	.42**
Gender	−.07	.11
Age	.12	−.02
Education	−.01	−.04
Treatment duration	.06	.07
Previous number of episodes	−.14	−.02
Antidepressant (at pretest)	−.17	−.35*
Additional treatment	.00	−.29
Antidepressant	−.12	−.49**
Psychotherapy	−.03	−.24

[a]*Outcome is defined as the difference score (pretest – posttest,* n = *47; pretest – follow-up,* n = *39) on the Beck Depression Inventory.*
*p < *.05*. **p < *.01*. ***p < *.001*.

average, those who took medication during or after the trial ($n = 13$) did not improve from pretest to follow-up ($d = .04$). In contrast, those who did not take any medication ($n = 26$) reported large improvements ($d = 1.6$).

Discussion

Compared with a wait-list control condition, standardized therapist-guided web-based CBT induced large and clinically relevant improvements in depression, anxiety, and well-being in a community sample of adults with chronic symptoms of mild to moderate depression. The follow-up indicated these effects to be persistent, although the use of medication was highly predictive of a negative long-term outcome. Despite the lack of face-to-face contact, participants were highly satisfied with the treatment and their therapist.

Primary results

After controlling for improvements in the control group, web-CBT had an effect size of .9. This compares well with the effects found in meta-analyses of face-to-face CT and CBT trials ($d = .8$: Gloaguen, Cottraux, Cucherat, & Blackburn, 1998; $d = .9$: Cuijpers et al., 2007) and therapist-guided web-CBT ($d = 1.0$: Spek, 2007). Furthermore, the low drop-out rate of 10% in the present trial was encouraging, given that poor adherence has been identified as one of the major challenges of online intervention (Eysenbach, 2005).

With regard to negative affect, results were less clear. Significant results were found with the Anxiety subscale of the DASS. The effects on DASS Depression and DASS Stress just fell short of statistical significance. However, given the magnitude of observed effects ($.5 < d < 1.0$), we expect future trials to find positive results.

In accordance with face-to-face CBT, 47% of the participants in the web-CBT condition recovered from their depression immediately after treatment. However, when this rate was compared with the recovery rates in the control group, strong significant differences between the groups were found with the SCL-90-R but not with the BDI-IA. Although the recovery rates based on these measures were comparable in the treatment group (49% and 44%, respectively), those in the control group diverged (6% for SCL-90-R vs. 28% for BDI-IA). Both rates of spontaneous recovery appear extreme based on what is known about the natural course of untreated depression (Posternak & Miller, 2001). Future studies should aim to resolve this issue.

In accordance with previous follow-up studies of online therapist-guided CBT (Andersson et al., 2004; Lange, Van de Ven, & Schrieken, 2003; Ruwaard et al., 2007; Spek, 2007; Wagner & Maercker, 2007) and face-to-face CT (Gloaguen, Cottraux, Cucherat, & Blackburn, 1998), the effects were found to be stable in the long term. This is encouraging, given the participants' self-reported chronic and recurrent depressive symptoms before treatment. Apparently, this treatment made a lasting difference.

Importantly, the persistent improvements were not explained by additional treatment, which some participants had sought in the 18-month period. On the contrary, pharmacotherapy was highly predictive of relapse in the long term. We would have expected the use of an antidepressant to have resulted in slightly lower, rather than higher, follow-up scores (Pampallona, Bollini, Tibaldi, Kupelnick, & Munizza, 2004). Participants who took an antidepressant during treatment may have terminated their medication too soon because of the short-term improvements as a result of the Internet treatment.

Alternatively, these participants may have attributed the immediate improvements not to their own efforts but to the medication. Also, participants who started pharmacotherapy after treatment may have done so simply because they did not experience long-term benefit from web-CBT. In any case, there is a clear need for updating the treatment manual to address combined therapy. Additionally, future trials should control for medication in a more rigorous manner.

The present treatment and the Internet-based guided self-help program of Andersson et al. (2005) appear equally effective, even though the present treatment requires more therapist time (2 hr vs. 7–14 hr). However, in Andersson et al., the attrition rate was higher (27% vs. 10% in the present treatment) and the effects on anxiety were lower ($d = .5$ vs. 1.0). Furthermore, the differences in efficacy may be obscured by differences in control group improvements. Andersson et al. (2005) found a small effect of .2 in the control group, whereas the present study revealed a large effect in the control group ($d = .8$). Clearly, it would be interesting to compare both approaches directly.

Limitations

We did not make use of a structured diagnostic interview to establish a formal diagnosis of depression or dysthymia. Face-to-face interviewing was not an option, given that we aim to develop fully Internet-based treatment. Instead, we used cut-off scores of self-report scales to determine the clinical status of the participants. Although the consequences of these cut-offs are known, observer-rated diagnoses may add to the validity of the results. Telephonic diagnostic interviews may provide a future solution.

A second limitation concerns the generalizability of the results. We excluded respondents with BDI-IA scores indicating severe depression (>29). Therefore, the results of the present study should not be generalized to individuals with severe depression. The generalizability of results might be further limited by our exclusion criteria. Note, however, that most excluded respondents were rejected because they suffered from posttraumatic stress or panic disorder, for which effective online alternative treatments exist, or because of dissociation and suicidal ideation, for which we presently consider online treatment unsuitable given the lack of face-to-face contact.

Another limitation is that the period between pretest and posttest differed somewhat between the groups studied in this trial. To control for this discrepancy, we used linear extrapolation to estimate the changes in the control group. As a result, the observed improvements in the control group were more pronounced. Thus, the extrapolation resulted in a conservative estimate of treatment efficacy. Nevertheless, replication studies should aim to avoid such corrections, for example by using the observed estimate of treatment duration (16 weeks) or by measuring both groups after a fixed interval regardless of treatment progress.

As a final limitation, we remind the reader that the long-term follow-up study was uncontrolled and that it included only those participants who completed treatment. The positive outcome of the long-term follow-up needs to be corroborated, preferably by a comparative study.

Future directions

The present results certainly are encouraging and warrant further study. The treatment shares many characteristics with existing computer-aided CBT but includes more therapist guidance and appears to be more effective. The results, therefore, underscore the suggestion of Palmqvist et al. (2007) and Spek (2007) that the efficacy of Internet-based CBT is related to the amount of therapist guidance. However, the cost–benefit ratio of various approaches of Internet-based CBT awaits further exploration. Future trials should aim for direct comparisons between programs with varying amounts of therapist guidance and should evaluate patient preference and treatment adherence as well as efficacy and costs.

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