Validity and Utility of the Current Definition of Binge Eating

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ABSTRACT

Objective: Binge eating, a cardinal symptom of bulimia nervosa (BN) and binge eating disorder (BED), continues to pose challenges in terms of its definition and thus construct validity and clinical utility. This article reviews the available empirical data that support or refute the current DSM-IV-TR defined characteristics of a binge episode.

Method: A systematic literature review was conducted using Medline/PubMed electronic database on DSM-IV-TR defined binge characteristics and associated attributes.

Results: Data support the current DSM guidelines indicating that binge episodes typically occur in less than 2 h. Size of binge episodes has variability across BN and BED diagnostic groups. Loss of control (LOC) continues to be a core feature of binge eating. Negative affect is the most widely reported antecedent. Strikingly, little is known about binge episodes among individuals with anorexia nervosa-binge/purge subtype.

Discussion: Available empirical evidence supports the current DSM duration and LOC attributes of a binge episode in BN and BED. However, a more controversial issues is the extent to which size is important in the definition of a binge episode (e.g., subjective vs. objective episodes) across diagnostic categories and the extent to which binge size informs prognosis, treatment, and clinical outcomes. Further study of binge eating attributes in AN is needed. © 2009 American Psychiatric Association.

Keywords: binge; binge eating; binge episode; anorexia nervosa; bulimia nervosa; binge eating disorder; eating disorder; bulimia; anorexia

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Validity and Utility of Current Definition of Binge Eating

Binge eating is a cardinal symptom of the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev. [DSM-IV-TR])[1] criteria for the diagnosis of bulimia nervosa (BN) and the provisional diagnosis of binge eating disorder (BED). Although central to the diagnoses of BN and BED, binge eating also occurs among individuals with anorexia nervosa-binge eating/purge subtype (AN-B/P).[1] Despite the prevalence and importance of binge eating in the spectrum of eating disorders, there continues to be a debate over how to define binge eating. Thus, it is unclear to what extent there is validity for this construct. Of further concern is whether the criteria for defining binge eating have validity in terms of predicting prognosis and treatment response, as this is a primary purpose of a scheme for clinical diagnosis.[2] The aim of this article is to review the available empirical research on binge eating in eating disorder populations with the goal of evaluating the extent to which data support the current conceptualization of binge eating and the utility of the behavior as a diagnostic criterion. It is of note that most studies of binge episodes have been conducted in the adult Caucasian population, and therefore recognized that generalizations across age, racial, and ethnic groups are premature.

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Background: Conceptual Definition of a Binge

The primary dimensions of a binge, as defined by DSM-IV-TR, include the consumption of a large amount of food (excessive), a temporal boundary to the episode (brief), and a subjective experience of lack of control (compulsive, unrestrained). The

definition of a binge shares some similarities and possible differences across eating disorder diagnoses. The DSM-IV-TR defines a binge in BN and BED as:

1. Eating, in a discrete period of time (e.g., within any 2-h period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances; and
2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating) (p. 594).[1]

For AN-B/P subtype, no definition of a binge is provided.

The diagnosis of BED further specifies that binge eating episodes are associated with three of the following characteristics:

1. Eating much more rapidly than normal
2. Eating until feeling uncomfortably full
3. Eating large amounts of food when not feeling physically hungry
4. Eating alone because being embarrassed of how much one is eating, and
5. Feeling disgusted with oneself, depressed, or very guilty after overeating (p. 787).[1]

Additionally, the criteria for BED indicate that marked distress is associated with binge eating. In BED, binge eating occurs at least 2 days per week for 6 months whereas in BN, the behavior occurs at least twice a week for 3 months.[1] Another distinguishing factor between BED and BN is that binge eating in BED is not associated with the regular use of inappropriate compensatory behaviors.

These criteria reflect an attempt to operationalize an experience that is both variable and subjective. However, as any clinician or patient can attest, it is often difficult to assess time periods, distinct episodes, food amounts, and a "sense of lack of control." In general, patients often describe difficulty completing self-report instruments because of the subjectivity inherent in the terms. Moreover, it is not clear that the criteria of duration and the size of binge episodes have meaningful clinical utility.[2,3] For example, some patients will report having "many" binge episodes in the course of a 2-h period, with each "episode" followed by self-induced vomiting. This raises the question of whether or not this is one continuous binge episode or several. Thus, the following analysis examines the current state of the science regarding the construct validity of binge eating and its utility in predicting clinical outcomes.

Method

Data Source

A systematic review of the literature was conducted using Medline/PubMed electronic data base, searching through November 2008. An initial search used the key words "anorexia," "anorexia nervosa," "bulimia," "bulimia nervosa," "binge eating disorder," combined with "binge," "binge eating," "binge episode," or "binge eating episode." This resulted in a large number of "hits" and was refined to those entries limited to humans and the English language. Other relevant journal and nonjournal sources (e.g., book chapters) obtained from related reference lists and bibliographies were also examined.

The pooled literature was then examined for data-based reports having relevancy to the question of "What is the definition of a binge in persons with BN, BED, or AN-B/P subtype?" Although the diagnostic criteria have changed from *bulimia* (DSM-III)[4] to *bulimia nervosa* (DSM-IIIR and subsequent editions),[1,5] the term BN is used in this article to refer to individuals diagnosed with the syndrome, including those studies preceding the introduction of BN. Because many of the studies utilized the DSM as inclusion criteria, a binge episode was often predefined by these formerly nonempirically derived definitions and is an obvious bias inherent to most of the identified studies. The question was expanded to examine the associated attributes of a binge episode, including types of food consumed, environment, experience during the episode, and the corresponding antecedents and consequences as these may provide clinically informative characteristics regarding the episode. The significance of binge frequency is reviewed in detail elsewhere (See Ref. 6). The empirical evidence was reviewed to assess the extent to which it supports or refutes the current DSM-IV-TR characteristics of a binge episode. In addition, to address the pragmatic utility of the concept of a binge, related studies of potentially relevant clinical correlates such as prognosis and outcome were examined.

Findings and Implications for DSM-V

DSM-IV-TR Defined Attributes of a Binge

Discrete Period of Time. Data on the nature of a discrete period of time of a binge episode are primarily limited to studies of BN and BED. While the existing diagnostic criteria for binge episodes in BN include a temporal boundary to the event: "in a

discrete period of time (e.g., within any 2-h period)" (p. 594),[1] there are limited data on how this term is typically operationalized. Although most investigations have focused on the duration of a binge episode, a discrete period of time may encompass the integrity or continuity of a binge episode as well such that there may be bouts of binge eating within a discrete period of time. A handful of studies have reported on the duration of BN binge episodes, but it is difficult to draw conclusions because of the limited sample size and varied methods. Four studies, using self-report food records, indicate an average duration of binge episodes in persons with BN as 37 min,[7] 56 min,[8] 59 min,[9] and 1.18 h (range, 15 min to 8 h).[10] Studies suggest that most binges last less than 2 h, with 78–98% occurring within this time frame.[11,12] Consistent with these findings are laboratory studies of eating behavior, rated as highly typical of a binge episode among participants with BN, where the duration was 43 ± 16 min.[13]

Studies of BED suggest that the duration of a binge episode, as observed in test meal studies, range on average from 19 to 49 min.[14–16] This time frame is supported by a population based study showing that 85.5% of episodes occur in 2 h or less for persons experiencing binge eating.[17]

Based on the studies to date, the mean duration of a binge episode does fall within a 2-h period. Thus, the DSM guideline appears to encompass the majority of binges. However, there are descriptions of binges that last much longer than 2 h[18] and are sometimes labeled as "binge days" rather than binge episodes.[19] It is important to remember that for most studies, inclusion criteria required self-report of binges to be within the DSM criteria, or "within any 2-h period" (p. 594).[1] Furthermore, there is no evidence that clinical utility can be gained from distinguishing longer and shorter binge episodes.[3,20] It remains unclear if treatment recommendations should be different for binges that are short versus extended over a day. Or, more directly, does duration really matter?

Size. To determine whether an individual is binge eating, based on the current diagnostic criteria for BN, clinicians need to decide whether, during an episode of eating, the individual consumes "an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances" (p. 594).[1] Currently, this determination is subjective. Sometimes, the answer is clear, in cases where caloric intake is in the realm of thousands of calories during a short period of a few hours or less. Other times, the decision is difficult for clinicians to make. Further complicating this determination is the influence of semantic meanings in the person making the judgment of what is a binge, although size and loss of control appear to be salient features.[21] While explicit definitions of what constitutes a large amount of food may add reliability, validity also needs to be examined.

Researchers have examined the amount of food consumed during self-reported binge episodes among individuals with BN and BED in a variety of ways. Methods have included conducting laboratory experiments involving monitored eating behavior and the use of a single- and/or multi-item test meal paradigm. Comparison of test meal methods is further complicated by differences across studies in terms of time of day of administration, use of standardized meals and/or preloads before the test meal, variations in food types as well as instructions to binge eat (e.g., "let yourself go" and "eat as much as you can").[13,22,23] Other investigations have used prospective and retrospective self-report food diaries, as well as descriptive information collected via questionnaires and surveys (Tables 1 and 2). These methods, too, have great variations, particularly with regard to duration of data collection (e.g., prospective food diaries range from 2 days to 2 weeks). The wide variety of assessment methods, the questionable accuracy of self-reported intake, and the small sample size of many studies, all pose challenges for integrating findings and drawing broad conclusions.

Nonetheless, there is some consistency across a number of early studies in BN, primarily laboratory investigations involving multi-item or monitored eating paradigms, in the amount of calories consumed during perceived binge episodes.[9,13,22–24] Means from these studies were in the range of 3,000 kcal to nearly 4,500 kcal, although there was a wide variability within studies (ranging as much as 7,000 kcal).

Self-report studies (e.g., food diaries) of binge size in BN found generally lower average caloric intakes in perceived binges, but extremely wide ranges both between and within individuals. For instance, several food diary studies report an average caloric binge intake in the range of 1,173–1,945 kcal[29–33,35,37] while others report higher averages 2,415–2,799 kcal.[36,38] This variability in size may be due, in part, to definitions used for the individual studies. For example, some studies did not provide instructions regarding what constitutes a binge episode[29,30,35] or relied on the participants classification of the eating episode as a binge, as have other investigators.[33,37,38] Other investigations appear to

TABLE 1. Representative studies on average caloric size of binge episodes in BN

Authors	*N*	DSM Criteria	Method	Mean kcal ± SD/Binge	Range
Laboratory					
Mitchell and Laine, 1985[9]	6 IP	III	Monitored eating	4,394	1,436–8,585
Kaye et al., 1986[24]	12 IP	III	Monitored eating	3,500 ± 1,338	—
Kissileff et al., 1986[22]	7 IP/OP	III	Multi-item, standard breakfast	4,477 ± 2,154	2,083–8,499
			Single-item (ice cream), standard breakfast	1,336 ± 1,018	83–2,919
Hadigan et al., 1989[23]	11 IP/OP	IIIR	Multi-item, standard breakfast	3,469 ± 1,347	∼700–5,600
Walsh et al., 1989[13]	12 IP/OP	IIIR	Multi-item, standard breakfast	3,031 ± 1,658	—
			Typical of a binge	3,352 ± 1,193	—
	10 IP/OP	IIIR	Single-item (ice cream), standard breakfast	1,328 ± 874	—
Hadigan et al., 1992[25]	6 OP	IIIR	Multi-item, standard breakfast	2,164 ± 1,603	—
LaChaussee et al., 1992[26]	8 IP/OP	IIIR	Multi-item, standard breakfast	2,680 ± 2,137	—
			Single-item (ice cream), standard breakfast	1,390 ± 612	800–2,549
Walsh et al., 1992[27]	25 IP/OP	IIIR	Multi-item, standard breakfast	3,583 ± 1,834	—
Kaye et al., 1993[28]	17 IP/OP	IIIR	Monitored eating	2,131 ± 1,154	—
Self-Report					
Mitchell et al., 1981[10]	25 OP	III	Self-report of average binge	3,415	1,200–11,500
Johnson et al., 1982[11]	316 CM	III	Survey	4,800	1,000–55,000
Rosen et al., 1986[29]	20 TS	III	Food diaries: 1 of 2 weeks, prospective	1,459 ± 1,172	45–5,138
Davis et al., 1988[30]	20 OP	III	Food diaries: 6 days, prospective	1,306 ± 945	669–2,327
Rossiter et al., 1988[31]	20 OP	III	Food diaries: 1 week, prospective	1,458 ± 1,329	—
Woell et al., 1989[32]	30	—	Food diaries: 3 weeks, 24 h dietary recall	1,945	—
Jansen et al., 1990[8]	9 OP	IIIR	Food diaries: 1 week, prospective	2,632 ± 1,347	—
Rossiter and Agras, 1990[33]	32 OP	IIIR	Food diaries: 1 week, prospective	1,173 ± 999	52–5,465
Elmore and de Castro, 1991[34]	19 NTS	IIIR	Food diaries: 1 week, prospective	∼ 1,110	—
Gleaves et al., 1993[35]	20 OP	IIIR	Food diaries: 2 weeks, prospective	1,349 ± 837	100–6,600
Fitzgibbon and Blackman, 2000[36]	42 TS	IV	Questionnaire	2,799 ± 1,537	—
Alvarenga et al., 2003[37]	30 IP	IV	Food diaries: 2 weeks, prospective	1,331 ± 1,328	—
Alpers and Tuschen-Caffier, 2004[38]	29 IP/OP	IIIR	Food diaries: 2days, prospective	2,415 ± 1,584	1,716–3,252

SD, standard deviation; IP, inpatient; OP, outpatient; TS, treatment seeking; CM, community sample; NTS, nontreatment seeking.
Adapted from Guertin.[39]

TABLE 2. Representative studies on average caloric size of binge episodes in BED

Authors	*N*	DSM Criteria	Method	Mean kcal ± SD/Binge	Range
Laboratory					
Goldfein et al., 1993[15]	10 CM	QEWP	Multi-item, standard breakfast	1,515 ± 393	—
			Single-item (ice cream), standard breakfast	743 ± 245	—
Yanovski et al., 1992[14]	10 CM	IV	Multi-item, standard breakfast	2,963 ± 127	2,261–3,585
Guss et al., 1994[16]	10 IP/OP	IV	Multi-item, standard breakfast	1,515 ± 404	—
			Single-item (ice cream), standard breakfast	765 ± 239	—
Telch and Agras, 1996[40]	7 CM	IV	Multi-item, standard breakfast	1607 ± 686	—
Anderson et al., 2001[41]	8	IV	Single-item (ice cream), normal-sized lunch	1,308 ± 532	—
Guss et al., 2002[42]	21 CM	IV	Multi-item, standard breakfast	2,143	—
Bartholome et al., 2006[43]	8 CM	IV	Multi-item, evening	2,286 ± 475	—
Raymond et al., 2007[44]	12 CM	IV	Multi-item, standard breakfast and lunch	2,151 ± 430	—
Sysko et al., 2007[45]	12 TS	IV	Single-item (macaroni/cheese), standard breakfast	943 ± 271	—
Self-Report					
Fitzgibbon and Blackman, 2000[36]	35 TS	IV	Questionnaire	2,307 ± 1,205	—
Bartholome et al., 2006[43]	8 CM	IV	Food diaries: six 24 h recall interviews	1,938 ± 1,411	—

SD, standard deviation; QEWP, questionnaire on eating and weight patterns[46]; IP, inpatient; OP, outpatient; TS, treatment seeking; CM, community sample.
Adapted from Guertin.[39]

have relied on the DSM definition of a binge, although it is unclear what criterion was used to demarcate a binge episode.[36]

Some of these studies also looked in more detail at inter and intrasubject distributions of binge episode caloric intake in BN and provided support for the existence of eating episodes that were identified by participants as binges but did not involve consumption of objectively large amounts of food, commonly known as subjective binges. In two studies, approximately a third of participants reported binges that were <500 kcal in size.[32,33] Only a minority of the samples indicated binges greater than approximately 2,000 kcal: 27% and 16.6%, respectively.[29,33] Rossiter and Agras[33] highlight within-subject variation (mean sample range:

TABLE 3. Representative studies on average caloric size of binge episodes in self-identified binge eaters

Authors	*N*	Method	Mean kcal ± SD/Binge	Range
Crowther et al., 1984[47]	29	Food diary: 2 weeks, prospective	606	30–2,024
Jansen et al., 1990[8]	20	Food diary: 1 week, prospective	986 ± 513	—
Grilo et al., 1994[48]	50	Telephone interview 2–3days post episode	1,258 ± 558	618–4,931

SD, standard deviation.

1,905 kcal) as evidence that binges can vary dramatically in size. This is supported by the exceedingly large variability noted in Table 1.

Studies of average caloric binge size in BED have primarily relied on test meal paradigms (Table 2). Similar to what is observed in BN, BED multi-item test meals are larger in caloric size than single-item test meals and range from 1,515 to 2,963 kcal.[14,16] Variability within studies of BED seems smaller relative to that observed in BN. Yet, other investigations, relying on the use of self-identified binge eaters (Table 3), note a broad range of average caloric size across studies (30–4,931 kcal).[47,48] This large range may be related to study methods. For example, Crowther et al.[47] appear to have participants indicate which episodes were considered binges. Their lower range limit of 30 kcal would suggest that subjective binge episodes were included in the analysis. In contrast, Grilo et al.[48] defined a binge as "the consumption of greater than 500 kcal in a discrete episode while experiencing a sense of loss of control," thus accounting for a range that begins above 500 kcal (Table 3).

Following instructions to binge, laboratory studies of persons meeting provisional criteria for BED suggest that these individuals eat significantly more kilocalories during a test meal in comparison to obese controls[14–16,41,44,45] and normal weight controls,[16,41,44,45] and this effect occurs regardless of negative mood state.[40] Such differences in binge episode intake did not reach statistical significance for other studies using self-report food diaries[36] or test-meal paradigms that manipulated the presentation amount of binge foods.[49] In contrast to studies comparing BED with non-BED controls, persons with BED have significantly less caloric intake during laboratory experiments of binge eating when compared to normal-weight subjects with BN[16] or subjects with BN matched on body mass index (BMI).[50]

Although there have been studies of food intake in persons with AN,[51–56] there is a paucity of data measuring actual binge episodes in this population. In a single study of hospitalized women with either BN or a group described as having both AN and BN,[57] there were no differences in mean binge caloric intake between diagnostic groups (although the reported average binge size of 9,313 ± 6,100 kcal is substantially larger than observed in other studies; see Table 1). More recently, findings from ecological momentary assessment in 84 women with AN or subsyndromal AN (mean BMI = 17.2, SD = 0.9, range 14.5–18.5) suggest the daily caloric intake for days with binge eating and purging behavior (4557.2 ± 3070.0) is significantly larger than days with binge eating alone (1606.7 ± 856.1 kcal), purging alone (1368.8 ± 1340.5 kcal), or binge/purge free days (1612.1 ± 1568.0 kcal).[58] Reported eating episodes ranged from 0 (diet soft drink) to over 15,000 kcal suggesting that some episodes resemble binges observed in BN.[58]

Based on these studies, does size matter? Over the years, a distinction between subjective binge episodes and objective binge episodes has developed. For many individuals, the amount of food is not the primary factor in defining a binge episode,[59,60] and other factors such as loss of control have been argued to be more important in defining a binge episode.[61] For example, as reviewed by Latner and Clyne,[62] many individuals with BED do not use large size as a criterion for describing their own episodes as binges.

Studies of BN have also shown that the amount of food is not necessarily central to the definition of a binge episode. For example, one study showed that the majority of binge episodes described by women with BN to be less than 1,000 kcal.[33] An early study by Rosen et al.[29] proposed that the perception of having binged in persons with BN is likely linked to a subjective feeling of anxiety about having eaten too much, yet the amount may not in fact be objectively large. These investigators found no association between binge calories and subjective ratings of anxiety, suggesting that the anxiety associated with a binge is not necessarily linked with the amount of food consumed. Instead, the determination of whether an amount of ingested food is "excessive" versus acceptable could be influenced by a host of factors including type of food ("forbidden"), preceding intake during the day or week, or anticipation of upcoming intake. Clinically, a person's definition of "large amount" is

highly subjective and influenced by personal beliefs and rules, which can vary day to day. Any size of food over a predetermined dietary rule (whether it be 550 kcal or 2,000 kcal) could be perceived to be large.

Fairburn and Cooper[63] have long provided a conceptualization of binge episodes that acknowledges perceived binges that are small in size. A strong rationale for attending to subjective binge eating episodes was based on the early studies described briefly above.[64] Fairburn and Cooper[63] distinguish binges categorically based on size as objective or subjective eating (OBE or SBE) and provide a schema for assessment. OBE is characterized by consumption of a large amount of food and a sense of loss of control, whereas SBE involves the same sense of loss control but the consumption of a small to moderate amount of food. If SBE and OBE are associated with similar levels of clinical impairment and/or other clinical validators, size may be a less critical defining attribute. Several studies do in fact suggest that SBE is associated with significant clinical impairment, similar to OBE. Size of binge episode (SBE vs. OBE) did not differentiate responses of women with BN on measures of psychiatric symptomatology, interpersonal distress, trait self-esteem, self-efficacy, or social adjustment.[65] Degree of dietary restraint, disinhibition, hunger, or general psychopathology did not significantly differ in women meeting DSM-IV BN (OBE) compared to those with DSM-IV BN without OBE (SBE group).[66] A similar lack of relationships was observed in women with BED[67] and a community sample of women with disordered eating.[68] Studies of community-based samples support the idea that binge episodes need not be objectively large to be associated with significant eating disorder psychopathology and functional impairment.[69–71]

Some studies have examined the relationship between OBE and SBE to other clinical correlates. Binge size is correlated with increased BMI in persons with BED.[42] The age of onset of binge eating appears to be similar across groups of female students with OBE and SBE.[72] Frequencies of OBE and SBE do not appear to be correlated with each other,[73] while those with OBE are likely to have a higher frequency of binge eating and purging behavior in comparison to those with SBE.[66] SBEs and OBEs differentiated placebo responders from placebo nonresponders in persons with BED, with SBEs predicting placebo response, preliminarily suggesting possible differences in prognosis.[74]

In summary, the literature on binge size illustrates that many binges in BN and BED are characterized by the ingestion of extremely large quantities of calories, in the range of 2,000–5,000 kcal, but there is a wide variation in the size of perceived binge episodes and many reported binges consist of small to moderate amounts of calories. Noticeably absent is a body of data describing binge eating episodes in AN. Thus, conclusions are largely limited to BN and BED and suggest that factors other than size are important in the perception of defining an eating episode as a binge. So, when returning to the overarching question "what is a binge?" we are forced to rethink, as have others,[75] whether size should be one of the primary defining characteristics of a binge. If large size remains a defining characteristic in diagnostic classification for BN, it is important to recognize that this captures just one type of overeating episodes (OBE), and that there are other types (e.g., SBE) with potential clinical importance.[76] Perhaps, size should be considered more of a descriptive dimension, with possible subgroups: only OBE, combination of OBE and SBE, only SBE. To consider this as an option, however, a number of important questions need to be answered. Fifteen years ago, there was a call for empirical work to determine whether difference in size of "binges" was diagnostically significant,[76] and yet we have very little information on this topic. For example, the distribution of OBE and SBE in the population of individuals with BN remains relatively unknown and it is unclear how these concepts should be defined in terms of calorie estimations. It is unclear whether or not, and if so to what extent, there are people who experience only SBE or OBE. Nor do we know what percentage of the population experiences both SBE and OBE, and what is the relative occurrence of each within those individuals.

Future studies would benefit from focusing on increasing an understanding of binge size in AN-B/P subtype as this is a clear gap in the literature with little data. Additionally, studies are needed to understand the extent to which binge size may differ based on the type of regularly used compensatory behaviors (e.g., purging vs. nonpurging). Future studies may profit from exploring the extent to which treatment recommendations are different for someone only having OBE compared to someone having only SBE or a combination of the two. If different recommendations are not warranted, then size may not be relevant as a defining attribute of a binge.

Loss of Control. Perceived loss of control (LOC) over eating has long been considered a central feature of binge eating episodes,[61] and evidence supports the relevance and importance of this dimension of

binge eating.[21,62,68,77,78] In DSM III[4] and DSM III-R,[5] "lack" of control was a requirement for the diagnosis of BN, but was not considered a defining aspect of binge eating behavior. Experiencing a sense of LOC over eating was added in DSM-IV[1] as a defining attribute of a binge episode. The definition of LOC has evolved over time from (1) fear of not being able to stop eating voluntarily[4] to (2) a feeling of lack of control over eating behavior during the eating binges[5] to (3) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).[1] Perceived LOC is a challenging concept to operationalize and is an inherently subjective experience. There are a few specific questions in the Eating Disorder Examination (EDE)[63] that are often used to help patients understand the intended meaning of the phrase and clinicians assess the behavior:

1. Did you have a sense of loss of control at the time?
2. Could you have stopped eating once you had started?
3. Could you have prevented the episode from occurring?

LOC has not historically been a focus of research, but recent interest in exploring differences between objective and subjective binge episodes (see section above) has highlighted the role of LOC in binge eating. When the size parameter is manipulated, LOC is the remaining defining attribute.[68] Initial findings that SBE and OBE are both associated with eating disorder psychopathology such as dietary restraint and disinhibition, as well as general psychopathology, such as depression, anxiety, and stress, suggest that LOC is a critical underlying attribute of a binge.[65,66]

Some studies show that LOC is associated with higher caloric intake among individuals with BN. Walsh et al.[13] examined the association between ratings of perceived control over eating and calories consumed in multiple-course test-meal situations. There was a significant inverse correlation between degree of control and calories consumed ($R^2 = .58$) for the BN group, but not for the control group.

LOC is also associated with psychological markers of distress among individuals with BED. Colles et al.[78] reported that emotional disturbance, due to perceived LOC, is associated with more symptoms of depression, greater appearance dissatisfaction, and poorer mental health-related quality of life. LOC has been shown to be associated with eating disorder psychopathology in community sample of Latinas.[79] In a study comparing recurrent overeating with recurrent binge eating (the difference being that the latter experienced LOC associated with overeating), those with recurrent binge eating (i.e., BED) had greater negative affect and weight dissatisfaction.[80] Interestingly, women with BED have been found to identify binge episodes more by feelings of LOC than by amount eaten[60]; it would be helpful to know if this is true for those with BN and AN-B/P subtype as well.

Although limited in number, there have been a few studies exploring LOC of eating specifically among youth. Findings are consistent in that LOC is linked with eating disordered cognitions, body dissatisfaction, anxiety, and depression.[71,81–83] LOC eating commonly occurs in children, with approximately one-third of a sample endorsing the experience, and it does not appear to differ in caloric intake from episodes without LOC present.[84] LOC eating in children has been shown to be associated with greater increase in BMI over time with an additional 2.4 kg weight gain annually,[85] supporting previous studies showing a relationship between binge eating and increased body weight or adiposity in children.[86,87]

Much of the research on LOC has been done in the population with binge eating or BED, not BN specifically; more work is needed with individuals with BN to further explore the functional role of LOC in binge eating episodes, the link between LOC and psychological distress in BN, and to examine how LOC is targeted in treatments and whether making it a more explicit focus of intervention could impact treatment outcome. Further research is needed to advance an understanding of objective measurement of LOC, its severity, and how to define this for individuals who either may be in denial about having LOC or who report yielding to the urge as "habit" and not LOC. As noted by Tarnofsky-Kraff et al. in a pediatric study,[88] although applicable to adults, future research needs to examine the prevalence of LOC in overweight as well as normal weight [and underweight—AN-B/P subtype] populations, the utility of measuring LOC on a continuum versus a categorical variable, specificity and sensitivity of LOC measures, the relationship between LOC and other eating and noneating psychopathology, and implications for clinical outcomes.

Other Attributes of a Binge

Types of Food Consumed. Studies of BN[9,13,22,24,32,37–38] and BED[14,36,42,43] have consistently demonstrated that individuals eat increased amounts of carbohy-

drates and fats relative to protein during an episode, although macronutrient composition is not very different from the average American diet.[89] Binges consist of more snacks and dessert type foods.[10,12,14,30,32,37,90] Carbohydrate intake has been found to be higher during a binge compared to nonbinge meals in BN,[91] yet others have not observed such differences.[92] In BN, a pattern of drinking large amounts of fluid and eating softer foods to facilitate vomiting has been reported.[9,37,93]

Environment. Binges typically occur at home and alone for individuals with BN,[12,18,30,94,95] BED,[96,97] and for nonpurging persons who regularly binge eat.[48] Individuals tend to be secretive about binge eating, although more so about purging behavior.[18] Binge episodes commonly occur in the afternoon or evening;[12,30,32,48,95,98] however, in some studies, one-third to over one-half of samples report that a binge could occur at any time of the day.[18,99] Seeing or preparing food, starting to eat, attending parties or events, or having unstructured free time are other reported possible environmental cues.[18,48,94,95]

Antecedents. In studies of eating disorders, boredom,[12,18,100–102] loneliness,[18,102–104] anxiousness or tension,[9,12,18,93,96,100–103,105,106] irritability,[94,102,107] frustration,[12,102,107] anger and/or hostility,[12,94,96,97,102,104,105,108,109] depression or dysphoria,[12,99,100,102,103,107,109] depersonalization and derealization,[18] stress,[109,110] and/or general negative mood or affect[7,30,95,98,105,109–116] have been reported to occur immediately before a binge. Women with BED have been found to have less prebinge negativity than women with BN,[115] yet other investigations report similar levels of distress across groups.[100] Increased hunger,[12,48,94,95,97,99,102,110] absence of hunger,[18,30] dieting, starvation, and dietary restraint are additional reported antecedents.[18,101,113,114,117,118] Others note that dietary restraint contributes to binge cravings rather than being a direct antecedent.[119] Differences in dieting do not appear to be a factor preceding a binge episode across the diagnostic eating disorder categories.[101] Distorted cognitions related to perceived pressure to be thin and body dissatisfaction,[7,118,120] negative thoughts about oneself,[103] food cravings,[98,99] thoughts of food and planning binge episodes have all been reported to occur before a binge episode.[12,18,48,94,102,109,110]

Experience During the Binge. During the episode, individuals report feelings of self-disgust, guilt, anxiety, shame, helplessness, fat, bloated, out of control, having no will power,[102] and negative affect and mood.[7,121] In contrast, an early study suggests that a majority of individuals feel free of negative mood states while binge eating.[18] Persons with BN are reported to describe pleasure in eating during the episode[20] and individuals with BED are more likely than those with BN to enjoy the taste, smell, and texture of the food while binge eating.[100]

Consequences. The literature on postbinge affective response is substantial and suggests that immediately following binge eating there is a brief period of positive feelings for some individuals, postulated to be related to relief from self-awareness and negative affect[122,123]; however, these feelings are temporary and quickly replaced by negative emotions.[124,125] Feelings immediately after a binge may be related to a host of other factors including the accessibility to purging and other compensatory mechanisms. Some studies of BN note postbinge improvement in anxiety,[18,24,93] irritation, frustration, boredom,[107] and negative affect and anger/hostility.[109] Yet other studies of BN and a few in BED suggest increased negative mood,[94,97,98,113,124] anxiety,[99,104] guilt and/or shame,[97,99,104,107] and feeling spaced out and/or disgust.[107] Among studies including purging subtype BN, self-induced vomiting commonly terminates binge episodes.[10,12,18,22,29,98] Other curtailing factors include stomach pain, being interrupted or disturbed by another person, falling asleep, and dysphoria.[101]

Although there is a large body of literature on "other attributes" such as antecedents and consequences, the vast majority of studies have been conducted in women with BN. Few studies have examined these aspects across eating disorder categories and additional studies would be helpful to further elucidate the role of these attributes in persons with BED and AN.

Discussion

Based on the available empirical data, several conclusions and suggestions for further consideration can be made regarding the current and future DSM definitions of a binge episode. It is evident that binge eating occurs across diagnoses of BN, BED, ED-NOS, and AN-B/P subtype, yet there is no specific definition of binge eating for ED-NOS or AN-B/P. An overarching consideration is the extent to which separate, specific definitions of binge eating are needed for each diagnostic category or whether it may be more helpful to focus on core dimensions that are characteristic across diagnoses and could form the basis of a trans-diagnostic set of defining criteria. Heuristically, a uniform definition of

"binge eating" for all eating disorders is likely to have greater clinical utility and lead to less confusion than having different definitions of the concept across categories.

There appears to be empirically based consensus that a discrete period of time (e.g., within a 2 h period) for a binge episode is a reasonable guideline. The example of a 2 h period appears to capture the majority of binge episodes for these groups. There does not appear to be any immediate value to extend this guideline given that there is no evidence to suggest implications for treatment or clinical outcome. However, it remains unknown if there is any clinically significant value in understanding the integrity or continuity of a binge episode.

Similar to duration, LOC appears to have empirically based consensus as the most salient defining feature of a binge episode. Diagnostic guidelines could benefit from the additional information to help assess LOC, but there is no debate that this feature is central to the definition of a binge. One option for consideration, pending further study of implications for treatment and outcome, is whether the definition of a binge episode should be based primarily or solely on the presence of LOC.

Size or amount eaten appears to be the most controversial component of the definition for a binge episode and remains an important area of consideration for the field. It is known that people experience binges that are objectively large and fit into the notion of a "classic" binge, but it is increasingly clear that many persons experience SBE that are small to average size and accompanied by levels of distress similar to OBE. Some people experience both, while others only one or the other. While SBE may be associated with significant distress, defining SBE faces many of the same challenges as defining OBE. In fact, data show that reliability of ratings of SBEs is lower than for OBEs.[126–128] Further understanding of the significance of OBE and SBE is needed, including the ability to demarcate one from the other, and the reliability and validity across eating disorder diagnostic groups. The issue of binge size is further complicated by the paucity of data on the implications of binge size for treatment, outcome, and long-term recovery. Binge size may be less important in children, in whom LOC appears to be central attribute, and developmental considerations make determination of objective binge size problematic. While beyond the scope of the current review, it is important to note that size may be of particular relevance when it comes to risk for, or actual weight gain, as well as potential understanding of and assessment for underlying genetic and physiological mechanisms related to hunger, satiety, and gastric functioning.

There are various possibilities for modifying current diagnostic criteria to capture more nuanced information with respect to binge size. Examples include (1) subtyping (or using specifiers) within diagnoses, e.g., BN-OBE subtype, BN-SBE subtype, and BN mixed OBE/SBE subtype or (2) including size as one dimension in a list of possible (but not all required) defining features, similar to the list currently utilized in BED research criteria. However, such specific recommendations are difficult without additional research and clarification of a number of issues. It is challenging to achieve specificity in defining and operationalizing SBE, and yet the parameters clinicians would use to estimate OBE vs. SBE in the clinical setting are unclear. Is there a meaningful calorie cutoff and does this vary based on individual characteristics? There need to be clear boundaries in terms of differentiating an SBE from the not uncommon experience of overeating with associated guilt and/or regret. At what point does eating an ordinary amount of food with some associated feelings of LOC and guilt become pathological? Distress and interference in functioning, as well as degree of importance to self-concept, need to be considered. It is possible that distress associated with eating is partly related to the individual's typical intake and/or body size. For instance, for individuals with AN, eating a small amount of food may feel distressing and out of control relative to their typical daily intake and dietary rules. Similarly, individuals who have had bariatric surgery may describe SBE because even ingesting a "normal" meal could feel large relative to their recommended and typical daily intake. These binge episodes may be just as distressing and feel just as out of control as OBE. Studies are needed to gather more information for operationalizing the concept of SBE and understanding its implications for the prognosis and treatment response.

Further research is also needed to determine whether treatment recommendations should differ depending on the presence of only OBE, only SBE or both. Studies comparing clinical outcomes by group across different treatments or different components of already established treatments would be useful. For instance, do individuals who have regular SBE benefit from the behavioral interventions of CBT or could treatment focus solely on cognitive elements?

More work is needed to clarify whether there are meaningful clinical correlates of OBE that differ

from SBE. If there are no differences in meaningful clinical correlates and no warranted differences in treatment recommendations, change to diagnostic criteria may consist only of expanding the size criterion to include smaller amounts of food so that SBE are recognized within diagnoses other than ED-NOS. If, however, further research shows that individuals with different profiles, in terms of binge size, respond differently to treatments and have important differences in clinical correlates, then more substantial modifications to current criteria may be warranted.

While this review attempted to be comprehensive, several limitations should be noted. The articles identified by the search are limited by the selected search terms, consistency of recognized terms, and mesh database. Importantly, many of the reviewed studies utilized the DSM as inclusion criteria, and thus a binge episode was often predefined by these formerly nonempirically derived definitions and poses an obvious bias. Additionally, among those studies selected for review, a number of them made some type of modification in applying diagnostic criteria. For example, some elected to include only purging BN participants or to include BN individuals who binge once a week. Furthermore, sampling remains a consideration given that endorsement of symptoms appears to be lower in community relative to hospital-affiliated samples.[46] Methods used by a number of studies pose limitations to generalization including the reliance on self-report (e.g., food diaries) and use of laboratory settings which are not representative of the individual's typical experience.

In summary, available empirical evidence supports the current DSM duration and LOC attributes of a binge episode in BN and BED. However, the extent to which size is important in the definition of a binge episode (e.g., SBE vs. OBE) across diagnostic categories remains in need of further study, particularly with regard to the extent to which it informs prognosis, treatment, and clinical outcomes. Additionally, further investigation is needed to elucidate the clinical characteristics of binge eating in AN.

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