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The Techniques for Overcoming Depression Questionnaire: Mokken Scale Analysis, Reliability, and Concurrent Validity in Depressed Cardiac Patients

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Abstract The Techniques for Overcoming Depression (TOD) questionnaire assesses the frequency with which patients being treated for depression use cognitive-behavioral techniques in daily life. This study examined its latent structure, reliability and concurrent validity in depressed cardiac patients. The TOD was administered at the initial and final treatment sessions in three trials of cognitive behavior therapy (CBT) ($n = 260$) for depression in cardiac patients. Mokken scaling was used to determine its dimensionality. The TOD is unidimensional in depressed cardiac patients, both at the initial evaluation (H = .46) and the end of treatment (H = .47). It is sensitive to change and the total score correlates with therapist ratings of the patient's socialization to CBT (r = .40, $p < .05$), homework adherence (r = .36, $p < .05$), and use of cognitive-behavioral techniques (r = .51, $p < .01$). TOD scores were associated with post-treatment depression scores in two of the trials ($p < .01$ in both analyses). The TOD is a unidimensional, reliable, valid, and clinically informative measure of self-reported use of cognitive-behavioral techniques for overcoming depression in cardiac patients. Studies of the TOD in other depressed patient populations are needed.

Keywords Cognitive therapy · Depressive disorder · Heart diseases · Patient compliance · Psychometrics · Questionnaires

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Introduction

Several variants of cognitive behavior therapy (CBT) have been evaluated in randomized controlled trials (RCTs) as treatments for depression in adults. The classic manual by Beck et al. (1979) focuses primarily on cognitive restructuring but also includes other intervention components. There is ample evidence that Beck's and other multicomponent varieties of CBT are efficacious relative to several different comparators. However, other trials and meta-analyses have shown that certain components of CBT, especially behavioral activation and problem-solving, if delivered as stand-alone interventions, are approximately as efficacious for depression as is multicomponent CBT (Barth et al. 2013; Bell and D'Zurilla 2009; Cuijpers et al. 2007, 2013; Dimidjian et al. 2006; Jacobson et al. 1996; Nezu and Perri 1989).

For example, a randomized dismantling trial recently compared mindfulness-based cognitive therapy to standard cognitive therapy and to treatment as usual in 274 patients with recurrent depression who were recruited from primary care and mental health facilities. The outcomes of both forms of cognitive therapy were similar, and relapse rates

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were similar with or without the mindfulness component (Williams et al. 2014). These and the earlier findings cited above raise questions about the incremental clinical value of including more than one or two components in cognitive-behavioral interventions for depression. However, an analysis of treatment process data from the intervention arm of the Enhancing Recovery in Coronary Heart Disease (ENRICHD) clinical trial showed that patients who were exposed to most or all of the ingredients of the trial's multicomponent cognitive-behavioral intervention (which was guided by Beck's manual) tended to have better depression outcomes than patients who were exposed to fewer components (Cowan et al. 2008).

In trials of individualized cognitive-behavioral interventions for depression, different patients may be exposed to different treatment components or combinations of components. Patients may also differ as to which cognitive-behavioral techniques they adopt and rely on to overcome depression, but few studies have examined this question. The Ways of Responding (WOR) scale (Barber and DeRubeis 1992) was developed to assess patient competence with the kinds of coping skills that are typically encouraged by cognitive therapists. The WOR is sensitive to treatment-related change (Barber and DeRubeis 2001), covaries with change in depression (Barber and DeRubeis 2001), and predicts relapse of depression after treatment (Barber and DeRubeis 1992; Strunk et al. 2007). However, the WOR is a relatively complex thought-listing instrument that asks patients to imagine how they will respond to depressive thoughts in a variety of stressful situations and to answer a series of additional questions about each situation. Given the complexity of the WOR and its restricted focus on cognitions, there is a need for a questionnaire that is simpler for patients and therapists to use and that assesses a broader range of the cognitive-behavioral techniques that depressed patients may use in daily life. Consequently, we developed the Techniques for Overcoming Depression (TOD) questionnaire as a clinical assessment tool for use in multicomponent CBT interventions. The TOD assesses the number and type of cognitive-behavioral techniques that patients report using to overcome their depression, and the frequency with which they have been using these techniques in daily life.

The purpose of this study was to evaluate the psychometric structure, reliability, and concurrent validity of the TOD, and to test the hypothesis that depressed cardiac patients who report using multiple cognitive-behavioral techniques, and using them frequently, tend to have better depression outcomes than similar patients who report using fewer techniques and/or using them infrequently. Because CBT homework assignments often involve using these techniques between sessions, and because a patient's willingness to use them is presumably influenced by his or

her socialization to CBT, we also investigated the relationships between the TOD and therapist ratings of socialization to CBT and homework adherence. Specifically, we hypothesized that (1) the individual TOD item ratings and the TOD total score increase from the initial clinical evaluation to the end of active treatment; (2) there are positive correlations between the TOD scores and therapist ratings of the patient's use of cognitive-behavioral techniques in daily life, homework adherence, and socialization to CBT; and (3) TOD scores predict depression scores at the end of treatment. Because much of our research focuses on the role and treatment of depression in heart disease, we tested these hypotheses on data from randomized controlled trials of CBT for depressed cardiac patients. The TOD is intended for use in a wide variety of depressed populations, not only in depressed cardiac patients, but it should not be used for clinical purposes in other populations until it has been tested in those populations.

Method

Development of the TOD Questionnaire

The TOD is a 16-item, self-report questionnaire. Each item presents one of the techniques or strategies that are often promoted in multicomponent cognitive-behavioral interventions for depression, e.g., "Challenge the depressing thoughts and images that run through my mind, and practice more helpful ways of thinking." Each item is rated on a 4-point scale (0, never or rarely; 1, sometimes; 2, often; 3, very often). The TOD total score is the sum of the 16 item ratings and ranges from 0 to 48. A score of zero would indicate that the patient is not using any of the listed techniques, whereas a score of 48 would suggest that the patient is frequently using all of the techniques. The instrument is displayed in Appendix 1.

To develop the questionnaire, we first reviewed the depression treatment manual by Beck et al. (1979), two cognitive therapy manuals by Beck (1995, 2005), and materials from several CBT training workshops to identify techniques that are often used to treat depression. We reviewed the CBT case files and audio recordings from the St. Louis site of the ENRICHD trial (Berkman et al. 2003) and from three other cognitive-behavioral depression trials that had been conducted in cardiac patient populations at this site (Freedland et al. 2002a, b; Carney et al. 2000; Lustman et al. 1998) to identify frequently-used techniques. The 16 most frequently used techniques were then described in layperson's terms, based on the in-session descriptions of these techniques by multiple patients who had been using them in their daily lives during trials

involving cognitive-behavioral interventions at our center. These items were then reviewed and edited by several of the cognitive behavior therapists, CBT supervisors, principal investigators, and co-investigators who were involved in these trials. The final wording of the items was based on the consensus judgment of this group. The scale was finalized before being used in three additional trials at our center. The data used in the present analyses were derived from these trials.

Participants

The data for the present analyses were obtained from the CBT arm of a completed RCT involving patients with depression and a recent history of coronary artery bypass graft (CABG) surgery ($n = 35$) (Freedland et al. 2009), the intervention arm of a recently completed RCT of CBT for depression in patients with heart failure ($n = 79$) (Freedland et al. 2015), and an uncontrolled trial of CBT and antidepressant medication to identify treatment-resistant depression in patients with coronary heart disease ($n = 157$) (Carney et al. 2016), for a total sample size of $n = 271$. The therapists in these trials had masters degrees in social work or counseling or doctoral degrees in clinical psychology, had advanced training and experience in CBT, and were supervised by the first author.

The patients and protocols differed across these studies. The Depression Interview and Structured Hamilton (DISH) (Davidson et al. 2006; Freedland et al. 2002a, b) was used in all three trials to determine the depression diagnosis at baseline. Thirty-seven percent of the participants in the CBT arm of the CABG trial met the DSM-IV criteria for minor depression, 63 % met the criteria for major depression at baseline, 68 % had a prior history of major depression, and they scored an average of 22.3 on the BDI at baseline. Fifty-four percent of them were on a nonstudy antidepressant medication during the trial, and they were given 12 weeks of individual CBT. The participants in the heart failure trial had major depression and scored an average of 30.7 on the baseline BDI. They were offered up to 6 months of individual CBT, but weekly sessions ended and the maintenance phase began when the patient met criteria for remission of depression. Consequently, the participants completed an average of 10.8 ± 5.8 sessions. Thirty-three percent of the participants were taking a nonstudy antidepressant. The participants in the treatment-resistant depression study had major depression with average baseline BDI scores of 30.2, and they were treated with up to 16 sessions of CBT, either alone or in combination with an antidepressant. Forty-nine percent of the patients were already taking an antidepressant at baseline, and 15 % were placed on an antidepressant during the trial.

Complete TOD item data were available at the initial clinical evaluation in $n = 260$ (96 %) of these cases, and data from the end of active treatment were available in $n = 212$ (78 %) of the cases. Depression outcome data were available from $n = 34$ patients in the CBT arm of the CABG study and $n = 56$ patients in the CBT arm of the heart failure study.

The mean age in the combined sample was 59.1 years (SD 10.0); 75 % ($n = 203$) were Caucasian and 45 % ($n = 121$) were female. All three studies were approved by the institutional review board (IRB) at Washington University Medical Center in St. Louis, Missouri. All participants provided written informed consent on IRB-approved consent forms.

Measures

The Beck Depression Inventory (BDI) (Beck et al. 1961) was administered to assess the severity of depression in the the post-CABG and treatment-resistant depression trials. The Patient Health Questionnaire (PHQ-9) (Kroenke et al. 2001) was used to assess the severity of depression in the heart failure trial.

Also in the heart failure trial, the therapists rated three aspects of patient engagement in therapy, based on rating scales that were created as clinical tools for this trial. The ratings included (1) socialization to CBT, (2) adherence to CBT homework assignments, and (3) use of cognitive-behavioral techniques in daily life. Each item was rated on a 7-point scale ranging from 0 to 6. The socialization rating ranged from 0 (patient has little or no understanding of the CBT model or of his/her role in treatment) to 6 (patient has excellent understanding of all relevant aspects of the CBT model and his/her role in treatment). The homework rating ranged from 0 (patient is unwilling to do any homework or did not comply at all with the latest assignment) to 6 (patient sees homework as an important and valuable part of his/her treatment and was fully compliant with latest assignment). The use of cognitive-behavioral techniques item ranged from 0 [patient has little or no skill in cognitive-behavioral techniques (e.g., challenging distorted thinking) or isn't using them] to 6 (patient has excellent cognitive-behavioral skills and uses them effectively in daily life). The therapists recording these ratings after each therapy session, based on their clinical observations during the session. The final ratings (i.e., the ones that were used in the present analysis) were completed before the patient completed the TOD. Thus, the patient's responses on the TOD did not influence the therapist's ratings.

Procedure

The TOD was administered to participants in the CBT arm, twice during each trial: at the initial clinical evaluation and at the termination of active cognitive-behavioral treatment. In the post-CABG and treatment-resistant depression trials, the participants completed the BDI at the baseline evaluation and again at the 12-week, post-treatment evaluation. Similarly, in the heart failure trial, patients completed the PHQ-9 at the baseline evaluation and at the 6-month post-treatment evaluation.

Statistical Analyses

A mixture of classical and modern psychometric methods were used to assess the TOD. Exploratory factor analysis and Mokken scaling were used to determine the dimensionality of the TOD. A scree plot and the parallel process method following a principal components analysis informed the decision of how many factors to retain (Hayton et al. 2004). Stata 13.0 was used to conduct the Mokken scale analysis with a procedure written by Jean-Benoit Hardouin (Hardouin 2004).

Mokken scaling was chosen because it is nonparametric; parametric item response theory (IRT) techniques require larger sample sizes than were available. Mokken scaling determines the dimensionality and hierarchy of scale items, and has previously been used with measures of depressive symptoms in cardiac patients (Cosco et al. 2012; Doyle et al. 2010). It is based on Guttman scaling, in which a positive endorsement of a binary item of given difficulty indicates that remaining items of lesser difficulty have also been endorsed (Guttman 1950). Mokken scaling is a probabilistic version of this procedure which can also evaluate polytomous items (Meijer and Baneke 2004; Stochl et al. 2012). The item means are used to represent the level of item difficulty. Loevinger's H coefficient (Loevinger 1948) is an estimate of the expected errors (probability that the items are chosen by chance) and observed errors (number of times items are endorsed as if not in an ordered sequence). The formula is: $H_i = [1 - ($observed Guttman errors/predicted Guttman errors$)]$. Higher H_i values indicate better item discrimination along the latent trait, and the mean Loevinger H for all items is the overall scale H. Mokken scales are interpreted as follows: $.30 \geq H < .40$ 'weak', $.40 \geq H < .50$ 'moderate' and $H \geq .50$ 'strong' (Meijer and Baneke 2004). A recommended analysis procedure was followed, which involves increasing the lower bound threshold for the item-scalability coefficients (c), commencing with $c = .01$, then $c = .05$ and increasing in steps of .05 until $c = .60$ (Meijer and Baneke 2004). Nondiscriminating items are excluded, depending on the threshold chosen, and the most interpretable solution is adopted. This report includes findings from Mokken analyses with the lower bound coefficient set at .35. We predicted that the TOD would form a unidimensional scale both at baseline and at follow-up, and that this would be found by both factor analytic and Mokken techniques. In response to recent recommendations and controversies (Dunn et al. 2014), internal consistency reliability was assessed with Cronbach's alpha and MacDonald's omega, using bootstrapping with 1000 replications to determine the bias-corrected 95 % confidence intervals (CIs).

Using data from the post-CABG depression trial, correlations between the TOD total scores and the therapist's independent ratings of the patient's engagement in CBT at the end of active treatment were computed in order to evaluate the concurrent validity of the TOD. A high positive correlation between the TOD total score and the therapist's rating of "patient's use of cognitive-behavioral techniques" would be consistent with a high level of agreement about the extent to which the patient is using these techniques in everyday life. Positive correlations between the TOD and the other therapist rating scales would indicate that patients who report frequently using multiple techniques tend to exhibit a better understanding and acceptance of the cognitive-behavioral model, and greater adherence to CBT homework assignments, compared to patients who report using relatively few techniques in daily life.

Paired t tests were used to compare TOD total scores between the initial clinical evaluation and the end of treatment. We hypothesized that the mean score would be significantly higher at the end of treatment than at the initial evaluation, consistent with the therapeutic objectives of helping patients to acquire cognitive-behavioral coping skills and of encouraging them to apply these skills in daily life to overcome their depression. Mean differences were also tested for the individual items. We hypothesized that on average, every item rating would increase between the initial clinical evaluation and the end of treatment.

Proc Mixed in SAS 9.3 (SAS Institute, Cary, NC) was used to conduct mixed model analyses of the association between TOD scores and BDI scores in the CABG trial, and between TOD scores and PHQ-9 scores in the heart failure trial. The depression outcome data from the treatment-resistant depression study were not yet available when the combined dataset for the present analysis was created. The data were fitted to linear mixed models with autoregressive (AR-1) covariance structures. In each model, the outcome variable was the depression score at the end of active treatment, and the fixed effects included the TOD scores at the initial evaluation and at the end of active treatment, and the depression score at the initial evaluation. We hypothesized that high TOD scores would be associated with lower depression scores at the end of active treatment.

Results

Both the scree plot and the parallel process methods after exploratory factor analysis indicated that a single dimension was the best fit both at baseline and at follow-up (see Appendix 1). The first factor explained 43 and 46 % of the variance at baseline and follow-up, respectively. The results of the Mokken analyses confirmed this unidimensional solution, and are shown in Table 1. At the initial clinical evaluation, analysis of all items at scalability threshold c = .35 yielded a single, 15-item "moderate" Mokken scale (H = .46), which omitted item #1 but retained all other items in this unidimensional solution. Analysis at higher scalability thresholds simply omitted further items, or did not lead to interpretable scales. A similar analysis of the TOD data from the end of active treatment again demonstrated a moderate unidimensional scale (H = .47), but this time retained all 16 items. Cronbach's alpha at baseline was .92 (95 % CI .89–.93), while MacDonald's omega was .91 (95 % CI .89–.93). At follow-up alpha was .92 (95 % CI .90–.94), with an omega of .92 (95 % CI .90–.94), indicating excellent reliability.

Paired t tests were used to compare TOD scores between the initial evaluation and the end of treatment in the overall sample as shown in Table 1. The TOD total score and all of the item ratings were significantly higher at the end of treatment than at the initial clinical evaluation (all p values <.001), consistent with the therapeutic objectives of CBT.

The effect size for pre-post change on the total score was $d = 2.06$ (95 % CI 1.85–2.32).

Using data from the end-of-treatment evaluation in the post-CABG depression trial, positive correlations were found between the TOD score and the therapist ratings of patients socialization to CBT (i.e., the patient's level of understanding of the cognitive model and of his or her role in treatment), adherence to cognitive-behavioral homework assignments, and use of cognitive-behavioral techniques in daily life. The BDI score at the end of active treatment correlated inversely with TOD total score. The correlations are displayed in Table 2. The therapist ratings themselves were positively intercorrelated. Use of cognitive-behavioral techniques correlated $r = .92$ ($p < .0001$) with socialization to CBT and $r = .56$ ($p = .0003$) with patient adherence to homework, and socialization to CBT correlated $r = .55$ ($p = .0003$) with adherence to homework.

A linear mixed model, fitted to the CABG trial data, showed a significant, inverse relationship over time between the TOD and the BDI (intraclass correlation [ICC] = −.43; b (95 % CI) = −.17 (−.07, −.27); $t = −3.52$; $df = 48$; $p = .001$). A similar model of data from the heart failure trial supported the hypothesis of an inverse relationship over time between the TOD and the PHQ-9 (ICC = −.26; b (95 % CI) = −.08 (−.03, −.14); $t = −3.05$; $df = 103$; $p = .003$). Both the BDI and the PHQ-9 demonstrated high reliability in these trials (BDI: alpha = .84 at the initial evaluation and .93 at the end of

Table 1 Mokken scale analysis of the TOD questionnaire and its sensitivity to change

Item	Initial clinical evaluation (n = 260)		End of active treatment (n = 212)	
	Mean (SD)	Hi	Mean (SD)	Hi
1. Increase emotional support	1.02 (0.81)		1.70 (0.79)	.38
2. Challenge depressing thoughts and images	1.05 (0.81)	.43	2.24 (0.74)	.44
3. Challenge depressing beliefs and attitudes	0.99 (0.84)	.46	2.27 (0.73)	.54
4. Challenge negative ideas about self	0.91 (0.86)	.48	2.14 (0.78)	.50
5. Identify counterproductive coping strategies	0.95 (0.79)	.39	1.88 (0.84)	.47
6. Cope with hard realities of life	1.04 (0.86)	.47	2.12 (0.76)	.49
7. Review priorities, values, or goals	1.06 (0.83)	.47	2.12 (0.77)	.45
8. Cope with everyday hassles and problems	1.05 (0.76)	.50	2.30 (0.72)	.50
9. Improve social life	0.74 (0.78)	.44	1.94 (0.82)	.45
10. Increase pleasant activities	0.92 (0.73)	.44	2.04 (0.86)	.48
11. Increase productive activities	0.99 (0.75)	.48	2.05 (0.78)	.46
12. Active problem-solving	0.93 (0.70)	.50	2.13 (0.71)	.53
13. Overcome adversity	1.22 (0.74)	.48	2.07 (0.77)	.50
14. Relaxation and stress management	0.75 (0.80)	.43	2.10 (0.86)	.48
15. Improve skills for difficult social situations	0.89 (0.75)	.50	1.98 (0.79)	.47
16. Manage health problems or health care	1.62 (0.82)	.38	2.25 (0.79)	.41
TOD total score	16.33 (8.24)	H = .46	33.68 (8.67)	H = .47

All paired t tests comparing initial and end-of-treatment scores were significant at $p < 0.001$

Table 2 Pearson correlations between TOD items, therapist ratings, and BDI score at end of active treatment (n = 34)

Item	Therapist ratings		BDI Total score	
	Socialization To CBT	Homework adherence	Use of CBT techniques	
1. Increase emotional support	.37*	.43*	.43*	−.42*
2. Challenge depressing thoughts and images	.13	.00	.23	−.21
3. Challenge depressing beliefs and attitudes	.23	.10	.34	−.33
4. Challenge negative ideas about self	.26	.27	.40*	−.44*
5. Identify counterproductive coping strategies	.26	.34	.32	−.40*
6. Cope with hard realities of life	.14	.07	.29	−.33
7. Review priorities, values, or goals	.21	.24	.22	−.42*
8. Cope with everyday hassles and problems	.33	.22	.40*	−.52**
9. Improve social life	.19	.40*	.28	−.42*
10. Increase pleasant activities	.45**	.38*	.51**	−.53**
11. Increase productive activities	.33	.26	.39*	−.43*
12. Active problem-solving	.29	.22	.49**	−.40*
13. Overcome adversity	.19	.19	.39*	−.48**
14. Relaxation and stress management	.52**	.48**	.59***	−.48**
15. Improve skills for difficult social situations	.43*	.41*	.54**	−.50**
16. Manage health problems or health care	.62***	.49**	.60***	−.53**
TOD total score	.40*	.36*	.51**	−.55***

* $p < .05$; ** $p < .01$; *** $p < .001$

treatment; PHQ-9: alpha = .80 at the initial evaluation and .82 at the end of treatment).

Discussion

The Techniques for Overcoming Depression questionnaire assesses the number of cognitive-behavioral techniques that patients adopt and the frequency with they use them in daily life to overcome depression. It captures an important aspect of the patient's perspective on CBT for depression, and it does so in terms that are understandable to patients, consistent with recent recommendations regarding outcome measures in psychiatric research (Arfken and Balon 2014).

The results of this study show that the TOD is a unidimensional measure when administered to depressed cardiac patients, and that it has excellent reliability, both when administered at the initiation of CBT and when readministered at the end of active treatment. Every item except for item #1 (finding more or better emotional support from other people) exceeded the $H_i \geq .35$ threshold for retention at the initial clinical evaluation, and every item including #1 exceeded this threshold at the end of active treatment. We retained this item because of its clinical utility, relatively high frequency of endorsement, and satisfactory H value at the end of active treatment. In addition, it scaled with all of the other items at a lower threshold (c = .20, data not shown). The fact that this item scaled better at the end than the initiation of treatment perhaps suggests that it assesses a technique that people with depression initially underutilize but that they tend to adopt as

they progress through therapy. Future work should investigate the utility of this item.

One of the defining characteristics of a Mokken scale is that patients who endorse relatively difficult items (i.e., items with low mean ratings) also tend to endorse the less difficult items. For example, patients who reported on the initial assessment that they had been practicing stress management and relaxation techniques (item #14; mean .75) also tended to report that they had been reviewing their priorities, values, or goals in life (item #7; mean 1.06).

Ideally, the difficulty level of each item should differ from those of the adjacent items, but this is not the case for some of the TOD items. For example, the difficulty levels are identical at the end of active treatment for item #6 (coping with hard realities) and #7 (reviewing priorities, values, or goals). If the TOD were too lengthy, it would be possible to drop one of these items without losing any ability to locate patients along the underlying latent dimension of the "tendency to use CBT-based techniques to overcome depression". However, the TOD is not a very lengthy instrument for use in the context of a CBT session, and the individual items may be as clinically informative as the total score. In addition, different patients may utilize different but equally difficult techniques. Thus, although some of the item difficulty levels are closer together than might be preferable, this is not a very compelling reason to eliminate any of the items from the questionnaire. With 16 items, the TOD achieves an acceptable balance between depth of measurement and respondent burden (Ryff 2014).

Comparison of the items and the total scores at the initial evaluation versus the end of active treatment show that the TOD is sensitive to treatment-related change. On average, the total score approximately doubled between the initial clinical evaluation and the end of active treatment across three different trials of CBT for depression in cardiac patients. This indicates that after exposure to CBT, patients tend to report that they are using a wider variety of cognitive-behavioral techniques to overcome their depression, and using these techniques more frequently than prior to treatment. This is consistent with the clinical objectives of multicomponent CBT (Hundt et al. 2013).

The mean of every TOD item also increased between the initial evaluation and the end of active treatment. In addition, there were some changes in the rank order of the item difficulties between the two assessments. For example, item #4 (challenging negative ideas about self) moved from being the 5th most difficult item on the initial assessment to the 12th at the end of active treatment. This suggests that CBT does more than simply reinforce the same techniques that patients were already using before therapy; it also encourages them to try new ones.

We examined the relationships between TOD scores and several therapist ratings at the end of active treatment in a post-CABG depression trial to evaluate the concurrent validity of the TOD. The strongest correlation was between the TOD total score and the therapist's independent rating of the patient's use of cognitive-behavioral techniques to overcome depression and related problems in daily life. The TOD score also correlated with the therapist's rating of the patient's socialization to CBT and of his or her adherence to CBT homework assignments. Thus, the TOD tends to corroborate what therapists learn through various means (e.g., by including a "past week review" on the session agenda and by reviewing homework assignments) about the patient's acquisition and application of cognitive-behavioral skills. The TOD accounts for 16–26 % of the variance in the therapist ratings. These are significant effects yet they imply that there is quite a bit of unexplained variance and they suggest that the TOD provides additional information about the patient's use of cognitive-behavioral techniques, above and beyond other methods that therapists may use to assess their patients' progress in therapy.

The therapist ratings correlated even more strongly with some of the individual TOD items than they did with the TOD total score. For example, the therapist's rating of the patient's socialization to CBT correlated .52 with the use of relaxation and stress management techniques and .62 with self-management of health problems or health care, compared to only .40 with the TOD total score. This suggests that patients who fully embrace the cognitive model and become actively engaged in treatment tend to rely more heavily on some techniques than others. Some patients may limit themselves to one or two techniques because of the relative emphasis that their therapist places on those particular techniques. However, the moderately strong correlations of the TOD total score with the therapist ratings also suggest that it tends to be better for patients to try a variety of techniques for overcoming depression than to rely on only one or two techniques. This is consistent with one of the core strategies of CBT, i.e., encouraging patients to experiment with new ways to cope with their problems and overcome their emotional distress (Hundt et al. 2013).

The TOD total score and most of the TOD items correlated significantly with end-of-treatment BDI scores in the post-CABG depression trial. In addition, TOD change scores predicted post-treatment BDI scores in the CABG trial and post-treatment PHQ-9 scores in the heart failure trial even after controlling for the self-reported severity of depression at baseline. It is not possible to determine from these findings whether increased use of cognitive-behavioral techniques plays a causal role in depression improvement. Nevertheless, increases in TOD total scores predict better depression outcomes in CBT. This suggests that the TOD has utility as an indicator of clinical progress. It also provides evidence that in multicomponent CBT for depression, better outcomes are associated with frequent utilization of multiple cognitive-behavioral techniques. This is consistent with a secondary analysis of data from the ENRICHD clinical trial which revealed a significant inverse relationship between the number of components of CBT to which patients were exposed and post-treatment depression scores (Cowan et al. 2008). More research is needed to clarify the implications of this association, given evidence that favorable outcomes can also be achieved with fewer treatment components, such as in behavioral activation (Cuijpers et al. 2007) and problem-solving interventions (Bell and D'Zurilla 2009).

Two items that showed relatively low correlations with the BDI at the end of treatment concern cognitive restructuring: challenging depressing thoughts and images, and challenging depressing beliefs and attitudes. This is surprising, given the centrality of cognitive restructuring in multicomponent CBT for depression. However, when working with depressed, medically ill patients, therapists often rely more heavily (at least initially) on behavioral than on cognitive strategies. Behavioral components such as behavioral activation, and practical efforts to address health-related problems, may play more prominent roles than cognitive techniques in the treatment of many medically ill patients (Skala et al. 2005).

It is often necessary to adapt cognitive-behavioral interventions to accommodate the functional limitations that are imposed by chronic medical illness. For example, in all three of the trials that supplied the data for this report, some of the sessions were conducted by telephone in order to overcome transportation- or infirmity-related barriers. In

most other respects, however, these interventions are no different than the ones used to treat depressed but otherwise medically well patients. TOD item #16 ("Learn more about how to manage my health problems or how to get good health care") may be somewhat less relevant when CBT is used to treat depression in otherwise medically well patients, although given the high prevalence of somatic complaints in these patients (Simon et al. 1999), this item could have broader relevance than it may seem. Studies of the TOD in depressed but otherwise medically well patients are needed to investigate this question.

The symptoms of major depression do not differ in any well-established, systematic way between medically ill and medically well patients (Freedland et al. 1992; Lustman et al. 1992). In addition, there are more similarities than differences in the treatment of depression between medically ill and medically well patients, and most of the differences are due to safety or accessibility issues (Freedland and Carney 2014). Little is known about whether there are any important differences between medically ill and medically well patients, or between patients with different medical conditions, in the techniques for overcoming depression that they adopt when treated with CBT. The TOD scale is likely to be a useful measure in research in this area.

The TOD assesses the self-reported frequency of use of cognitive-behavioral techniques for overcoming depression, but it does not assess the *quality* of CBT skill use. As discussed in a recent review (Hundt et al. 2013), there is evidence that favorable depression outcomes depend both on the frequency of CBT skill use and on proficiency with these skills. Thus, if a patient's depression scores are not improving despite relatively high scores on the TOD, the therapist should evaluate whether the highest-frequency techniques are being used in an effective manner, and focus on further skill development if any deficits are identified.

Many other psychotherapy process variables have been examined in previous studies, and the TOD may be as strong of a predictor of treatment outcomes as some of the most frequently investigated processes variables, or perhaps even stronger. For example, a recent meta-analysis of psychotherapy studies (Horvath et al. 2011) found an overall correlation between therapeutic alliance measures and treatment outcomes of .28 (95 % CI .25–.30). In contrast, end-of-treatment TOD scores correlated $-.26$ with post-treatment PHQ-9 scores in our heart failure trial and $-.43$ with post-treatment BDI scores in our CABG trial. As another example, a meta-analysis of therapist adherence and competence studies (Webb et al. 2010) found that neither factor was a significant predictor of therapy outcomes. Whether the TOD is an independent predictor of depression outcomes in CBT after controlling for other process measures is unknown and should be studied. However, the patient's use of cognitive-behavioral

techniques in daily life is a clinically important indicator of therapeutic progress in CBT, regardless of whether the TOD has independent predictive value.

Limitations

This study has several limitations. First, the data were combined from three different trials. CBT was used to treat depression in every trial, but the study protocols differed in ways that might have affected the present results. For example, the post-treatment assessments occurred at different intervals. Second, all of the participants were cardiac patients with depression as a comorbid condition. Consequently, the generalizability of the present findings to other medically ill patients, or to depressed but otherwise medically well patients, remains to be evaluated. None of the TOD items allude specifically to heart disease, so the questionnaire will not have to be modified for studies of other patient populations. Third, some of the participants in these trials were taking antidepressants in addition to participating in CBT, but data on antidepressants were not available in our composite analysis dataset. It is possible that antidepressant use could have influenced some of the pre-post increases in TOD scores as well as the strength of their relationship to depression outcomes. Fourth, the validity correlations were based on a relatively small sample of participants in a single trial, and no data pertaining to the instrument's discriminant validity were available. Further research on the clinical validity and utility of the TOD questionnaire is needed. Studies with larger sample sizes would permit the use of more sophisticated item response theory methods to more stringently evaluate the scale and its individual items. Fifth, no objective behavioral data were collected on the patients' actual use of cognitive-behavioral techniques in daily life. Consequently, it was not possible to evaluate accuracy of the patients' self-reported data. This is an important aspect of the construct validity of the TOD that warrants further investigation. Finally, this study was not designed to determine whether the patient's use of cognitive-behavioral techniques in daily life plays a causal role in the remission of depression. Additional research is needed to determine whether increases in TOD scores mediate treatment-related decreases in depression scores.

Conclusion

The results of the study suggest that the TOD is a valid clinical tool for use in CBT for depression in cardiac patients. A review of progress since the initiation of treatment is an important agenda item for the end of active

treatment. Change on the TOD is a clinically useful indicator of the extent to which the patient is applying cognitive-behavioral skills in daily life. In the three trials included in the present analysis, the therapists have presented their depressed cardiac patients with a side-by-side comparison of the initial and final TOD questionnaires at the end of active treatment. Most patients are surprised to see how few techniques they were using prior to treatment, and how many techniques they have been using lately. This helps them to understand that they have been playing an active role in their own recovery, and that they will be able to use these same techniques to help prevent relapses and, if necessary, to overcome future episodes of depression. In addition, the TOD serves as a reminder of techniques that the patient has not been using frequently but that could be helpful when needed. Consequently, the pre-post TOD comparison is often one of the most clinically useful activities on the end-of-treatment agenda.

In summary, the Techniques for Overcoming Depression (TOD) questionnaire is a reliable, unidimensional scale that is sensitive to treatment-related change and clinically useful in multicomponent CBT for depression in patients with heart disease. Further research is needed to evaluate its validity and utility, especially in other patient populations, and to determine whether additional refinements might improve the instrument. Future work should investigate the utility of Item #1, specifically whether it is worth retaining in its current form, whether it requires re-wording, or whether it is truly only applicable toward the end of therapy. Research on the relationship between TOD ratings and ecological momentary assessments of the use of cognitive-behavioral techniques would also be informative.

Compliance with Ethical Standards

Informed Consent All procedures performed in each of the studies that involved human participants were fully compliant with the ethical standards of the institutional research board at Washington University School of Medicine, the 1964 Helsinki Declaration and its later amendments, and with ethical standards for psychological research. Written informed consent was obtained on an IRB-approved form from all participants included in the study.

Animal Rights No animal studies were carried out by the authors for this article.

Appendix 1: Techniques for Overcoming Depression (TOD) Questionnaire

Instructions: These are some of the techniques that can help people to overcome their depression. Some of them may be more helpful or important for you than other ones are. Lately, how often have you been using these techniques?

|		Never or rarely	Sometimes	Often	Very often
		0	1	2	3
1.	Find more or better emotional support from other people	0	1	2	3
2.	Challenge the depressing thoughts and images that run through my mind, and practice more helpful ways of thinking	0	1	2	3
3.	Challenge my depressing beliefs and attitudes, and work on replacing them with more helpful beliefs and attitudes	0	1	2	3
4.	Challenge the negative ideas I have about myself, and work on replacing them with ideas that will improve my self-esteem	0	1	2	3
5.	Figure out if I'm doing something to help or protect myself that actually makes my problems worse or makes me feel worse, and work on finding better ways to take care of myself	0	1	2	3
6.	Develop better ways to cope with the hard realities of life (especially problems that are beyond my control, like having a serious illness or losing a loved one)	0	1	2	3
7.	Review my priorities, values, or goals in life, and work to change whatever is getting in the way of having a better life	0	1	2	3
8.	Improve my ability to cope with everyday hassles and problems	0	1	2	3
9.	Work on improving my social life, spending more time with other people I enjoy, or meeting new people	0	1	2	3
10.	Get more active doing things I enjoy or get pleasure out of, such as recreational activities, hobbies, reading, travel, etc.	0	1	2	3

continued

		Never or rarely	Sometimes	Often	Very often
		0	1	2	3
11.	Get more active doing things that give me a sense of accomplishment or achievement, or that make me feel that I'm doing something useful, important, or helpful	0	1	2	3
12.	Actively work on solving the problems that get me down	0	1	2	3
13.	If something important is not going the way I want it to, figure out what I can do to make it go better	0	1	2	3
14.	Practice techniques for relaxing and managing stress	0	1	2	3
15.	Improve my skills for dealing with difficult social situations, such as learning how to be more assertive, finding better ways to communicate, controlling my anger, etc.	0	1	2	3
16.	Learn more about how to manage my health problems or how to get good health care	0	1	2	3
17.	Other (describe):				
	Total score:				

Appendix 2

See Fig. 1.

We retained only one factor, as the acute inflection after the first factor in the plot indicates that a single factor solution is best. In the parallel analysis, any factors with eigenvalues lower than ones that were randomly generated (dashed line) should be rejected (Hayton et al. 2004), again supporting the single-factor solution (Table 3, 4).
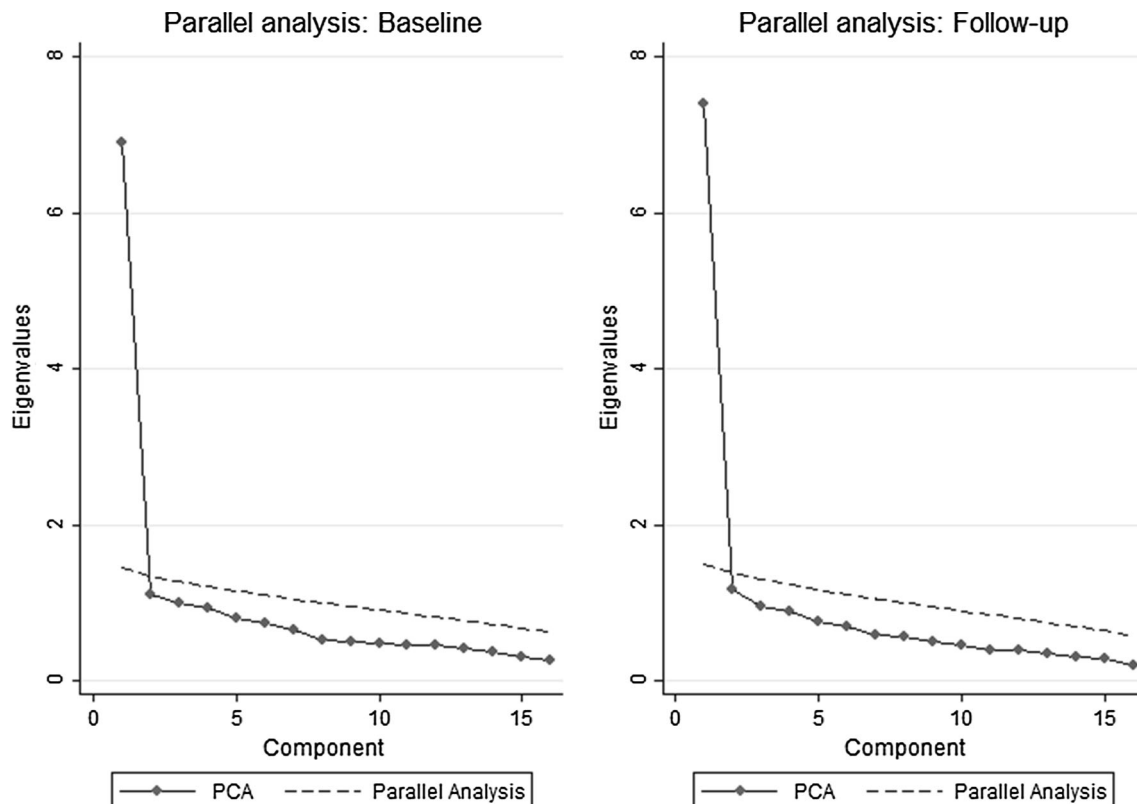
Fig. 1 Scree plots at baseline and follow-up, with parallel analysis indicating random eigenvalues. Parallel analysis compares a random dataset with the same number of observations and variables to the current data. We used 1000 replications, so the results indicate the average eigenvalues of these replications

Table 3 Factor analysis and internal consistency of the TOD questionnaire

Item	Initial clinical evaluation			End of active treatment		
	Factor loading	Communality	Item alpha	Factor loading	Communality	Item alpha
1. Increase emotional support	.35	.50	.91	.50	.38	.92
2. Challenge depressing thoughts and images	.65	.61	.90	.65	.50	.92
3. Challenge depressing beliefs and attitudes	.68	.64	.90	.76	.66	.91
4. Challenge negative ideas about self	.70	.66	.90	.74	.59	.91
5. Identify counterproductive coping strategies	.59	.35	.91	.66	.45	.92
6. Cope with hard realities of life	.71	.51	.90	.72	.52	.91
7. Review priorities, values, or goals	.69	.48	.90	.67	.50	.92
8. Cope with everyday hassles and problems	.73	.53	.90	.71	.54	.92
9. Improve social life	.64	.47	.90	.64	.66	.92
10. Increase pleasant activities	.66	.45	.90	.70	.68	.91
11. Increase productive activities	.71	.53	.90	.67	.57	.92
12. Active problem-solving	.74	.56	.90	.76	.61	.91
13. Overcome adversity	.67	.51	.90	.74	.59	.91
14. Relaxation and stress management	.62	.40	.90	.69	.49	.92
15. Improve skills for difficult social situations	.74	.55	.90	.67	.46	.92
16. Manage health problems or health care	.54	.29	.91	.58	.36	.92

The first factor explained 43 % of the variance at baseline, and 46 % at follow-up

Table 4 Inter-item correlations

Baseline correlation matrix

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1.00															
2	.16	1.00														
3	.14	.60	1.00													
4	.13	.54	.58	1.00												
5	.28	.41	.33	.43	1.00											
6	.24	.44	.39	.51	.43	1.00										
7	.23	.35	.36	.46	.43	.54	1.00									
8	.22	.41	.44	.51	.41	.61	.55	1.00								
9	.25	.36	.29	.38	.40	.38	.42	.41	1.00							
10	.26	.45	.43	.36	.33	.39	.34	.39	.53	1.00						
11	.25	.41	.46	.41	.32	.39	.45	.47	.48	.63	1.00					
12	.30	.42	.48	.44	.34	.54	.50	.50	.44	.41	.55	1.00				
13	.31	.36	.40	.37	.31	.41	.46	.46	.37	.42	.46	.52	1.00			
14	.20	.32	.43	.38	.30	.35	.42	.39	.34	.38	.46	.48	.45	1.00		
15	.27	.42	.45	.42	.43	.48	.48	.51	.48	.41	.52	.53	.50	.50	1.00	
16	.12	.26	.38	.25	.26	.37	.33	.41	.31	.33	.31	.39	.40	.29	.38	1.00

Follow-up correlation matrix	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		1.00														
2		.30	1.00													
3		.29	.67	1.00												
4		.30	.55	.60	1.00											
5		.36	.35	.42	.53	1.00										
6		.31	.42	.56	.45	.44	1.00									

Table 4 continued

Follow-up correlation matrix	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7	.27	.35	.48	.44	.43	.49	1.00									
8	.19	.40	.53	.52	.41	.44	.53	1.00								
9	.48	.26	.35	.44	.32	.43	.32	.40	1.00							
10	.34	.39	.50	.41	.35	.48	.36	.40	.58	1.00						
11	.30	.40	.40	.43	.34	.44	.35	.38	.46	.68	1.00					
12	.35	.48	.61	.53	.49	.55	.51	.49	.44	.42	.41	1.00				
13	.27	.42	.51	.52	.51	.51	.54	.53	.37	.41	.45	.59	1.00			
14	.26	.39	.45	.43	.46	.43	.36	.44	.39	.52	.47	.47	.41	1.00		
15	.25	.28	.42	.40	.40	.40	.39	.46	.44	.44	.40	.46	.52	.52	1.00	
16	.32	.32	.34	.35	.30	.37	.38	.47	.37	.38	.32	.37	.32	.40	.45	1.00

All correlations are significant at $p < .05$

All correlations are significant at $p < .01$

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