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Self-Monitoring and the Assessment of Binge Eating

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Thirty women diagnosed with either bulimia nervosa (BN) or binge eating disorder (BED) kept continuous prospective records of their food intake without receiving additional simultaneous treatment. Compared with the frequency of binge eating assessed during initial structured interviews, participants showed a substantial decrease in their frequency of binge eating during self-monitoring. Average binge-eating frequency fell from 0.91 to 0.40 binge episodes per day, $t(29) = 5.04, p \leq .001$. Participants with both disorders reduced their binge eating at similar rates. Half of all participants with BED and 16.6% of those with BN ceased to meet *DSM-IV* binge-eating frequency criteria for their disorder during the self-monitoring phase. Of participants with BED, 27.8% were abstinent from binge eating during self-monitoring. These findings suggest that self-monitoring of food intake may substantially reduce binge eating in women with bulimia nervosa or binge eating disorder.

Self-monitoring is widely used in cognitive-behavioral therapy (CBT). It functions not only as an assessment device, but also as a treatment intervention with reactive effects, where the frequency of the monitored behavior changes in the desired direction as a result of self-monitoring. Numerous reports have examined the reactivity of clinically relevant behaviors, such as cigarette smoking (Abrams & Wilson, 1979), alcohol intake (Sobell & Sobell, 1973), and insomnia (Jason, 1975). These reactive effects of self-monitoring typically have the advantage of occurring immediately (Korotitsch & Nelson-Gray, 1999) and of persisting as long as they are used (Nelson, Boykin, & Hayes, 1982). However, research on self-monitoring has steeply declined since the early 1980s (Korotitsch & Nelson-Gray).

It has been proposed that not only self-monitoring behaviors, but also various events and objects associated with the self-monitoring procedure, such as therapist instructions and training in the procedure, self-monitoring diaries, etc., may function as reminders of the target behavior's ultimate conse-

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quences (Nelson & Hayes, 1981). More immediate consequences of self-monitoring, such as the therapist's or client's evaluation of the recorded behaviors, can also serve as reminders of the behavior's long-term consequences and change its frequency (Fremouw & Brown, 1980). Therefore, to maximize the availability of these cues and, in turn, the therapeutic effect of self-monitoring, clients should be encouraged to self-monitor and carry their recording device continuously throughout the day. However, Muraven and Baumeister (2000) have proposed that self-control is a limited, depletable resource that is best strengthened if self-control efforts such as vigilance are interspersed with periods of rest. The keeping of self-monitoring records could be construed as a form of vigilance independent of the vigilance required in efforts to control the target behavior. Food intake may be an especially good target behavior for self-monitoring, as bouts of eating tend to occur in discrete episodes separated by time, making continuous monitoring possible without consuming an exhaustible resource.

The effect of self-monitoring on body weight has been examined in obese patients. Self-monitoring of caloric intake produces weight loss (Romanczyk, 1974) and is used almost universally in behavioral weight-loss treatment. However, these reactive changes depend in part on the specific target behavior being monitored (Fremouw & Brown, 1980). Self-monitoring of weight alone (Romanczyk) or of eating habits alone (and not caloric intake) (Mahoney, 1974; Mahoney, Moura, & Wade, 1973) does not impact weight, and qualitative feedback from food diaries on the types of food consumed produces less weight loss than quantitative feedback from calorie self-monitoring (Fremouw & Brown).

Although there have yet been no direct studies on reactivity to self-monitoring in eating disorders, there is reason to believe that self-monitoring may play a central role in the reduction of binge eating in CBT for bulimia nervosa (BN). Analyses of the time course of CBT for BN reveal that change occurs significantly sooner than in comparison treatments, with most improvement taking place in the first few treatment sessions (Wilson et al., 1999). Self-monitoring, the first treatment intervention used in CBT for BN (Fairburn, Marcus, & Wilson, 1993), may be responsible for this effect (Wilson & Vitousek, 1999). In patients with binge eating disorder (BED), one indication of a possible reactivity effect is the high rate of placebo response that has been described in these patients (Stunkard, 2002). In each study where placebos have been found to have this effect, patients were simultaneously keeping self-monitoring records, and this self-monitoring may have augmented or in part accounted for patients' high rates of remission (Stunkard).

CBT is well established as an empirically supported treatment for BN and BED (Wilson & Fairburn, 2002), but little is known about the specific components of treatment that are responsible for its effectiveness. By isolating self-monitoring from the context of treatment, the current investigation examined its specific effect on binge eating in women with BN and BED. Binge eating, or an objective bulimic episode (OBE), is defined in the fourth

edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*) as the intake of an unequivocally large amount of food consumed while experiencing a loss of control over eating (American Psychiatric Association [APA], 1994). Another common but nondiagnostic feature of these disorders is the experience of a loss of control over eating even when the amount of food eaten is not large. Not considered binge eating, these bouts are termed subjective bulimic episodes (SBEs; Fairburn & Cooper, 1993).

Methods

Participants

Participants were recruited through newspaper and Internet advertisements for a research study on binge eating, and were offered $50 and free treatment in return for participation. Ninety-six respondents who reported binge eating during a brief phone interview were invited in for an evaluation. Of this initial group, 56 women who were interviewed did not meet either *DSM-IV* diagnostic criteria for BN or *DSM-IV* research criteria for BED and were not invited to participate in the study. Thirty women did satisfy criteria for BN ($n = 12$) or BED ($n = 18$) and participated in the study. Eight women who met these diagnostic criteria were invited to participate but declined. Two additional women who satisfied diagnostic criteria were referred for immediate treatment because they exhibited signs of suicidal ideation. Participant flow is outlined in Figure 1. Participants were 90% white, 6.7% Asian, and 3.3% Hispanic.

Procedure

The Eating Disorder Examination (EDE; Fairburn & Cooper, 1993) was used to diagnose patients and to obtain their baseline binge-eating frequency. The EDE is a structured interview with established test-retest and interrater reliability (Rivzi, Peterson, Crow, & Agras, 2000) and concurrent validity (Fairburn & Cooper; Rosen, Vara, Wendt, & Leitenberg, 1990). Participants were also assessed for symptoms of depression using the Beck Depression Inventory–II (BDI-II; Beck, Steer, Ball, & Ranieri, 1996).

Following the interview, a diagnosis was assigned to qualifying participants, who were then trained in the self-monitoring procedure. They were instructed to record the type and estimated quantity of all food and beverage intake immediately after it occurred, the time and place of intake, whether they considered the bout of eating to be a meal, snack, or binge, and whether they experienced a loss of control over eating. This self-monitoring procedure for the recording of food intake was based on the self-monitoring procedure used in CBT for BN and BED (Fairburn et al., 1993). In CBT, patients also record their thoughts and emotions related to eating; participants were not instructed to do so here because the emphasis was solely on the effect on binge eating of the recording of food intake. Each participant completed a sample food record during this training session. In an effort to minimize possible expectancy effects, participants were told that "self-monitoring will not

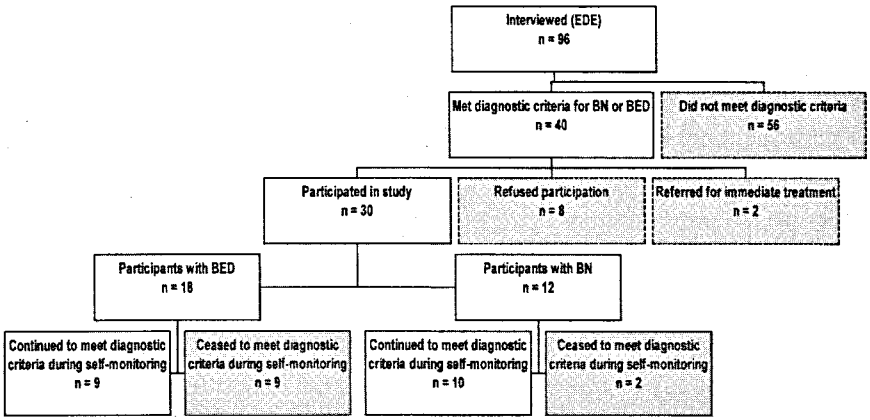

FIG. 1. Participant flow during the study.

necessarily have any effect on your behavior, but it is useful for taking a closer look at it." In addition, participants were not receiving treatment during the present investigation and were given no indication that the self-monitoring would have therapeutic value.

At this meeting participants were notified that they would be contacted by telephone the following evening, and were asked for a convenient time to call, "to give [them] a chance to ask any questions that might come up." To evaluate participants' compliance with self-monitoring, during this telephone conversation participants were asked to read aloud their food records entered that day. Any omissions or necessary corrections were pointed out at this time, and participants were given the chance to ask questions about the self-monitoring procedure.

Beginning the day of the training session, participants kept continuous food records each day until their follow-up appointment, when records were collected and reviewed. In most cases this appointment was scheduled for 7 days later, with a range of 6 to 18 days. The first 6 to 7 days of records were analyzed for the present study. These procedures preceded a 4-week study on the nutritional composition of the diets of women with eating disorders (the results of which will be reported elsewhere). This subsequent study also did not provide treatment, and this was made clear to participants in advance. Following their research participation, however, free treatment was made available to participants.

This study was approved by the Rutgers University Institutional Review Board, and informed consent was obtained from all participants.

Statistical Analysis

The EDE interview assessed the frequency of OBEs in the most recent 4 weeks, and this frequency was averaged across the 28 days to obtain an aver-

age daily binge frequency. (The EDE also obtains the frequency of OBEs in the 2 months preceding the most recent 4 weeks that are the primary assessment target during the interview.) OBEs were identified from EDE interview responses and from self-monitoring by the primary investigator in accordance with the interview guidelines (Fairburn & Cooper, 1993). These guidelines, along with the training required to administer the EDE, provide instructions for distinguishing between subjective bulimic episodes (SBEs) and OBEs. The actual EDE questions are also designed to distinguish between these types of overeating.

For the 16 participants who kept records for 7 or more days, an average daily binge frequency during self-monitoring was obtained by dividing by 7 the frequency of OBEs entered on food records for the first 7 days that records were kept. Fourteen participants kept records for 6 days, and in these cases total OBEs were divided by 6 to obtain daily averages. Average daily frequencies during baseline and during self-monitoring were compared using a paired samples t test. The average difference between the two frequencies ("reactivity") was then compared across diagnostic categories (BN versus BED) using an independent samples t test. Possible correlations were explored between reactive effects and age, body mass index (BMI = kg/m^2), and BDI-II scores. The proportion of participants who fell below *DSM-IV* binge-eating frequency criteria for their disorder during self-monitoring was calculated, as was the proportion of participants who became abstinent from binge eating during self-monitoring, and the relative sizes of these subgroups were compared across diagnostic categories using a chi-square test.

Results

BED participants' mean BMI was 32.3, and BN participants' mean BMI was 23.1, $t(28) = 5.56, p \leq .001$; participants' mean age (33.4) and BDI-II score (26.9) did not differ between groups, as shown in Table 1. The baseline binge-eating frequency was 0.91/day for all participants. A trend emerged for this frequency to be higher for women with BN (1.20/day) than for those with BED (0.72/day), $t(28) = 1.97, p \leq .06$. Baseline binge frequency was not significantly correlated with age, BMI, or BDI-II scores. (The daily binge frequency during the 4 weeks prior to the interview was not significantly different from the frequency reported for the 2 months that preceded them, Ms = 0.91/day and 0.78/day, respectively.)

All participants were compliant with record-keeping procedures and did not skip any days of self-monitoring; in addition, each participant was able to recite (presumably reading from their food records) a list of the foods and their quantities consumed that day, when spontaneously asked to do so on the telephone the evening after their visit.

During self-monitoring, mean binge frequency fell to less than half of the frequency during the preceding month as reported on interviews, from 0.91/day to 0.40/day, $t(29) = 5.04, p \leq .001$. (The average daily OBE frequency

TABLE 1
MEANS (AND STANDARD DEVIATIONS) OF DEMOGRAPHIC CHARACTERISTICS AND RESPONSES TO SELF-MONITORING OF PARTICIPANTS IN EACH DIAGNOSTIC CATEGORY

	Participant Characteristics	
	BED	BN
Age	35.56 (10.76)	31.50 (8.75)
BMI	32.31 (5.19)	23.06 (3.04)[a]
BDI	25.72 (11.54)	29.33 (9.14)
Interview binge frequency (OBE/day)	1.20 (0.90)	0.73 (0.41)
Self-monitoring binge frequency (OBE/day)	0.27 (0.33)	0.59 (0.43)[a]
Proportion ceasing to meet diagnostic criteria	50%	16.7%
Proportion abstinent	27.8%	0%[a]
N	18	12

[a] Significant difference between BED and BN at $p \leq .05$.

computed from the full range of days of self-monitoring, 6 to 18 days, was 0.41/day, nearly identical to the frequency over the first 6 to 7 days.) The frequencies of binge eating reported on interview and on self-monitoring were significantly correlated, $r(30) = .56$, $p \leq .001$. The difference in average (weekly) binge frequency is shown in Figure 2.

During the self-monitoring period, the binge frequencies of BN (0.59/day) vs. BED (0.27/day) participants differed from each other, $t(28) = 2.37$, $p \leq .05$. Reactivity, or the average reduction in binge frequency from interview to

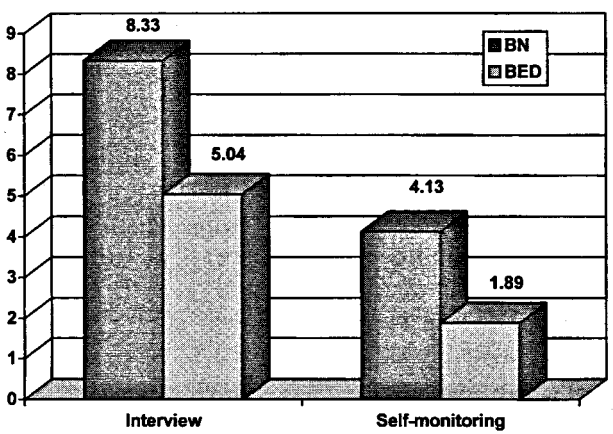

FIG. 2. Mean weekly rates of binge eating (daily frequency of OBEs × 7) of participants with BN or BED as reported during interviews and during subsequent self-monitoring of food intake.

self-monitoring, was not different for the two diagnostic groups. Reactivity was not significantly correlated with age, BMI, or BDI-II scores.

The *DSM-IV* diagnostic criteria for BN specify that, on average, binge episodes must occur at least twice each week for 3 months. Research criteria for BED require that binge eating occur, on average, on at least 2 days each week for 6 months (APA, 1994). During self-monitoring, 9 out of 18 BED patients binged less than 2 days per week, compared with only 2 of 12 BN patients who fell below two episodes per week, $\chi^2(1) = 3.45, p \leq .06$, as shown in Figure 3. There were no differences in age, BMI, or BDI-II scores between participants with two or more OBEs/week and those with fewer than two OBEs/week during self-monitoring. Five participants in the BED group (27.8%) became abstinent from binge eating (reported zero OBEs) during self-monitoring. There were no participants with BN who became abstinent, and the different proportions across groups was significant, $\chi^2(1) = 4.92, p \leq .05$. There were no differences between the BED participants who continued binge eating and who became abstinent in age, BMI, or BDI-II scores.

The frequency of SBEs was not significantly different from interview to self-monitoring (*M*s = 0.84/day for interviews and 0.63/day during self-monitoring), indicating that the perception of loss of control over eating, even when the amount of food is not large, did not differ in frequency between interview and self-monitoring. There were no differences between BN and BED participants for mean SBE frequencies during interviews (*M*s = 0.94/day and 0.71/day, respectively) or during self-monitoring (*M*s = 0.67/day and 0.61, respectively).

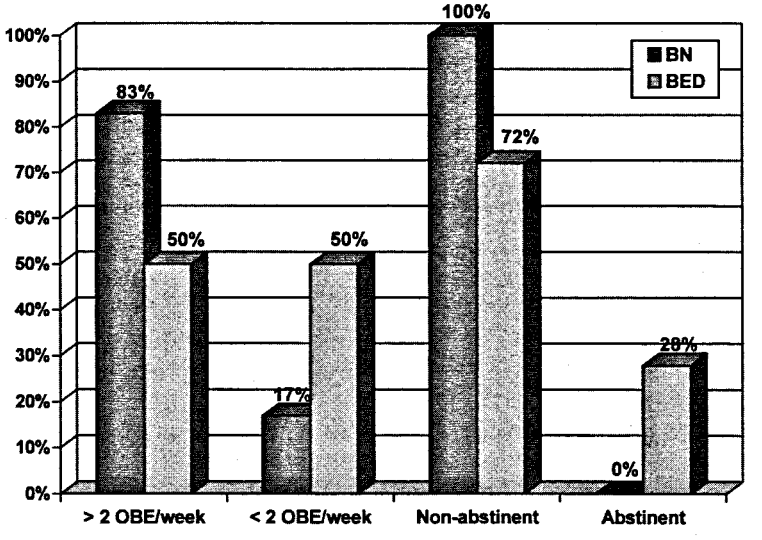

FIG. 3. Proportion of participants with BN and BED whose binge eating frequency dropped below 2 OBEs/week and who became abstinent from binge eating during self-monitoring.

Participants were also tracked throughout their participation in a nutritional intervention during the following 4 weeks and subsequent treatment (CBT) at the Rutgers Eating Disorders Clinic. There were no differences in baseline binge-eating frequency on the EDE, binge eating during self-monitoring, BDI-II scores, BMI, or change scores from baseline interview to self-monitoring binge-eating frequency between participants who completed the additional study ($n = 18$) and those who dropped out ($n = 12$). Among those who completed the study (and thus also continued self-monitoring), the frequency of OBEs reported on continued self-monitoring (averaged across different nutritional interventions) was close to that initially reported during self-monitoring alone (0.58/day and 0.41/day, respectively; $t[17] = 1.49$, *ns*). Participants were offered free treatment and 20 began attending treatment sessions. Eight patients subsequently dropped out of treatment and 12 completed treatment. Treatment dropouts had a significantly higher mean frequency of binge eating at baseline than treatment completers, as reported on both the EDE, $t(18) = 2.29$, $p < .05$ (Ms = 1.36/day vs. 0.63/day) and self-monitoring records, $t(18) = 3.31$, $p < .005$ (Ms = 0.76 vs. 0.23).

Discussion

The present study found a significant difference between the frequency of binge eating assessed through interview and the frequency reported on subsequent self-monitoring in women with BN and BED. The frequency of binge-eating episodes recorded during a period of self-monitoring fell to less than half (44%) of that reported in an initial structured interview in participants receiving no treatment. While self-monitoring, a proportion of women in each diagnostic category fell below the average weekly number of binges specified in the *DSM-IV* criteria: 16.6% of those with BN and a full 50% of those with BED. In addition, 27.8% of participants with BED became completely abstinent from binge eating during the self-monitoring phase.

Among the 20 participants who subsequently enrolled in CBT, those who dropped out of treatment did not differ in the degree of change in binge eating frequency (from interview to self-monitoring) from those who completed treatment. However, subsequent dropouts had a higher mean frequency of binge eating on both the EDE and self-monitoring. Enhancement of the motivation of patients who may not be ready for action-oriented treatment (e.g., Vitousek, Watson, & Wilson, 1998) may help prevent treatment dropout resulting from lack of motivation in patients with eating disorders of varying severity (Geller, Cockell, & Drab, 2001).

The lower frequency of binge eating during self-monitoring compared to interview may be attributable to reactivity, but alternative explanations may account for this finding. First, it is possible that the two assessment devices accurately captured natural fluctuations in the frequency of binge eating over time that would have occurred without the intervention of self-monitoring. Two factors argue against this explanation. First, the self-monitoring phase

immediately followed the 4-week phase assessed during initial interviews. These 4 weeks were similar to the 2 months that preceded them, when mean OBE frequency was 0.78/day, suggesting the stability of OBE frequency over time. Second, the effect of self-monitoring was a change in binge eating that occurred in a uniform direction across participants and diagnostic groups. However, it is impossible to rule out the interpretation that decreased binge eating frequency resulted merely from the passage of time.

Another explanation for the finding is that no change in the actual frequency of binge eating occurred. Instead, it is possible that either the EDE interview or self-monitoring is less accurate than the other measure and yielded a biased assessment: Either the EDE systematically overestimates the frequency of binge eating or self-monitoring systematically underestimates it. This explanation could have serious implications for the use of either measure for assessment and diagnostic purposes, especially for diagnosing BED, where a 50% mismatch would have occurred across the two measures in identifying the disorder. Although numerous studies have separately supported the validity of the EDE (e.g., Fairburn & Cooper, 1993; Rosen et al., 1990) and of self-monitoring (e.g., Davis, Freeman, & Garner, 1988; Elmore & DeCastro, 1991; Kirkley, Burge, & Ammerman, 1988), only one study has directly compared the results of these two measures (Loeb, Pike, Walsh, & Wilson, 1994). Loeb and colleagues compared binge frequencies of BN patients obtained from 7 days of prospective self-monitoring with frequencies generated from an EDE administered at the end of this period. Consistent with the significant correlation between measures found here, Loeb et al. found strong correlations for binge-eating frequencies reported in EDE and diary formats, at points both before ($r = .90$) and after ($r = .93$) treatment. In addition, regression analyses indicated that the binge eating frequencies obtained by the two assessment measures were similar. (This study did not provide information about reactivity because participants filled out food diaries prior to their EDE assessment.) The EDE and self-monitoring were also compared indirectly in a recent evaluation of assessment measures in participants with BED. Grilo, Masheb, and Wilson (2001a) initially compared the EDE to a questionnaire version of the interview (EDE-Q; Fairburn & Beglin, 1994). Although previous research has shown only a moderate association between the EDE and EDE-Q in the assessment of binge eating (Fairburn & Beglin), Grilo et al. (2001a) reported closely corresponding frequencies of binge eating yielded by the instruments in their sample. This initial evaluation was followed by 4 weeks of prospective self-monitoring (accompanied by additional treatment) and then an additional EDE-Q. EDE-Q binge-eating frequencies were highly correlated with self-monitored frequencies, and self-monitored frequencies did not differ significantly from EDE-Q frequencies. A second study replicated these findings (Grilo, Masheb, & Wilson, 2001b). Overall, previous studies suggest that the EDE and self-monitoring may yield responses with strong correlation and agreement. Differences between the measures in the present study may therefore be due to true reactivity rather

than natural fluctuation, inflated reports on interviews, or underestimated reports on self-monitoring.

The rapid response of BED patients to disparate forms of treatment, and even minimal treatments, including placebos in some cases, has been cited as evidence that BED is an unstable condition (Stunkard, 2002). The present study provides further evidence that a substantial proportion of women with BED may respond to a minimal intervention: self-monitoring. A greater proportion of BED participants than BN participants became completely abstinent from binge eating during the self-monitoring. However, women with BED did not show greater changes than women with BN from their binge-eating frequency reported on interviews to that reported during self-monitoring. The higher rate of abstinence and the trend toward a higher proportion of BED participants falling below average weekly *DSM-IV* criteria for binge eating appears to stem from the somewhat lower binge-eating frequency of this group at baseline.

The instructions to participants given in the present study were designed to minimize potential expectancy effects by telling participants to expect little effect of self-monitoring on their behavior. Evidence for the effectiveness of this counterdemand manipulation is limited; however, a study that manipulated expectancy effects found that participants who had been told to expect a decrease in smoking decreased their smoking in response to self-monitoring significantly more than those who were told that the experimenter had no idea what changes self-monitoring would produce (Karoly & Doyle, 1975). Although the procedures used here may possibly have reduced expectancy effects, the lack of a placebo control group makes it impossible to isolate the effects of self-monitoring from remaining expectancy effects or other nonspecific factors, such as investigator attention or the knowledge of future treatment, that could also have contributed to a reduction in binge eating. Future research on self-monitoring could include a control group that keeps no food records but returns to the clinic setting to review their food intake.

The period of self-monitoring examined here was 6 to 7 days, indicating a short-term reduction in binge eating that seems to occur immediately. The effect appeared to be maintained, as suggested by the mean daily binge frequency (0.39/day) on all self-monitored days of those 10 participants who completed self-monitoring records for 8 or more days ($M = 11$); this frequency was nearly identical to that computed from all participants for the first 6 to 7 days (0.40/day). Participants' average daily binge frequencies, when computed separately for each of the different days on which self-monitoring occurred, ranged only from 0.37/day to 0.47/day, suggesting consistency of the effect over time. Maintenance of the effect is also suggested by the similar binge frequency during a subsequent 5-week nutritional study, but at that point participants were subjected to other experimental interventions in addition to ongoing self-monitoring. The maintenance of the effect of self-monitoring in participants who dropped out of this study or from subsequent treatment is unknown. Previous research suggests that the reactive effect of self-monitoring is maintained for (only) as long as self-monitoring is continued (Nelson et al.,

1982). One direction for future research would be examining the longevity of the reduction in binge eating following self-monitoring, to determine whether the effect can persist even after it is discontinued.

Participants were compliant in bringing in completed food records, but food diaries do not allow verification of their compliance in keeping records immediately after eating as participants were instructed to do. The brief telephone contact with participants following their first day of self-monitoring provided some evidence of ongoing record keeping, but for verification of continuous monitoring, an ideal method in future studies may be hand-held computers, where responses are time-stamped and participants cannot "fake" their records after the fact. There is no biological marker for the occurrence of binge eating and no existing method of verifying patients' reports on food records. Therefore, it is necessary to rely upon self-report in interviews or self-recording. Although food diaries kept by patients with eating disorders have been shown to give a good estimate of food intake in several studies (Davis et al., 1988; Elmore & DeCastro, 1991; Kirkley et al., 1988), the accuracy of the procedure still has limitations (Schlundt, 1995) that may have an impact on their use as a dependent variable in the present study. As an intervention, however, accuracy or lack thereof has been shown to be independent of reactivity, so that even inaccurate self-monitoring can lead to symptom amelioration (Korotitsch & Nelson-Gray, 1999). One method to increase accuracy is observation under controlled conditions, such as feeding laboratories, where participants' actions can also be directly observed. Under such circumstances, however, responses to an intervention such as self-monitoring might be difficult to tease apart from the reactivity to direct observation.

Already a central intervention strategy in CBT for these disorders, self-monitoring may account for a significant proportion of the improvement produced in treatment. The current investigation lends credence to the hypothesis that the early response to CBT for BN may be related to patients' reactivity to self-monitoring, the first intervention used in this treatment. The effect of self-monitoring was relatively consistent across the days on which it was used, with similar numbers of binges occurring on each of the days examined. It seems that the decrease in binge eating shown here may be an immediate and persisting effect of self-monitoring. It is possible that this effect can be maintained and enhanced during treatment as other therapeutic strategies are introduced to bolster it. In future studies, a dismantling approach, where CBT is administered both with and without self-monitoring, is recommended to clarify and isolate the effect of self-monitoring as a component of treatment.

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