

Mobile Therapy: Use of Text-Messaging in the Treatment of Bulimia Nervosa

Jennifer R. Shapiro, PhD^{1*}
 Stephanie Bauer, PhD²
 Ellen Andrews, BA¹
 Emily Pisetsky, BA¹
 Brendan Bulik-Sullivan¹
 Robert M. Hamer, PhD^{1,3}
 Cynthia M. Bulik, PhD^{1,4}

ABSTRACT

Objective: To examine a text-messaging program for self-monitoring symptoms of bulimia nervosa (BN) within the context of cognitive-behavioral therapy (CBT).

Method: Thirty-one women participated in 12 weekly group CBT sessions and a 12 week follow-up. Participants submitted a text message nightly indicating the number of binge eating and purging episodes and rating their urges to binge and purge. Automatic feedback messages were tailored to their self-reported symptoms.

Results: Fully 87% of participants adhered to self-monitoring and reported good acceptability. The number of binge eating and purging episodes as well as

symptoms of depression (BDI), eating disorder (EDI), and night eating (NES) decreased significantly from baseline to both post-treatment and follow-up.

Discussion: Given the frequent use of mobile phones and text-messaging globally, this proof-of-principle study suggests their use may enhance self-monitoring and treatment for BN leading to improved attendance, adherence, engagement in treatment, and remission from the disorder. © 2009 by Wiley Periodicals, Inc.

Keywords: bulimia nervosa; treatment; technology; text messaging

(*Int J Eat Disord* 2010; 43:513–519)

Introduction

Bulimia nervosa (BN) is characterized by recurrent binge-eating followed by inappropriate compensatory behaviors such as self-induced vomiting or misuse of laxatives. Individuals with BN place undue emphasis on weight and shape. BN commonly occurs in women of normal body weight, has a typical onset in adolescence or early adulthood, and afflicts 1–3% of young adult women.¹

CBT is a multimodal intervention that includes techniques such as psychoeducation, recognizing, and modifying responses to antecedent cues, challenging automatic thoughts, thought restructuring,

problem solving, exposure with response prevention, and relapse prevention.² Self-monitoring of food intake, binges, and purges is a central element of therapy. Treatment is most commonly administered in individual or group therapy over 16–20 sessions, although substantial clinical change can occur in as few as eight sessions.^{3,4} Group therapy represents a more parsimonious use of therapist time, is an effective treatment, and ultimately is more cost-effective,⁵ although the time course to recovery may be somewhat slower and abstinence rates lower.⁶

Although CBT is effective for ~40–67% of patients,^{7–10} efforts are required to augment and improve treatment to better serve individuals who drop out (0–33%),^{11,12} fail to engage (14%),¹² or relapse (33%).⁸ The highest risk period for relapse is in the 6 months after treatment,¹³ with risk declining at 4-year follow-up.⁸ After 10 years, 11% of individuals originally diagnosed with BN continued to meet full diagnostic criteria for BN and 18.5% met criteria for eating disorder not otherwise specified.^{7,8} Due to these substantial concerns, a recent systematic review of the treatment of eating disorders has highlighted the importance of exploring adaptations of technology to further enhance CBT or fluoxetine treatment.¹⁴

Various means of information technology (e.g., web-based treatment, text messaging, personal

Accepted 28 June 2009

Supported by Mental Health Initiative (A Foundation for Mental Health and an Alexander von Humboldt Stiftung German-American Trans-Coop grant).

*Correspondence to: J.R. Shapiro, University of North Carolina at Chapel Hill, Department of Psychiatry, CB 7160, Chapel Hill, North Carolina 27599. E-mail: jshapiro@med.unc.edu

¹ Department of Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

² Center for Psychotherapy Research, University of Heidelberg, Heidelberg, Germany

³ Department of Biostatistics, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

⁴ Department of Nutrition, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Published online 28 August 2009 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/eat.20744

© 2009 Wiley Periodicals, Inc.

digital assistants [PDAs]) are currently being used for self-monitoring and treatment delivery. This may increase the frequency of patient-provider contact, reach individuals who may not have access to specialty care, and result in better treatment acceptability in today's technological society thus leading to increased treatment engagement and decreased attrition. Although self-monitoring is one of the hallmark features of CBT for BN, patients often do not adhere to self-monitoring.^{15,16}

Grounded in behavioral theory of practice and reinforcement, text messaging may enhance self-monitoring given that behaviors change most when goals are set, and when cueing, support, and positive reinforcement are provided.¹⁷ In contrast to traditional paper diaries, text messaging can be used discretely and quickly and provides time/day stamps so behaviors are recorded immediately and accurately and can be set up to provide individuals with immediate support and feedback to their monitoring behavior. This approach to self-monitoring is in marked contrast to the potential shame, stigmatization, and drudgery associated with carrying around paper self-monitoring diaries, the frequent practice of back-fill, and having to wait until your next appointment (if at all) to get feedback on your behaviors. Text messaging has been shown to be acceptable for providing support, effecting behavior change, and/or maintaining treatment gains in diabetes,^{18,19} asthma,²⁰ smoking cessation,^{21,22} and monitoring targeted behaviors associated with obesity in children.²³ Bauer and colleagues developed a text-messaging program to support individuals on a weekly basis after they completed CBT for BN. Results showed that patients found the intervention to be highly convenient, flexible, and well tolerated. The vast majority rated the program as good or very good, noted that they would recommend the program to others and indicated that they would participate again if they needed additional assistance. Although most were satisfied with weekly check-ins, 39% felt that more frequent interaction would have been valuable.^{24,25} In contrast, Robinson et al.²⁶ found a low use of text messaging for after-care in BN and high attrition and suggested that text messaging required further adaptation to make it a more useful tool. The current proof-of-principle study was designed to expand on these previous investigations to examine the feasibility and acceptability of using a text-messaging program for daily self-monitoring of BN symptoms during CBT.

Method

Participants

Women over the age of 18 with BN were recruited through physician referral, referral from the University of North Carolina Eating Disorders Program, and advertisements in the community. Exclusion criteria include diagnosis of anorexia nervosa, developmental learning disorders that could interfere with comprehension of the intervention, current severe depression [score ≥ 29 on the Beck Depression Inventory; BDI;²⁷] or active suicidal intent, and inability to speak English fluently. Individuals taking psychoactive medication were included if their BN symptoms remained stable (i.e., were neither improving nor deteriorating) while on medication. A total of 54 women called and left a message of interest about the study. Of these 54, 11 never responded to a follow-up phone call and 43 underwent the telephone screening. Of these 43, 12 did not advance to a personal meeting due to not living in North Carolina during the treatment ($n = 4$), time of group was inconvenient ($n = 4$), did not show to interview ($n = 2$), did not meet diagnostic criteria for BN on the phone ($n = 2$). Thus, a total of 31 women presented for the personal interview and completed baseline data. Of these, 29 (93.6%) were Caucasian, 1 (3.2%) was African American, and 1 (3.2%) was Asian. The mean age of participants was 26.3 ± 8.6 years (range: 17–49 years; note: one person was almost 18 and permitted through IRB and parental consent to participate). Nineteen (61.3%) have been previously treated for BN.

Procedure

Participants first underwent a telephone screening ($n = 43$). Those who met preliminary criteria were invited to a personal interview, which included an initial brief semistructured assessment to rule out any exclusion criteria, establish BN diagnosis, and to provide consent to participate. Assessments occurred at baseline, week 12 (post-treatment), and week 24 (follow-up). The study was approved by the Biomedical Institutional Review Board at the University of North Carolina at Chapel Hill.

Measures

Height and Weight. Height and weight were assessed in a hospital gown and without shoes using a stadiometer and digital physician's scale, respectively, calibrated regularly according to protocol. BMI (kg/m^2) was calculated.

Structured Clinical Interview (SCID) for DSM-IV, Eating Disorders Modules.²⁸ The eating disorders portion of the SCID was administered to determine BN diagnosis and rule out other eating disorders diagnoses.

Eating Disorders Inventory-II (EDI).²⁹ This self-report instrument contains 91 items used to assess severity of symptomatology on dimensions clinically relevant to eating disorders.

Binge-Purge Questionnaire. We created a measure to investigate number of binge eating and purging episodes based on recall. At post-treatment and follow-up, participants responded to two questions “In the past week, how many binges (and purges) did you have?” These numbers were compared with the numbers of weekly binge eating and purge episodes that the participant provided during the interview at baseline.

Night Eating Questionnaire.³⁰ The NEQ is a brief, 14-item questionnaire which evaluates the behavioral and psychological symptoms of NES, including morning hunger, craving, and control of food intake after the evening meal and upon waking at night, evening hyperphagia, nocturnal ingestions of food, and sleep and mood disturbance.³⁰ The measure has an acceptable alpha (0.70); convergent and discriminant validity have been established.³⁰

Beck Depression Inventory-II (BDI).²⁷ The BDI is one of the most widely used self-report measures of depression. The BDI-II contains 21 items and measures depression on four levels of severity. A score of ≥ 29 is defined as severe depression.

Self-Monitoring. Consistent with standard CBT, all participants were instructed to record their daily food intake (type and amount of food); thoughts, feelings, and situations associated with the eating episode; and binges/purges each day via paper diaries. At the end of the day, participants were instructed to complete daily responses to the following three items: (1) How many binges did you have today? (2) How many times did you purge today (vomit, restrict, laxative use, excessive exercise)? (3) How strong was your peak urge to binge today (0 = no urge, 8 = extreme urge)? and (4) How strong was your peak urge to purge today (0 = no urge, 8 = extreme urge)? Given that some engage in binge/purge behavior without feeling an urge, whereas others feel an urge but do not engage in the behavior, we opted to measure both urges and actual behavior. Participants were encouraged to keep paper and pencil diaries since despite low adherence, they remain the “gold standard” of self-monitoring. The text-messaging program was designed to record the four targeted symptoms described above (i.e., not used as an entire program to monitor meal plans, thoughts, feelings, and cues).

Treatment Acceptability. At post-treatment participants completed treatment acceptability Likert scales to address the following questions: (1) How much did the intervention meet your expectations? (2) How likely would you be to recommend the intervention to a friend?

(3) How likely would you be to participate in the intervention again if necessary? (4) How much did you enjoy the self-monitoring forms? (5) How much did you enjoy using the text-messaging program? A description of the scale was provided such that 0 = never or not at all or extremely negative and 10 = extremely positive. Although this is not a previously validated measure, similar measures have been used in previous studies.²³

Text Messaging

Each night participants submitted a text message to the program indicating their numbers of: (1) binge eating episodes, (2) purging episodes, (3) peak urge to engage in binge, and (4) peak urge to engage in a purge (Likert scale 0–8; 0 = no urge, 8 = extreme urge) and received an immediate feedback message. Hundreds of feedback messages were developed to avoid duplicate messages and included specific feedback on data as well as suggestions of skills to use; algorithms were based on (1) how many goals were met (the goal was abstinence from binge eating and purging) and (2) enhancement or deterioration from the previous day. An example feedback message consisted of: “*Good job with resisting your strong urge to purge today. Try harder not to give into the binge eating tomorrow. Call a friend instead.*” If at 9 am the following morning, there has been no input, participants received a text-message prompt to input their data. Participants began monitoring on treatment day 1 and continued monitoring their symptoms during the 12 week treatment phase and an additional 12 weeks for a total of 24 weeks. They then returned to the clinic for a follow-up evaluation. All participants used their own phones and were reimbursed for text-messaging charges during the course of the study.

Treatment

Participants met in groups of 5–8 participants for 1.5 h for 12 consecutive weeks. All groups were facilitated by a clinical psychologist. Treatment provided skills and techniques typical of CBT treatment for BN as described earlier.

Statistical Analyses

This study was designed to be a proof-of-principle study to explore the feasibility of using text messaging as a self-monitoring tool in the treatment of BN. The primary outcome measure in this study was adherence to self-monitoring; secondary outcome measures included treatment acceptability, and change in symptoms of BN over time after participating in CBT. Primary analyses used descriptive statistics, change scores from baseline to post-treatment and baseline to follow-up, with significance testing performed using single-group *t*-tests on the change scores. *p* values should be interpreted with

caution due to the exploratory nature of this study. Analyses were conducted with SAS, version 9.1.3.³¹

Results

Attrition

Dropouts were defined as those who stopped coming to treatment sessions and stopped monitoring. The dropout date is whichever was later (date of last treatment visit or last monitoring date). Of the 31 who interviewed, all met inclusion criteria but only 25 actually showed up to the first group session. A total of 15 completed the treatment and post-treatment questionnaires (48.4% of the total sample and 60% of those who began treatment). The average number of sessions attended was 7/12 (range: 0–12) for the full 31 sample and 8/12 (range: 1–12) for the 25 who began treatment.

Self-Monitoring Adherence

Frequency of monitoring was calculated by counting the number of days self-monitoring was done divided by the number of days between the participant's first scheduled monitoring day and last scheduled monitoring day or drop out date. Due to slight variations in the exact number of days that different waves of the study were expected to monitor, a more accurate comparison is percentage of total monitoring days rather than actual number of days monitored. Self-monitoring binge eating and purging behavior was calculated on 18 participants who had monitoring behavior over at least a 2-week period, the first week and a nonoverlapping last week, even if a participant dropped out before the post-treatment evaluation.

Participants demonstrated 87% adherence to self-monitoring. Furthermore, two of the participants asked if they could continue to use the program even after the study ended as it helped them with their recovery.

Treatment Acceptability

The treatment acceptability measure asked participants to rate various aspects about the program on a 0–10 Likert scale with 0 indicating the most negative response and 10 indicating an extremely positive response. The questions and the ratings are as follows (mean \pm SD): (1) How much did the intervention meet your expectations? (7.1 ± 2.0), (2) How likely would you be to recommend this intervention to a friend? (7.9 ± 1.6), (3) How likely would you be to participate in this intervention

again if necessary? (7.7 ± 2.8), (4) How much did you enjoy the self-monitoring forms? (5.0 ± 2.4), and (5) How much did you enjoy using the text-messaging program? (6.3 ± 2.4). Thus, participants rated all aspects of the program including text messaging as above average other than self-monitoring forms which were rated as average.

Preliminary Effectiveness

Table 1 presents baseline, post-treatment, and follow-up scores on the various measures as well as text-messaging data. Preliminary effectiveness was assessed in completers only. As can be seen in the table, participants significantly improved in their self-reported binge and purge episodes obtained via paper measures. Notably, participants reported an average of six binge episodes in the past week at baseline and 2.5 at post-treatment ($p < 0.01$); they reported an average of 14.5 purges in the past week at baseline and 4.3 at post-treatment ($p < 0.05$). In addition, participants' scores on all other outcome measures (BDI, EDI, NEQ) significantly improved from baseline to post-treatment and follow-up.

We also calculated the number of binges, number of purges, peak urge to binge, and peak urge to purge reported during the first week of self-monitoring and during the last week of self-monitoring. To do this, we had to follow an algorithm. First, a participant had to have self-monitored for at least 2 weeks, or the first and last week would overlap, which would make defining change problematic. We then counted number of binges, purges, urges to binge, urges to purge in the first week and in the last week of self-monitoring. Thus, we were able to calculate self-monitoring statistics on only a subset of participants. Text-messaging results showed that only the mean number of purges significantly reduced from the first week of monitoring to the last week of monitoring.

Discussion

This study was the first study to investigate whether a novel technology of text messaging could be used as a self-monitoring tool within the context of outpatient group CBT. Results showed that participants generally accepted the text-messaging program and adhered to self-monitoring 87% of the time, which is higher than many published self-monitoring adherence rates.³² These results are consistent with Stone et al. who found a 94% adherence to the PDA and only an 11% adherence to

TABLE 1. Scores on baseline and post-treatment outcome measures

	Baseline: Entire Sample	Baseline: Completers Only	Post-Treatment (Week 12)	Follow-Up (Week 24)
Height (inches) Mean \pm SD (<i>n</i>)	65.2 \pm 3.1 (31)	N/A	N/A	N/A
Weight (pounds) Mean \pm SD (<i>n</i>)	137.0 \pm 30.0 (31)	131.2 \pm 14.1 (13)	133.5 \pm 14.1 (13)	133.9 \pm 15.3 (13)
BDI Mean \pm SD (<i>n</i>)	24.6 \pm 11.0 (31)	23.1 \pm 10.7 (15)	11.4 \pm 9.6 (15)****	8.8 \pm 9.4 (14)***
EDI (total score) Mean \pm SD (<i>n</i>)	108.9 \pm 41.4 (31)	102.9 \pm 35.4 (15)	58.7 \pm 34.5 (15)***	52.6 \pm 18.8 (14)**
NEQ Mean \pm SD (<i>n</i>)	20.1 \pm 6.6 (31)	21.1 \pm 6.9 (15)	16.9 \pm 6.9 (15)**	14.2 \pm 7.6 (14)***
# Binges in past week: Mean \pm SD (<i>n</i>)	5 (30)	5.8 \pm 4.8 (15)	2.5 \pm 1.9 (15)**	2.9 (14)*
# Purges in past week Mean \pm SD (<i>n</i>)	7 (30)	14.5 \pm 19.4 (15)	4.3 \pm 5.4 (15)*	4.4 \pm 5.7 (14)*
Text-messaging data ^a				
Mean per day per week \pm SD (<i>n</i>)				
# Binges	N/A	0.8 \pm 0.9 (18)	0.7 \pm 0.6 (18)	N/A
# Purges	N/A	1.9 \pm 2.4 (18)	1.0 \pm 1.2 (18)*	N/A
Urge to Binge	N/A	4.7 \pm 2.3 (18)	4.2 \pm 2.6 (18)	N/A
Urge to Purge	N/A	5.0 \pm 2.4 (18)	4.0 \pm 2.5 (18)	N/A

BDI, Beck depression inventory; EDI, eating disorders inventory; NEQ, night eating questionnaire.

Results are compared with baseline completers only:

* = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; **** = $p < 0.0001$.

^a All data on table is based on self-report measures during data collection periods except for text-messaging data, which is a summary of the first and last week of text-messaging data.

paper diaries.¹⁵ Because self-monitoring is associated with increased adherence to goals, increasing the frequency of self-monitoring could be expected to lead to higher remission rates. In addition, participants improved on paper and pencil self-reported measures of binge eating and purging episodes from baseline to post-treatment as well as improvements in depression, and both eating disorder and night eating symptoms. Interestingly, when looking at the text-messaging data, only the number of purging episodes was significantly reduced from baseline to post-treatment. Specifically, at both baseline and post-treatment, the number of binge episodes over the past week reported via the binge-purge questionnaire was similar to those reported via text messaging (i.e., results were similar across measurement method). The number of purges over the past week reported at baseline was also consistent across measurement methods. However, at post-treatment, the number of purges reported via text messaging was greater (7 per week) than that reported via the binge-purge questionnaire (4 per week). Thus, it is unclear which data collection method is more accurate. If the daily time stamped text-messaging technique is more accurate than retrospective weekly recall, then it is plausible that participants are significantly underreporting (either accidentally or purposefully) their symptoms when asked to report retrospectively. This inaccuracy is important for research and clinical purposes; errors may be made when individuals are asked to recall the number of binge/purge episodes on a weekly basis but also if they back-fill their self-monitoring forms (i.e., complete weekly forms retrospectively before meeting with the provider).

Although this study was designed as a proof-of-principle study, we nonetheless must discuss limitations. Appreciation of these limitations will assist with designing subsequent trials that incorporate text-messaging components for self-monitoring. First, the initial sample size was small. Second, attrition was high but notably not much higher than the reported 33% drop out rate reported in previous studies.^{11,12} A large portion of participants in most studies of BN fail to engage in treatment and/or drop out. Thus, it is important to enhance treatment in such ways that are likely to increase acceptance, usability, and completion. As society becomes more technologically savvy, researchers and clinicians must utilize such modes of communication as they are increasingly being shown to increase treatment acceptability. This pilot study was the first to show that participants accepted and adhered to a text messaging self-monitoring program within the context of outpatient CBT for BN. Future studies should continue to enhance treatments to reduce attrition; however, we found that text messaging may be one vehicle to enhance self-monitoring for those individuals who remain in an intervention program. Third, this was a within group design and we did not compare results to a traditional paper diary group. Thus, we are unable to determine if text messaging would significantly improve treatment acceptability, adherence, effectiveness, and completion relative to a control group. However, our results are promising in that 87% of participants adhered to self-monitoring, which is much higher than adherence rates to traditional paper and pencil based self-monitoring.¹⁵ Fourth, when comparing the number of binge eating and purging episodes, the baseline data were

extrapolated from the SCID, whereas the post-treatment data were taken from the binge-purge questionnaire. Thus, although the questions queried the same behaviors, it was asked verbally at baseline and asked via questionnaires at post-treatment and follow-up. However, results showed that participants reported a much higher rate of binge eating and purging episodes at baseline via a clinical interview and fewer episodes at post-treatment via a questionnaire. Despite the slight differences in methods of inquiry, we are confident that they yielded similar results; if social desirability was in effect, one would suspect that the results would have been reverse (i.e., report lower frequencies on a verbal interview).

Bearing the limitations in mind, these initial promising results as well as previous studies that have demonstrated a higher adherence rate in electronic diaries versus paper diaries,^{15,23} support the further exploration of incorporate text-messaging-based self-monitoring in larger randomized clinical trials comparing traditional therapy with a more enhanced technological version. Although the results of this pilot study do not demonstrate reduced attrition, the text messaging demonstrated a high self-monitoring adherence rate for those who remained in the study.

Independent of the limitations inherent in our study, there are inherent challenges with text messaging that may limit generalization and widespread use. Providers must have access to a secure server to host the text-messaging program. The server at times may malfunction and not accept incoming or outgoing text messages until it is rebooted. Although the cost of text-messaging plans is relatively inexpensive, it may be inaccessible for individuals without mobile phones and individuals who live in rural areas may have no mobile phone coverage. However, these limitations were infrequent and the benefits strongly outweighed the challenges we encountered.

In sum, the specific advantages of text messaging include its wide dissemination, low cost, availability, flexibility, convenience, and interactivity. Mental health professionals are currently limited in the services available to patients. In terms of behavioral treatment, patients often do not receive any clinical input beyond the 50 min per week that they meet with their therapist. In addition, after terminating treatment, relapse is common.⁸ Text messaging could be used as part of a stepped care approach to maintain more frequent contact with patients after they are discharged from inpatient or partial hospitalization treatment to maintain contact and help

prevent relapse. Finally, the cost-effectiveness of such programs should be examined in greater detail; text messaging may prove to be a cost-effective method for increasing adherence and effecting behavior change, which could ultimately enhance CBT for those who do not have regular access to treatment providers, need more frequent contact, drop out of treatment, or for treatment nonresponders. If effective, this methodology could readily be exported to other populations and settings for improving digestive diseases, nutritional disorders, and other eating disorders as well as dissemination to remote settings in which access to health-care is limited.

The authors greatly appreciate Lauren Reba-Harrelson, MA for facilitating some of the intervention groups.

References

1. American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. Washington, DC: American Psychiatric Association Press, 1994.
2. Fairburn CG. Cognitive-behavioral treatment for bulimia. In: Garner DM, Garfinkel PE, editors. *Handbook of Psychotherapy for Anorexia and Bulimia*. New York, NY: Guilford Press, 1985, p. 160–192.
3. Bulik M, Sullivan P, McIntosh V, Carter F, Joyce P. Predictors of rapid response to cognitive-behavioral therapy in women with bulimia nervosa. *Int J Eat Disord* 1999;26:137–144.
4. Wilson G, Fairburn C, Agras W, Walsh B, Kraemer H. Cognitive-behavioral therapy for bulimia nervosa: Time course and mechanisms of change. *J Consult Clin Psychol* 2002;70:267–274.
5. Mitchell J, Peterson C, Agras S. Cost effectiveness of psychotherapy for eating disorders. In: Miller N, editor. *Cost-Effectiveness of Psychotherapy: A Guide for Practitioners, Researchers, and Policy Makers*. New York: Oxford University Press, 1999, p. 270–278.
6. Chen E, Touyz S, Beumont P, Fairburn C, Griffiths R, Butow P, et al. Comparison of group and individual cognitive-behavioral therapy for patients with bulimia nervosa. *Int J Eat Disord* 2003;33:241–254.
7. Keel PK, Mitchell JE, Miller KB, Davis TL, Crow SJ. Long-term outcome of bulimia nervosa. *Arch Gen Psychiatry* 1999;56:63–69.
8. Keel PK, Mitchell JE. Outcome in bulimia nervosa. *Am J Psychiatry* 1997;154:313–321.
9. Fairburn CG. The current status of the psychological treatments for bulimia nervosa. *J Psychosom Res* 1988;32:635–645.
10. Anderson D, Maloney K. The efficacy of cognitive-behavioral therapy on the core symptoms of bulimia nervosa. *Clin Psychol Rev* 2001;21:971–988.
11. Mitchell J. A review of the controlled trials of psychotherapy for bulimia nervosa. *J Psychosom Res* 1991;35(Suppl 1):23–31.
12. Waller G. Drop-out and failure to engage in individual outpatient cognitive behavior therapy for bulimic disorders. *Int J Eat Disord* 1997;22:35–41.
13. Olmsted M, Kaplan A, Rockert W. Rate and prediction of relapse in bulimia nervosa. *Am J Psychiatry* 1994;151:738–743.

14. Berkman ND, Bulik CM, Brownley KA, Lohr KN, Sedway JA, Rooks A, Gartlehner G. Management of Eating Disorders. Evidence Report/Technology Assessment No. 135. (Prepared by the RTI International-University of North Carolina Evidence-Based Practice Center under Contract No. 290-02-0016.) AHRQ Publication No. 06-E010. Rockville, MD: Agency for Healthcare Research and Quality, April 2006.
15. Stone AA, Shiffman S, Schwartz JE, Broderick JE, Hufford MR. Patient non-compliance with paper diaries. *BMJ* 2002;324:1193–1194.
16. Stone AA, Shiffman S, Schwartz JE, Broderick JE, Hufford MR. Patient compliance with paper and electronic diaries. *Control Clin Trials* 2003;24:182–199.
17. Bandura A. A social cognitive theory. *Ann Child Dev* 1989;6:1–60.
18. Franklin V, Waller A, Pagliari C, Greene S. “Sweet Talk”: Text messaging support for intensive insulin therapy for young people with diabetes. *Diabetes Technol Ther* 2003;5:991–996.
19. Ferrer-Roca O, Cardenas A, Diaz-Cardama A, Pulido P. Mobile phone text messaging in the management of diabetes. *J Telemed Telecare* 2004;10:282–285.
20. Anhoj J, Moldrup C. Feasibility of collecting diary data from asthma patients through mobile phones and SMS (short message service): Response rate analysis and focus group evaluation from a pilot study. *J Med Internet Res* 2004;6:e42.
21. Rodgers A, Corbett T, Bramley D, Riddell T, Wills M, Lin RB, et al. Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tob Control* 2005;14:255–261.
22. Obermayer JL, Riley WT, Asif O, Jean-Mary J. College smoking cessation using cell phone text messaging. *J Am Coll Health* 2004;53:71–78.
23. Shapiro JR, Bauer S, Kordy H, Hamer RM, Ward D, Bulik CM. Use of text messaging for monitoring sugar-sweetened beverages, physical activity, and screen time in children: A pilot study. *J Nutr Educ Behav* 2008;40:385–391.
24. Bauer S, Percevic R, Okon E, Meermann R, Kordy H. Use of text messaging in the aftercare of patients with bulimia nervosa. *Eur Eat Disord Rev* 2003;11:279–290.
25. Bauer S, Hagel J, Okon E, Meermann R, Kordy H. Experiences with the use of short message service in the post-hospitalization follow-up care of patients with bulimia nervosa. *Psychodynamische Psychotherapie* 2006;3:127–136.
26. Robinson S, Perkins S, Bauer S, Hammond N, Treasure J, Schmidt U. Aftercare intervention through text messaging in the treatment of bulimia nervosa-feasibility pilot. *Int J Eat Disord* 2006;39:633–638.
27. Beck AT, Steer RA, Brown GK. Manual for Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation, 1996.
28. First M, Spitzer R, Gibbon M, Williams J. Structured Clinical Interview for DSM-IV Axis I Disorders, Research Version, Patient Edition. New York: Biometrics Research, New York State Psychiatric Institute, 1997.
29. Garner D. Eating Disorders Inventory-2: Professional Manual. Odessa, FL: Psychological Assessment Resources, Inc., 1991.
30. Allison KC, Lundgren JD, O’reardon JP, Martino NS, Sarwer DB, Wadden TA, et al. Psychometric properties of a measure of severity of the night eating syndrome. *Eat Behav* 2008;9:62–72.
31. SAS Institute Inc SAS/STAT[®] Software: Version 9.1.3. Cary, NC: SAS Institute, Inc., 2004.
32. Boutelle KN, Kirschenbaum DS. Further support for consistent self-monitoring as a vital component of successful weight control. *Obes Res* 1998;6:219–224.