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Predictors of response to cognitive behavioral treatment for bulimia nervosa delivered via telemedicine versus face-to-face

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Abstract

Objective—This study presents the results of a receiver operating characteristics (ROC) analysis to evaluate response to cognitive behavioral treatment (CBT) for patients with bulimia nervosa (BN), delivered via telemedicine (TV-CBT) or face-to-face (FTF-CBT).

Method—Data were gathered on 116 adults treated with CBT for BN. Response to treatment (i.e., percent reduction in binge eating and purging behavior) were examined at weeks two, four, six, and eight. ROC analysis was completed to predict abstinence at end of treatment (EOT) as well as 3-month and 1-year follow-up for the entire sample and by treatment group (TV-CBT versus FTF-CBT).

Results—ROC analyses revealed that abstinence at EOT and one-year follow-up was predicted by percent reduction in binge eating behavior while abstinence at three-month follow-up was predicted by percent reduction in purging behavior. Results showed differences in predictors of treatment response when ROC analyses were completed for the entire sample and by treatment group.

Conclusions—Results suggest that evaluating percent reduction in binge eating and purging at weeks two, four, six, and eight of treatment is a clinically useful tool for predicting treatment response at EOT, three-month, and one-year follow-up.

As a first line treatment for bulimia nervosa (BN), CBT has been extensively researched and remains the best established treatment currently available for BN patients (1, 2).

Traditionally, CBT is delivered face-to-face. However, in an attempt to make CBT more accessible to a wider group of patients, our group has been examining the effectiveness of delivering CBT via telemedicine (3). Our research in this area has shown that CBT delivered via telemedicine (TV-CBT) is comparable to face-to-face CBT (FTF-CBT) (4, 5).

Despite the effectiveness of CBT for BN patients, attrition from clinical trials tends to be high and not all patients respond (2). ROC analysis (also referred to as signal detection analysis) is a clinical tool used to identify optimal cut off points that could differentiate

between patients who would optimally respond to treatment and those who would be more likely to drop out or fail to respond. Using ROC analysis, Agras and colleagues found that higher rates of binge eating and purging among a large sample of patients receiving CBT for BN were not found to be associated with treatment response or early termination; however, early response to treatment (i.e., percent decrease in binge eating and purging after the first 6 sessions) was a significant predictor of end of treatment response (6). This finding highlights the clinical utility of ROC analysis in identifying patterns of responding, and may have a significant impact on treatment planning. Overall, identifying patients who are not responding to CBT early in treatment and those more likely to discontinue treatment prematurely may assist clinicians in identifying an alternative course of treatment (7).

The aim of this paper was to examine treatment response among a sample of patients who received CBT, some via telemedicine and some face-to-face by random assignment, using ROC analysis to: 1) determine optimal cut-off points to identify patients who are more likely to respond to treatment; and 2) compare differences in response to treatment between responders and non-responders.

METHOD

Participants

Participants were 116 women and men, 18 and older, who were included as a part of a larger study (5) and met DSM-IV criteria for one of the following conditions: (1) Full DSM IV for BN (2) DSM-IV criteria for BN except binge eating/purging at a minimum frequency of once per week; (3) DSM-IV criteria for BN with only subjective binge eating episodes. Written informed consent was obtained from all participants. This study was conducted at nine areas in eastern North Dakota and northwestern Minnesota (which adjoins North Dakota to the east) and was approved by institutional review boards at the University of North Dakota (Grand Forks, North Dakota) and MeritCare Health System (Fargo, North Dakota).

Treatment

Cognitive Behavioral Therapy—The therapy used in this study was the manualized CBT developed by Fairburn and colleagues (8, 9). The therapy was delivered by doctoral level psychologists who were trained and experienced in eating disorders treatment. Twenty sessions over a sixteen week period were delivered in person by a therapist who traveled to the area where the patient lived (FTF-CBT) or using a telemedicine system (TV-CBT) linking a regional healthcare system facility using T1 lines. The assessors were also Ph.D. level who had prior experience with the assessment instruments from previous studies.

Outcome Measures

The Eating Disorder Examination (EDE; 10) was used to assess the frequency of binge eating and purging. The EDE was administered at baseline, at the conclusion of treatment and 3-months and 12-months following treatment. The EDE is a well-validated measure and has been used extensively as an outcome measure for treatment studies for BN. Percent reduction in binge eating, purging (vomiting, laxative abuse, and diuretic abuse), and

combined binge eating and purging were determined based upon the EDE interview. Abstinence was defined when none of these behaviors were reported in the previous twenty-eight days. Self-reported binge eating and purging data were obtained by self-report at 2-week intervals during treatment.

Statistical Analysis

Non-parametric ROC analysis was conducted to compare differences in response to treatment between responders and non-responders and to identify optimal cut-off points on measures of treatment outcome to determine treatment response. For a more detailed description of ROC analyses, see Agras et al. (6). Treatment response was measured as abstinence from binge eating and purging behaviors. ROC analysis was completed by entering percent reduction in binge eating and purging from baseline at weeks two, four, six, and eight and used to predict response to treatment at end-of-treatment as well as three-month and one-year follow-up. One method of assessing the overall accuracy of the percent reduction in binge eating and purging as a measurement of treatment response is the area under the curve (AUC) value. This value ranges from 1.0 to 0.5 with 1.0 indicating 100% accuracy in distinguishing treatment responders from non-responders and 0.5 indicating that the test cannot distinguish between responders and non-responders any better than chance. Furthermore, the specificity and sensitivity of the percent reduction in binge eating and purging as a diagnostic test of treatment response was also determined by identifying the best cut point with the coordinates of the AUC table. This cut point represents the criterion value with the highest accuracy and the ideal balance between sensitivity and specificity, serving as a decisional threshold. All primary analyses were conducted using SPSS for Windows Version 15.0 (SPSS Inc., Chicago, Illinois).

RESULTS

Table 1 presents the sociodemographic characteristics of the sample. The sample was relatively homogenous in terms of gender (98.3% women) and race (95.7% White participants). Overall, among this sample ($N = 116$), 72.4% completed treatment and 38.8% were abstinent from binge eating and purging behaviors at the end of treatment.

Differences in early response between responders and non-responders

ROC analysis was completed from baseline to weeks two, four, six, and eight. Table 2 presents the cut point values of percent reduction in binge eating and purging for each week both overall and by treatment group (FTF-CBT and TV-CBT). The results of this analysis found that the variable associated with the highest AUC over all was percent reduction in binge eating at week eight with a value of .739 which means that a randomly selected patient who is responding to treatment will have a greater percent reduction in binge eating than a randomly selected patient who is not responding to treatment 73.9% of the time. However, when these analyses were completed separately by treatment group, there were differences in the variables associated with the highest AUC. For the TV-CBT group, the variable associated with the highest AUC was percent reduction in binge eating at week six with a value of .746. For the FTF-CBT group, the variable associated with the highest AUC was percent reduction in binge eating at week eight with a value of .740.

The best cut point for percent reduction in binge eating for EOT analysis at week eight for the entire sample is -75.96 , meaning that participants who showed at least a 75.96 percent reduction in binge eating were more likely to be abstinent from binge eating and purging behaviors by EOT than participants who showed less than 75.96 percent reduction in binge eating by week eight. This value represents the best trade-off between specificity and sensitivity to discriminate between participants who are responding to treatment and participants who are not responding to treatment. This test has a sensitivity (true-positive rate) of 64% and specificity (false-negative rate) of 65%. However, when these analyses were completed separately by treatment group (FTF-CBT and TV-CBT), there were differences in the best cut point for percent reduction in binge eating. For the TV-CBT group, the best cut point for percent reduction in binge eating is -44.51 at week six with a true-positive rate of 61.90% and a false-negative rate of 62.20%. For the FTF-CBT, the best cut point for percent reduction in binge eating is -87.23 at week eight with a true-positive rate of 70.80% and a false-negative rate of 70.60%.

ROC analysis was also completed to determine optimal cut points during treatment to predict response to treatment at the three-month and one-year follow-up for the entire sample as well as by treatment group. For the overall sample, these analyses were not significant for the three-month or the one-year follow-up. However, response to treatment by treatment group analyses was significant for both three-month and one-year follow-up. Table 3 presents the cut point values of percent reduction in binge eating and purging for weeks two, four, six, and eight for the three-month follow-up and Table 4 presents the cut point values of percent reduction in binge eating and purging for weeks two, four, six, and eight for the one-year follow-up. For the TV-CBT group, the best predictor for response to treatment at the three-month follow-up was a 22.18 percent reduction in purging at week four ($AUC=.677$), with a true-positive rate of 64.30% and a false-negative rate of 60.00%. For the FTF-CBT groups, the best predictor of response to treatment at three-month follow-up was a 5.26 percent reduction in purging at week two ($AUC=.648$), with a true-positive rate of 53.80% and a false-negative rate of 65.00%. For the one-year follow-up, the best predictor of response to treatment was a 26.79 percent reduction in binge eating at week four for the TV-CBT group ($AUC=.781$) true-positive rate of 71.40% and a false-negative rate of 66.70%. For the FTF-CBT group, the best predictor of response to treatment was an 82.86 percent reduction in binge eating at week six ($AUC=.656$), with a true-positive rate of 55.60% and a false-negative rate of 60.00%.

CONCLUSIONS

Currently, CBT is the most effective first line treatment for BN; however some patients fail to respond to therapy (2). Therefore, assessing response to treatment throughout the phases of treatment would be highly valuable in the treatment of BN.

The results of this study suggest that examining percent reduction in binge eating and purging behaviors at each week of treatment of a 20-session course of CBT treatment is an accurate measure of response to treatment, both for EOT outcomes as well as treatment outcomes at three-month and one-year follow-up. The results indicate that a 76% reduction of binge eating by week eight is a significant predictor of response to treatment at the end of

the course of treatment for patients who were treated with CBT face-to-face or via telemedicine. Significant predictors of response for three-month and one-year follow-up were not significant for the entire sample. However, when data from EOT, three-month and one-year follow-up was examined by treatment group, there were differences in the predictors of treatment response. These results suggest that reductions of binge eating and purging are indicative of treatment response at different phases of treatment. For initial EOT outcomes, it appears that the best outcomes for treatment are associated with percent reduction in binge eating at the sixth week for patients being treated via telemedicine or eighth week of treatment for patients being treatment with CBT face-to-face. Conversely, for three-month follow-up, the best predictor of response to treatment is reduction in purging behaviors at the fourth week of treatment for patients being treated via telemedicine or sixth week of treatment for patients being treatment with CBT face-to-face. However, since the percent reduction for the FTF-CBT group is so small, it is not clinically useful and should be interpreted with caution. Lastly, for the one-year follow-up, the results indicate that reduction in binge eating is the best predictor of treatment response at week four for the TV-CBT group and week six for the FTF-CBT group.

Agras and colleagues (6) used ROC analysis to examine response to treatment for BN and found that patients who reported a 70% or less reduction in purging by week four (session six) of treatment were more likely to not respond by EOT. However, other cut points from each week of treatment were not reported in this study. The results from the present study suggest that reduction in purging behaviors in the earlier stages of treatment are also predictive of abstinence at three-month follow-up. In addition, the results from our study show that reduction in binge eating is predictive of response to treatment at EOT as well as at one-year follow-up for patients treated with CBT face-to-face or via telemedicine. These results suggest that the mode of treatment may affect the predictors of treatment response.

Several more recent studies have replicated Agras and colleagues (6) results that early response to treatment is a predictor of outcome both for BN (12) and binge eating disorder (BED) (13). Furthermore, early response to treatment has been investigated for other psychiatric disorders such as depression (14) and obsessive-compulsive disorder (OCD; 15) and has been found to be predictive of treatment outcome. Therefore, the current results are consistent with a trend in both psychosocial and pharmacological treatment outcome research that has identified that early response to treatment is an effective tool in assessing the clinical utility of a particular treatment.

ROC analysis can benefit both clinicians and researchers who are conducting clinical trials of CBT for BN. These results highlight the importance of assessing binge eating and purging behaviors throughout treatment to identify patients who are less likely to respond to treatment both in the short term as well as the long term (three-months to one-year following treatment). This method of assessment can be used to improve treatment planning for patients who may not benefit from CBT so that alternative treatment can be identified, such as antidepressant medication (6). Furthermore, identifying patients who are not responding will also decrease the financial cost of treatment. However, additional research is needed to further elucidate how response to CBT treatment for BN may differ based on how it is delivered.

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Table 1

Baseline Demographic and Clinical Characteristics

Characteristic	N	%
Current Diagnosis		
Bulimia Nervosa	62	53.7
Eating Disorder NOS	54	46.6
Female	114	98.3
Caucasian	111	95.7
Post High School Education	93	80.2
Currently Employed	96	92.8
Marital Status		
Not Married/Single	64	55.1
Married/Living with partner	42	36.2
Divorced	10	8.6
Treatment Outcomes		
Completed Treatment	84	72.4
Abstinence at end of treatment	45	38.8
Abstinence at 3-month follow-up [*]	27	23.3
Abstinence at 1-year follow-up [*]	16	13.8

Abstinence = no behaviors reported in previous 28 days based upon EDE interview

^{*}There was missing data for these variables, percent of total sample reported.

Table 2

Cut-off values for percent reduction in binge eating and purging behaviors at EOT with the best trade off between true-positive and false-positive rates at weeks two, four, six, and eight for the overall sample and by treatment group.

Week of Treatment	OVERALL			TV-CBT			FTF-CBT		
	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Purging Behaviors
Week Two									
Cutoff	-16.03	-4.17	-5.56	-4.17	-36.67	-10.82			
True-positive rate (%)	62.20	44.40	47.60	28.60	62.50	54.20			
False-negative rate (%)	64.80	54.90	64.90	56.80	64.70	52.90			
Week Four									
Cutoff	-38.75	-29.29	-18.33	-7.50	-61.25	-53.95			
True-positive rate (%)	57.80	53.30	57.10	47.60	70.80	58.30			
False-negative rate (%)	57.70	53.50	56.80	48.60	70.60	58.80			
Week Six									
Cutoff	-52.78	-52.59	-44.51 *	-13.39	-73.21	-76.14			
True-positive rate (%)	62.20	55.60	61.90	57.10	62.50	66.70			
False-negative rate (%)	62.00	59.20	62.20	56.80	61.80	35.30			
Week Eight									
Cutoff	-75.96 *	-56.35	-52.78	-41.48	-87.23 *	-72.08			
True-positive rate (%)	64.40	60.00	61.90	57.10	70.80	66.70			
False-negative rate (%)	64.80	59.20	64.90	56.80	70.60	67.60			

* represents the value with the highest AUC.

Table 3

Cut-off values for percent reduction in binge eating and purging behaviors at three-month follow-up with the best trade off between true-positive and false-positive rates at weeks two, four, six, and eight by treatment group.

Week of Treatment	TV-CBT			FTF-CBT		
	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Purging Behaviors	% Reduction in Purging Behaviors
Week Two						
Cutoff	-7.14	-6.25	-22.50	-5.26*		
True-positive rate (%)	42.90	28.60	53.80	53.80		
False-negative rate (%)	60.00	56.80	55.00	65.00		
Week Four						
Cutoff	-26.79	-22.18*	-59.82	-40.97		
True-positive rate (%)	50.00	64.30	61.50	38.50		
False-negative rate (%)	50.00	60.00	65.00	40.00		
Week Six						
Cutoff	-59.62	-37.50	-77.50	-78.64		
True-positive rate (%)	50.00	57.10	53.80	53.80		
False-negative rate (%)	50.00	50.00	60.00	55.00		
Week Eight						
Cutoff	-60.39	-53.57	-87.23	-69.70		
True-positive rate (%)	50.00	57.10	53.80	53.80		
False-negative rate (%)	55.00	55.00	55.00	55.00		

* represents the value with the highest AUC.

Table 4

Cut-off values for percent reduction in binge eating and purging behaviors at one-year follow-up with the best trade off between true-positive and false-positive rates at weeks two, four, six, and eight by treatment group.

Week of Treatment	TV-CBT			FTF-CBT		
	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors	% Reduction in Binge Eating Behaviors	% Reduction in Purging Behaviors
Week Two						
Cutoff	-10.00	-6.25	-41.67	-5.26		
True-positive rate (%)	42.90	42.90	55.60	44.40		
False-negative rate (%)	80.00	60.00	60.00	50.00		
Week Four						
Cutoff	-26.79 *	-30.95	-59.82	-24.12		
True-positive rate (%)	71.40	71.40	55.60	44.40		
False-negative rate (%)	66.70	73.30	50.00	40.00		
Week Six						
Cutoff	-41.67	-67.95	-82.86 *	-78.64		
True-positive rate (%)	71.40	71.40	55.60	44.40		
False-negative rate (%)	66.70	73.30	60.00	40.00		
Week Eight						
Cutoff	-53.57	-65.15	-86.61	-51.11		
True-positive rate (%)	57.10	57.10	44.40	55.60		
False-negative rate (%)	60.00	60.00	40.00	50.00		

* represents the value with the highest AUC.