Development of the 7-Item Binge-Eating Disorder Screener (BEDS-7)

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ABSTRACT

Objective: Develop a brief, patient-reported screening tool designed to identify individuals with probable binge-eating disorder (BED) for further evaluation or referral to specialists.

Methods: Items were developed on the basis of the *DSM-5* diagnostic criteria, existing tools, and input from 3 clinical experts (January 2014). Items were then refined in cognitive debriefing interviews with participants self-reporting BED characteristics (March 2014) and piloted in a multisite, cross-sectional, prospective, noninterventional study consisting of a semistructured diagnostic interview (to diagnose BED) and administration of the pilot Binge-Eating Disorder Screener (BEDS), Binge Eating Scale (BES), and RAND 36-Item Short-Form Health Survey (RAND-36) (June 2014–July 2014). The sensitivity and specificity of classification algorithms (formed from the pilot BEDS item-level responses) in predicting BED diagnosis were evaluated. The final algorithm was selected to minimize false negatives and false positives, while utilizing the fewest number of BEDS items.

Results: Starting with the initial BEDS item pool (20 items), the 13-item pilot BEDS resulted from the cognitive debriefing interviews (n = 13). Of the 97 participants in the noninterventional study, 16 were diagnosed with BED (10/62 female, 16%; 6/35 male, 17%). Seven BEDS items (BEDS-7) yielded 100% sensitivity and 38.7% specificity. Participants correctly identified (true positives) had poorer BES scores and RAND-36 scores than participants identified as true negatives.

Conclusions: Implementation of the brief, patient-reported BEDS-7 in real-world clinical practice is expected to promote better understanding of BED characteristics and help physicians identify patients who may have BED.

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Binge-eating disorder (BED) was formally included as a distinct eating disorder in the *DSM-5*.[1] BED is characterized by recurrent episodes of binge eating accompanied by feeling a lack of control and marked distress over one's eating behaviors. The binge episodes must occur on average at least once per week over a 3-month period, not occur exclusively during the course of bulimia nervosa or anorexia nervosa, and not be associated with recurrent inappropriate compensatory behaviors.[1] The 12-month prevalence rates of BED in the United States for adult women and men are estimated at 1.6% and 0.8%, respectively.[2] The estimated lifetime prevalence in the US population is approximately 2.6[2] and is expected to increase.[3,4] However, recognition of BED within the general medical community is most likely limited due to a lack of awareness of and familiarity with this newly categorized eating disorder.

In a recent systematic literature review, Ágh and colleagues[5] concluded that BED is a serious condition that impairs health-related quality of life (HRQL) and increases health care costs. Ágh et al[5] presented several studies finding lower levels of HRQL for patients with BED in comparison to general population norms based on Medical Outcomes Study 36-item Short-Form Health Survey physical and mental component summary scores.[6,7] BED has been linked with several comorbid health conditions, including diabetes, hypertension, stroke, and heart disease,[2] and other psychiatric illnesses such as anxiety and depression.[8]

Effective treatments for BED have the potential to reduce the burden of BED on patients and the health care system. Because general practitioners have the most contact with patients overall and psychiatrists see patients at higher risk for BED (eg, patients with eating disorders and associated mental health issues), general medicine and psychiatric practices may be ideal settings for assessment of BED. A BED screening tool could improve general awareness and knowledge of BED and facilitate patient-physician communication in both general and specialty settings. However, to our knowledge, no existing tool reflects the *DSM-5* criteria for BED and is brief enough for physicians to easily incorporate into their practices. The focus of this article was to describe the qualitative and quantitative research conducted to develop the 7-item Binge-Eating Disorder Screener (BEDS-7), a patient-reported screening tool designed to identify individuals with probable BED for further evaluation or referral.

METHODS

The BEDS-7 was developed in 3 phases: development of an initial item pool based on *DSM-5* diagnostic criteria, existing tools, and input from clinical experts (January 2014); cognitive debriefing interviews to test and refine draft items (March 2014); and quantitative evaluation to finalize and develop a scoring algorithm for the screener (June 2014–July 2014).

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki 2008 and reviewed and approved by RTI International's Institutional Review Board (Durham, North Carolina).

Clinical Points

- Binge-eating disorder (BED) is a new and distinct diagnosable eating disorder in the *DSM-5*; as such, physicians are less familiar with recognizing its signs and symptoms.
- The 7-item Binge-Eating Disorder Screener (BEDS-7), a brief screener for BED, can assist physicians in identifying patients who may have BED and making the necessary follow-up decisions related to patient referrals or additional assessment and potential diagnosis of BED.
- While the BEDS-7 could be incorporated into a general screening assessment for various health and psychiatric conditions, physicians may need additional education and insight into identifying specific patients at highest risk for BED or those who would benefit most from its identification and potential treatment.

Initial Item Development

Potential concepts for the screening tool were identified through a review of *DSM-5* diagnostic criteria (Table 1) and targeted literature search of existing patient-reported tools designed to assess the signs and symptoms of BED. On the basis of identified concepts, a preliminary item pool was developed by 3 psychologists (D.B.D., S.E.F., and T.M.B.) and instrument development experts. Phone interviews were conducted with 3 BED clinical experts to obtain feedback on candidate items and ensure that the *DSM-5* criteria were accurately represented.

Cognitive Debriefing Interviews

To pretest and refine the draft BEDS item pool, 2 iterative sets of face-to-face cognitive debriefing interviews were conducted with 13 participants self-reporting BED characteristics in 2 US locations. Interview participants, recruited and screened by qualitative research firms in each location, were aged ≥ 18 years with a normal or greater body mass index (BMI ≥ 19) based on self-reported height and weight. Each firm recruited from their established database of general community residents previously agreeing to be contacted for research opportunities.

Participants were asked to answer and provide feedback on the draft BEDS items using a "think-aloud" process to identify any problems with question phrasing or response options. The interviewers also asked participants how they would revise the BEDS items (if needed) to make them clearer and easier to answer. The initial pool of 20 items (tested in the first set of interviews) addressed 13 unique concepts. A reduced item pool of 15 items was tested in the remaining interviews; alternative items were tested for several concepts. Results from these interviews were used to create a 13-item draft version of the BEDS for quantitative evaluation and further refinement. The 13 draft items represented each *DSM-5* diagnostic criterion for BED.

Quantitative Evaluation

Data were collected from 97 participants in a multisite, cross-sectional, prospective, noninterventional study to finalize the content and develop a scoring algorithm for the screener.

Table 1. *DSM-5* Criteria for Binge-Eating Disorder[a]

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
   1. Eating, in a discrete period of time (eg, within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances
   2. A sense of lack of control over eating during the episode (eg, a feeling that one cannot stop eating or control what or how much one is eating)

B. The binge-eating episodes are associated with 3 (or more) of the following:
   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 of feeling embarrassed by how much one is eating
   5. Feeling disgusted with oneself, depressed, or very guilty afterward

C. Marked distress regarding binge eating is present

D. The binge eating occurs, on average, at least once a week for 3 months

E. The binge eating is not associated with the recurrent use of inappropriate compensatory behavior as in bulimia nervosa and does not occur exclusively during the course of bulimia nervosa or anorexia nervosa

[a]Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (©2013). American Psychiatric Association.[1]

Sample

Similar to the pool of general community residents in the cognitive debriefing interviews, participants with and without self-reported BED characteristics were recruited and screened by qualitative research firms in 4 US locations. Participants were aged ≥ 18 years with a normal or greater BMI (≥ 19). Due to the low prevalence of BED, individuals more likely to meet diagnostic criteria for BED were overrecruited. Specifically, screening items consistent with the *DSM-5* criteria for BED[1] were developed and used to target a study sample with half of the participants self-reporting all BED characteristics.

Procedure

Individual data collection sessions consisted of a semistructured diagnostic interview administered by 1 of 2 PhD-level clinical psychologists (D.B.D. and T.M.B.) (to diagnose BED) and administration of the 13-item BEDS pilot version, the Binge Eating Scale (BES),[9] and the RAND 36-Item Short-Form Health Survey (RAND-36).[10] Interviewers were blinded to participants' responses to the recruiting items and self-report instruments. The order of the diagnostic interview and instrument administration was counterbalanced.

Given the absence of any known clinical interviews updated to reflect the *DSM-5* criteria (at the time of this study), the BED criteria from the Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders–Research Version, Non-Patient Edition (SCID-I/NP)[11] were updated. Study participants were diagnosed as having BED (yes) or not having BED (no) using the modified BED portion of the

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Table 2. Binge-Eating Disorder Screener (BEDS) 13-Item Pilot Version Item-Level Response Distributions[a]

BEDS Item/Response	BED Diagnosis[b] Yes (n = 16)	BED Diagnosis[b] No (n = 81)
1 Episodes of excessive overeating in last 3 months, n	16	81
Yes	16 (100.0)	76 (93.8)
No	0	5 (6.2)
Missing	0	0
2 Episodes of excessive overeating at least once per week in last 3 months, n	16	81
Yes	14 (87.5)	49 (60.5)
No	2 (12.5)	32 (39.5)
Missing	0	0
3 Feel distressed about episodes of excessive overeating, n	16	76
Yes	16 (100.0)	56 (73.7)
No	0	14 (18.4)
Missing	0	6
4 No control over eating, n	16	76
Never or rarely	0 (0)	11 (14.5)
Sometimes	6 (37.5)	14 (18.4)
Often	6 (37.5)	35 (46.1)
Always	4 (25.0)	16 (21.1)
Missing	0	0
5 Eat faster than normal, n	16	76
Never or rarely	1 (6.3)	17 (22.4)
Sometimes	5 (31.3)	20 (26.3)
Often	5 (31.3)	20 (26.3)
Always	5 (31.3)	18 (23.7)
Missing	0	1
6 Eat until uncomfortably full, n	16	76
Never or rarely	0	4 (5.3)
Sometimes	3 (18.8)	21 (27.6)
Often	8 (50.0)	28 (36.8)
Always	5 (31.3)	22 (28.9)
Missing	0	1
7 Continue eating even though not hungry, n	16	76
Never or rarely	0	4 (5.3)
Sometimes	2 (12.5)	12 (15.8)
Often	9 (56.3)	28 (36.8)
Always	5 (31.3)	32 (42.1)
Missing	0	0
8 Embarrassed by how much eaten, n	16	76
Never or rarely	0 (0)	13 (17.1)
Sometimes	3 (18.8)	21 (27.6)
Often	3 (18.8)	16 (21.1)
Always	10 (62.5)	26 (34.2)
Missing	0	0
9 Disgusted or guilty afterward, n	16	76
Never or rarely	0	9 (11.8)
Sometimes	2 (12.5)	13 (17.1)
Often	3 (18.8)	22 (28.9)
Always	11 (68.8)	32 (42.1)
Missing	0	0
10 Make self vomit, n	16	76
Never or rarely	15 (93.8)	70 (92.1)
Sometimes	1 (6.3)	4 (5.3)
Often	0	1 (1.3)
Always	0	1 (1.3)
Missing	0	0
11 Use laxatives, diuretics, or other medications, n	16	76
Never or rarely	14 (87.5)	64 (84.2)
Sometimes	0 (0)	4 (5.3)
Often	2 (12.5)	3 (3.9)
Always	0	5 (6.6)
Missing	0	0
12 Exercise excessively, n	16	76
Never or rarely	11 (68.8)	47 (61.8)
Sometimes	3 (18.8)	11 (14.5)
Often	1 (6.3)	9 (11.8)
Always	1 (6.3)	9 (11.8)
Missing	0	0
13 Fast or severely reduce food intake intentionally, n	16	76
Never or rarely	11 (68.8)	46 (60.5)
Sometimes	3 (18.8)	19 (25.0)
Often	1 (6.3)	6 (7.9)
Always	1 (6.3)	5 (6.6)
Missing	0	0

(continued)

[a]Data are presented as n (%) unless otherwise specified.
[b]As determined by a modified version of the BED criteria (part of module H) from the Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders–Research Version, Non-Patient Edition.[11]

SCID-I/NP. As part of the informal training to conduct the diagnostic interview, both interviewers diagnosed an initial set of participants and discussed any differences related to the use and interpretation of interview feedback until consensus was obtained.

The 16-item BES measures the presence and severity of binge-eating behaviors that may be indicative of an eating disorder. Total scores range from 0 to 46 points. BES cut scores proposed by Timmerman[12] were used to classify study participants into 3 severity subgroups: none or mild (≤ 17), moderate (18 to 26), and serious (≥ 27). The RAND-36, a 36-item generic HRQL measure, assesses 8 concepts and yields subscale scores for each, ranging from 0 to 100, with higher values denoting more favorable health.

Analysis

The observed item-level response distributions of the 13 BEDS items by BED diagnosis were reviewed to guide the selection of an optimal algorithm for identifying participants' BEDS screening status (positive or negative).

A reference BEDS classification algorithm was defined by a specific response pattern to the 13 items on the basis of *DSM-5* criteria. Numerous alternative classification algorithms were also formed by altering the responses required for the 13 items under the reference algorithm and eliminating nondiscriminating items (between those who did and did not meet the BED diagnostic criteria from the clinical interview). Each classification algorithm resulted in 4 diagnostic accuracy subgroups (true positive, false positive, true negative, false negative) on the basis of structured clinical interview (BED diagnosis: yes or no) and BEDS algorithm screening status.

The accuracy of the reference and alternative BEDS screening status subgroups in predicting BED diagnosis (ie, sensitivity and specificity) was tabulated to compare algorithm performance. The optimal algorithm was expected to produce a reasonable number of false positives while minimizing the number of false negatives so that most or all individuals with BED are detected for follow-up and few, if any, are missed.

Table 3. Participant Characteristics at Screening (N = 97)

Characteristic/Item	BED Diagnosis[a] Yes (n = 16)	No (n = 81)
Sex, female, n (%)	10 (62.5)	52 (64.2)
Age, mean years (SD)	42.4 (12.0)	40.6 (12.3)
Body mass index category, n (%), kg/m^2		
Underweight (< 18.5)	0	0
Normal (18.5–24.9)	1 (6.3)	16 (19.8)
Overweight (25–29.9)	3 (18.8)	25 (30.9)
Obese (30–39.9)	7 (43.8)	30 (37.0)
Extreme obesity (≥ 40)	5 (31.3)	10 (12.3)
Race/ethnicity, n (%)		
White	8 (50.0)	58 (71.6)
Black	4 (25.0)	10 (12.3)
Asian	0	7 (8.6)
Hispanic or Latino	2 (12.5)	4 (4.9)
Other	2 (12.5)	2 (2.5)
Current employment, n (%)		
Full-time	7 (43.8)	43 (53.1)
Part-time	5 (31.3)	14 (17.3)
Not employed or retired	3 (18.8)	14 (17.3)
Disabled	0	3 (3.7)
Student	1 (6.3)	7 (8.6)
Participation in a weight-loss program in the past 2 years, yes, n (%)	5 (31.3)	11 (13.6)

[a]As determined by a modified version of the BED criteria (part of module H) from the Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders–Research Version, Non-Patient Edition.[11]

RESULTS

Initial BEDS Item Pool

The preliminary BEDS item pool developed for clinical expert review included 18 items addressing 12 unique concepts relevant to the diagnosis of BED (alternative items were developed for 6 concepts).

While all 3 clinical experts deemed these 18 items to be appropriate candidates for a BED-specific screener, several improvements resulted, including minor modification of several items and the addition of new items addressing the concept of distress (due to bingeing). The experts also recommended the implementation of a stopping rule at the beginning of the screener if respondents indicated a lack of binge eating in the past 3 months. The resulting pool of 20 items addressed 13 unique behaviors pertaining to binge eating and the lack of recurrent compensatory behaviors (eg, vomiting) and included alternative items for 7 of these concepts.

Cognitive Debriefing Interviews

The cognitive debriefing participants (n = 13) had a mean age of 41.6 years (range, 21–59 years) and a mean BMI of 36.2 (range, 23.3–53.2), and 53.8% (n = 7) were female. Approximately two-thirds (69.2%, n = 9) were white, and 92.3% (n = 12) had completed at least some college. While interview participants reported many BED characteristics, none had received a diagnosis of BED from a health care professional.

Interview participants easily understood the BEDS instructions, questions, and response scales. As noted previously, alternative items were tested; the items deemed clearer or easier to answer by interview participants were retained for further testing.

On the basis of results of the 2 iterative rounds of cognitive debriefing interviews, and representing all *DSM-5* BED criteria, a 13-item pilot version of the BEDS was developed (Table 2). Items 1 and 2 establish the presence of participants' excessive overeating during the past 3 months. If a participant reports at least 1 episode of excessive overeating per week during that time period, he or she is directed to items 3–13. If a participant reports no episodes of excessive overeating (no to both items 1 and 2), the participant is directed to stop.

Quantitative Evaluation

Ninety-seven adults participated in the BEDS quantitative evaluation. Table 3 shows the participant characteristics by BED diagnosis status and overall. Of the 97 participants, the ratio of females to males was relatively similar—approximately 60%:40%—across BED diagnosis status. Nearly half (n = 47, 48.5%) endorsed all the recruitment screening items consistent with the *DSM-5* criteria for BED (data not shown), and 16 (16.5%) of these participants were ultimately diagnosed with BED via the clinical interviews. The proportions of females and males diagnosed with BED were similar (10/62 female, 16%; 6/35 male, 17%). While the small sample size prohibits generalization, compared to those not diagnosed with BED, participants with BED tended to be slightly older (median age: 46 years), have higher BMIs (median: 34.7), be black or Hispanic, be employed part-time, and have participated in a weight-loss program.

The mean and median item scores tended to be similar in magnitude, irrespective of the order of the diagnostic interview and instrument administration. Table 2 shows the item-level response distributions of the 13-item pilot BEDS.

BEDS Classification Algorithms

The left side of Table 4 shows the item response pattern of the reference BEDS classification algorithm. The right side of Table 4 shows that only 3 of the 16 participants diagnosed with BED during the clinical interview responded in a manner wholly consistent with the reference algorithm, yielding a low sensitivity of 18.8% (true positive rate) and an unacceptably high false-negative rate of 81.2% (ie, 13 of 16). However, a specificity of 89.3% indicates that the majority of participants not diagnosed with BED on the basis of the clinical interview were also not identified as probable BED by the reference algorithm.

Because a primary goal was to develop a screener that would identify all (or nearly all) individuals with probable BED, instrument developers considered discarding items that reduced sensitivity, while retaining items that maximized specificity. Originally, item 1 (excessive overeating in last 3 months) and item 2 (excessive overeating at least once per week in last 3 months) were viewed as key items because their content is important in a clinical interview. However, the inclusion of item 2 in the BEDS-7 algorithm (for a total of 8 items) yielded a sensitivity of 87.5% and specificity of 56.0%. All 16 participants diagnosed with BED responded

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Table 4. Diagnostic Accuracy of the BEDS Reference and BEDS-7 Classification Algorithms and the BES Severity Subgroups[a]

Classification Method	BEDS Response	Required BEDS Item Response													BEDS Screening Status	BED Diagnosis Status, n[b]		
		Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13		Yes	No	Total[c]
Reference algorithm	Yes	X	X	X	–	–	–	–	–	–	–	–	–	–	Positive	3 (18.8)[d]	8	11
	No	–	–	–	–	–	–	–	–	–	–	–	–	–	Negative	13	67 (89.3)[e]	80
	Never/rarely	–	–	–	–	–	–	–	–	–	X	X	X	X	Total	16	75	91
	Sometimes	–	–	–	–	–	–	–	–	–	–	–	–	–				
	Often	–	–	–	X	X[f]	X[f]	X[f]	X[f]	X[f]	–	–	–	–				
	Always	–	–	–	X	X[f]	X[f]	X[f]	X[f]	X[f]	–	–	–	–				
BEDS-7 algorithm	Yes	X	–	X	–	–	–	–	–	–	–	–	–	–	Positive	16 (100.0)[d]	46	62
	No	–	–	–	–	–	–	–	–	–	–	–	–	–	Negative	0	29 (38.7)[e]	29
	Never/rarely	–	–	–	–	–	–	–	–	–	X	–	–	–	Total	16	75	91
	Sometimes	–	–	–	X	–	–	X	X	X	X	–	–	–				
	Often	–	–	–	X	–	–	X	X	X	–	–	–	–				
	Always	–	–	–	X	–	–	X	X	X	–	–	–	–				
BES severity subgroup[g]	NA														Moderate/serious (18+)	16 (100.0)[d]	54	70
															None/mild (≤17)	0	27 (33.3)[e]	27
															Total	16	81	97

[a]X indicates that the response is required for a positive classification by the BEDS, – indicates that the response is not required. Positive and negative predictive values were not estimated due to the oversampling of individuals with BED characteristics in the quantitative evaluation sample.
[b]BED diagnosis was determined by a clinical interview using a modified version of the BED criteria (part of module H) from the Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders–Research Version, Non-Patient Edition.
[c]Of the 97 participants, 91 responded "yes" or "no" to item 1, item 2, and item 3.
[d]The sensitivity is presented in parentheses and is defined as the probability that the BEDS algorithm will be positive when the participant was diagnosed with BED (ie, true positive rate).
[e]The specificity is presented in parentheses and is defined as the probability that the BEDS algorithm will be negative when the participant was not diagnosed with BED (ie, true negative rate).
[f]At least 3 of the 5 items (5, 6, 7, 8, and 9) marked as "often" or "always."
[g]Timmerman[12] BES subgroups: none or mild (≤17 points), moderate (18 to 26 points), and serious (≥27 points).
Abbreviations: BEDS = Binge-Eating Disorder Screener, BES = Binge Eating Scale, NA = not applicable.

yes to item 1 and only 14 responded yes to item 2. While the specificity of the algorithm including item 2 was moderately better than the BEDS-7 algorithm (38.7%), sensitivity was reduced by 12.5%. Measurement error associated with item 2 was also a concern, because respondents must recall the total number of episodes during the past 3 months and divide by 12 to ensure an accurate answer. Ultimately, the developers decided to remove item 2 rather than sacrifice some of the screener's sensitivity by retaining a question with a significant potential for inaccurate response.

Researchers explored over 15 alternative BEDS classification algorithms without including responses on item 2 (data not shown); item 1 and item 3 (distress) were included to maintain maximum sensitivity (100% using only items 1 and 3). Response distributions of the remaining 10 items were reviewed, and each item was added to gauge its impact on specificity. The response patterns for item 5 (eat faster than normal), item 6 (eat until uncomfortably full), and item 7 (continue eating) were similar with overlapping content. To create the briefest screener, only item 7 was retained. Additionally, while the items addressing compensatory behaviors (items 10, 11, 12, and 13) did not contribute substantially to the screener's predictive value, to maintain face validity, item 10 (vomiting) was retained.

Ultimately, 7 items (final BEDS-7 items shown in Supplementary Appendix 1) were retained in the algorithm that maximized sensitivity and obtained the highest possible specificity. The response pattern of the BEDS-7 required for a diagnosis of BEDS is shown in the left-hand side of Table 4. The BEDS-7 algorithmic scheme yielded 100% sensitivity and 38.7% specificity when applied to the study sample. Specifically, with use of the BEDS-7, 100% of the participants who received a diagnosis of BED via the clinical interview screened positive (true positives). Among those without a diagnosis of BED (n = 75), 38.7% (n = 29) screened negative on the BEDS-7 (true negatives). Forty-six of the 62 participants who screened positive using the BEDS-7 (74.2%) were not diagnosed with BED via clinical interviews. Table 4 shows that the sensitivity (at 100%) and specificity (33.3%) of the 16-item BES subgroup[12] ranges were similar to those observed using the BEDS-7.

Table 5 shows select characteristics for participants identified by the BEDS-7 algorithm as true positives, true negatives, and false positives (there were no false negatives due to the 100% sensitivity). A higher proportion of women (71%, 44 of 62) than men (51%, 18 of 35) were identified with probable BED. Of the participants identified with probable BED, those who were not diagnosed with BED tended to be younger (median age: 33.5 years) and have a lower BMI (median: 30.9) than those diagnosed with BED (median age: 46.0 years, median BMI: 34.7). Notably, participants who were classified as unlikely to have BED had the lowest median BMI (29.9). Participants who were correctly identified tended to have higher BES scores and lower mean RAND-36 subscale scores, both indicating poorer health status, than participants identified as true negatives.

Table 5. Sample Characteristics by Subgroups Formed by BEDS-7 Screening Status and BED Diagnosis Status[a,b,c]

Characteristic/Measure	True Positives (n = 16)	False Positives (n = 46)	True Negatives (n = 29)
Sex, female, n (%)	10 (62.5)	34 (73.9)	16 (55.2)
Age, mean years (SD)	42.4 (12.0)	36.4 (10.6)	47.0 (11.4)
Body mass index, mean (SD), kg/m^2	36.3 (9.4)	32.4 (8.4)	31.4 (7.9)
Body mass index category, n (%)			
Underweight (< 18.5)	0	0	0
Normal (18.5–24.9)	1 (6.3)	9 (19.6)	4 (13.8)
Overweight (25–29.9)	3 (18.8)	12 (26.1)	11 (37.9)
Obese (30–39.9)	7 (43.8)	19 (41.3)	10 (34.5)
Extremely obese (≥ 40)	5 (31.3)	6 (13.0)	4 (13.8)
Participation in a weight-loss program in the past 2 years, yes, n (%)	5 (31.3)	9 (19.6)	1 (3.5)
Race, n (%)			
White	8 (50.0)	31 (67.4)	21 (72.4)
Black	4 (25.0)	8 (17.4)	2 (6.9)
Asian	0	5 (10.9)	2 (6.9)
Hispanic or Latino	2 (12.5)	2 (4.3)	2 (6.9)
Other	2 (12.5)	0	2 (6.9)
BES score, mean (SD)	30.4 (7.5)	25.3 (6.4)	13.6 (9.7)
BES score subgroups, n (%)			
None or mild (≤ 17)	0	4 (8.7)	20 (69.0)
Moderate (18–26)	5 (31.3)	25 (54.3)	4 (13.8)
Serious (≥ 27)	11 (68.8)	17 (37.0)	5 (17.2)
RAND-36, mean (SD)			
Physical functioning	66.3 (23.8)	78.8 (18.4)	70.0 (28.7)
Role limitations due to physical health	56.3 (32.3)	64.7 (37.5)	63.4 (46.4)
Role limitations due to emotional problems	43.8 (45.1)	59.4 (37.8)	64.3 (45.3)
Energy/fatigue	34.1 (19.9)	38.6 (20.1)	48.9 (26.4)
Emotional well-being	53.5 (18.6)	58.6 (20.0)	70.9 (19.5)
Social functioning	54.7 (28.1)	63.3 (22.9)	72.8 (25.0)
Pain	61.7 (24.9)	69.0 (24.6)	64.1 (20.8)
General health	44.7 (19.2)	54.2 (21.2)	59.1 (24.6)

[a]As determined by a modified version of the BED criteria (part of module H) from the Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders–Research Version, Non-patient Edition.[11]

[b]Given the 100% sensitivity for the BEDS-7 classification algorithm (ie, all true positives were identified), the table does not show false negatives as this subgroup of participants was inaccurately overlooked (with a negative screening) and a gold-standard diagnosis of BED was not identified.

[c]A total of 91 participants (instead of 97) was the base for the BEDS classification algorithm due to missing values on the pilot version of the BEDS.

Abbreviations: BEDS-7 = 7-item Binge-Eating Disorder Screener, BES = Binge Eating Scale, RAND-36 = RAND 36-Item Short-Form Health Survey.

DISCUSSION

The goal of this study was to develop a brief, valid, patient-reported screening tool for use in primary care and general psychiatry settings to identify individuals most likely to have BED and to facilitate further evaluation or referral to specialists. The 13-item BEDS pilot version, developed with a review of existing instruments and input from BED clinical experts, was included in a cross-sectional study of 97 participants, including a semistructured clinical interview to diagnose BED. Although the presence of all 13 concepts addressed in the BEDS pilot version is required to clinically diagnose BED (per *DSM-5* criteria), analyses were conducted to investigate the feasibility of eliminating items for the briefest screening tool possible without sacrificing its face and content validity or predictive ability. Maximizing the sensitivity of the BEDS was considered critical to ensure that future respondents with BED receive further evaluation and care. Additionally, a moderate level of specificity was considered reasonable because the consequences of further evaluating a modest number of individuals without BED are outweighed by those of missing individuals needing treatment.

The sensitivity and specificity of numerous candidate classification algorithms were evaluated. The BEDS-7 maximized sensitivity (100%) while closely preserving the content of the *DSM-5* criteria. In comparison to the 16-item BES, the BEDS-7 is shorter with comparable sensitivity and specificity. Contributing to the high rate of false positives from the BEDS-7 was a large proportion of individuals who did not meet diagnostic criteria for BED during the clinical interview but reported that they were regularly engaging in excessive overeating episodes, had a lack of control over this behavior, and were distressed about the behavior.

A potential weakness of this study is the small number of individuals diagnosed with BED (n = 16) from the clinical interviews. Obtaining a larger sample of individuals diagnosed with BED was the original intent, but differences between individuals' initial self-report of food and eating behaviors and perceptions via the phone screening versus those obtained in the clinical interview proved meaningful. As such, consistent with the high rate of false positives from the BEDS-7, many individuals not diagnosed with BED self-reported BED behaviors and beliefs.

A strength of this study is the rigorous design, which allowed for the development of a brief screening tool based on existing instruments, clinician and patient input, and quantitative evaluation to inform item reduction and scoring in a sample of participants including a subset diagnosed with BED. Additionally, the BEDS-7 would appear to have broader utility in clinical settings beyond that of primary care and general psychiatry, for example, in the allied health practitioner clinic or office setting. Implementation of the BEDS-7 in real-world clinical practice is expected to promote better understanding of BED characteristics and help health care professionals identify patients who may have BED for appropriate follow-up.

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Potential conflicts of interest: **Dr Herman** is an employee of Shire Development, LLC. **Ms Deal** is currently an employee of Pfizer, Inc but was employed at Shire Development, LLC during the conduct of this project. **Drs DiBenedetti**, **Nelson**, **Fehnel**, and **Brown** are employees of RTI Health Solutions.

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Previous presentation: Content from this original research was presented at the following annual meetings and conferences: American Psychiatric Association 168th Annual Meeting, Toronto, Canada, May 16–20, 2015 ▪ XXIst Annual Meeting of the Eating Disorders Research Society, Taormina, Sicily, September 17–19, 2015 ▪ Canadian Psychiatric Association 65th Annual Conference, Vancouver, Canada, October 1–3, 2015.

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Additional information: Shire develops and manufactures treatments for psychiatric disorders, including binge-eating disorder.

Supplementary material: See accompanying pages.

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Supplementary material follows this article.

THE PRIMARY CARE COMPANION
FOR CNS DISORDERS

Supplementary Material

Article Title: Development of the 7-Item Binge-Eating Disorder Screener (BEDS-7)

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List of Supplementary Material for the article

1. Appendix 1

Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Appendix 1: BEDS-7

The following questions ask about your eating patterns and behaviors within the last 3 months. For each question, choose the answer that best applies to you.				
1. **During the last 3 months,** did you have any episodes of excessive overeating (i.e., eating significantly more than what most people would eat in a similar period of time)?			Yes	No
NOTE: IF YOU ANSWERED "NO" TO QUESTION 1, YOU MAY STOP. THE REMAINING QUESTIONS DO NOT APPLY TO YOU.				
2. Do you feel distressed about your episodes of excessive overeating?			Yes	No
Within the past 3 months…	**Never or Rarely**	**Sometimes**	**Often**	**Always**
3. **During your episodes of excessive overeating,** how often did you feel like you had no control over your eating (e.g., not being able to stop eating, feel compelled to eat, or going back and forth for more food)?				
4. **During your episodes of excessive overeating,** how often did you continue eating even though you were not hungry?				
5. **During your episodes of excessive overeating,** how often were you embarrassed by how much you ate?				
6. **During your episodes of excessive overeating,** how often did you feel disgusted with yourself or guilty afterward?				
7. **During the last 3 months,** how often did you make yourself vomit as a means to control your weight or shape?				

Scoring the BEDS-7: If the response to Q1 is "Yes," Q2 through Q7 are answered. If the response to Q1 is "No," the remaining questions do not apply as the screening result is negative. If the response to Q2 is "Yes" and a shaded box is checked for each of the items Q3 through Q7, the screening result is positive.