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Factor Structure of the Eating Disorder Examination Interview in Patients With Binge-eating Disorder

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Abstract

Despite the widespread use of the Eating Disorder Examination (EDE) as a primary assessment instrument in studies of eating and weight disorders, little is known about the psychometric aspects of this interview measure. The primary purpose of this study was to evaluate the factor structure of the EDE interview in a large series of patients with binge-eating disorder (BED). Participants were 688 treatment-seeking patients with BED who were reliably administered the EDE interview by trained research clinicians at three research centers. Exploratory factor analysis (EFA) performed on EDE interview data from a random split-half of the study group suggested a brief 7-item 3-factor structure. Confirmatory factor analysis (CFA) performed on the second randomly selected half of the study group supported this brief 3-factor structure of the EDE interview. The three factors were interpreted as Dietary Restraint, Shape/Weight Overvaluation, and Body Dissatisfaction. In this series of patients with BED, factor analysis of the EDE interview did not replicate the original subscales but revealed an alternative factor structure. Future research must further evaluate the psychometric properties, including the factor structure, of the EDE interview in this and other eating-disordered groups. The implications of these factor analytic findings for understanding and assessing the specific psychopathology of patients with BED are discussed.

INTRODUCTION

The Eating Disorder Examination interview (EDE) (1) is one of the major assessments currently used in studies of eating and weight disorders (2). The EDE interview assesses a variety of overeating behaviors, inappropriate weight control behaviors, and specific behavioral and cognitive features of eating disorder psychopathology. The EDE interview comprises four subscales that were clinically (rationally) derived initially for anorexia

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nervosa and bulimia nervosa (3). Subsequent research using the EDE and other measures has found that many of these features exist to varying degrees across diverse disordered eating and weight problems (4,5). Since its development (3), this semi-structured, investigator-based interview has been widely viewed as the best-established method for assessing the complex behavioral and cognitive features that comprise eating disorder psychopathology (5–8). Moreover, the use of the EDE as the primary measure has increased in growing numbers of treatment outcome studies with patient groups that differ from the original basis of the EDE, such as obese patients with binge-eating disorder (BED) (e.g., refs. 9,10). Despite its wide-spread and expanded use in studies of diverse eating and weight disorders, there is a dearth of basic psychometric research on this assessment instrument. For example, there are only three published reports on the factor structure of the EDE (11–13) and all failed to replicate the original EDE subscale structure.

The EDE interview's four subscales, derived initially for anorexia nervosa and bulimia nervosa, have not been replicated in subsequent research with diverse study groups. Mannucci *et al.* (12), in a study of 115 adult obese patients without BED, reported that a principal components analysis with varimax rotation with EDE data revealed a two-factor solution (a restraint factor and a second factor with most variables from the three other subscales). Wade *et al.* (13), in a study of 699 young adolescent female twin pairs recruited from the Australian twin registry, performed principal components analyses with nonorthogonal promax rotation on EDE data separately for each twin (i.e., as a test of "stability" of the factor structure solutions). The two sets of exploratory factor analyses (EFAs) suggested factor solutions that failed to replicate the original EDE scales. Moreover, the two EFA solutions were unstable (i.e., failed to replicate across the twin pairs). Wade *et al.* (13), however, noted that the first factor (which accounted for roughly 41% of the overall variance) showed stability (i.e., replicated) for both twins. This single factor consisted of eight items reflecting both weight and shape concerns (all but three of the items comprising the original EDE weight concern and shape concerns subscales). Bryne *et al.* (11), in the first confirmatory factor analysis (CFA) of the EDE, tested the original 4-factor EDE model against 3-, 2-, and 1-factor models using data obtained from three study groups (158 eating-disordered, 170 treatment-seeking obese, and 329 non-eating-disordered community-based subjects). CFA failed to reveal adequate fits for any of the models tested in any of the three study groups, with the exception that a brief 8-item 1-factor solution (reflecting weight and shape concerns) had an adequate fit but only within the eating-disordered group. This 8-item 1-factor (weight and shape concerns) model observed within the eating-disordered group (11) included the same eight items that comprised the first factor reported by Wade *et al.* (13) for the twin sample.

Two recent studies have investigated the factor structure of the self-report version EDE-Questionnaire (EDE-Q) (14). Peterson *et al.* (15) performed an EFA using principal axis analysis with nonorthogonal promax rotation using data from a community sample of 203 women with bulimic symptoms and discovered a factor structure that did not replicate the original four factors of the EDE-Q. Hrabosky *et al.* (16), in a study with 337 obese bariatric surgery candidates, performed EFA (using principal axis factoring and oblique rotation) on a random split-half sample and tested the observed factor solution using CFA on data from the second split-half sample. The EFA suggested and the CFA supported a 12-item 4-factor structure that was clearly distinct from the original EDE subscale structure.

In summary, the three studies published to date about the factor structure of the EDE interview and the two published studies of the EDE-Q did not provide empirical support for the clinically derived original EDE subscale structure. Moreover, all these studies reported different factor structures, perhaps due to the use of different statistical approaches as well as diverse patient and nonpatient samples. Thus, the purpose of this study was to evaluate

the factor structure of the EDE in a large series of patients with BED by first using EFA to suggest an acceptable factor structure and then to examine that structure using CFA in randomly selected split-half samples.

METHODS AND PROCEDURES

Participants

Participants were 688 (557 women and 131 men) patients meeting DSM-IV-TR (Diagnostic and Statistical Manual, fourth edition, text revision) (17) full research criteria for BED. Participants were respondents to advertisements for treatment studies at three university-based research programs: Yale University School of Medicine ($N = 423$), Neuropsychiatric Research Institute ($N = 158$), and University of Minnesota School of Medicine ($N = 107$). Exclusion criteria included pregnancy, current treatment for eating/weight problems, specific medical problems (diabetes, thyroid, renal, or cardiac diseases), or severe psychiatric problems (bipolar disorder, psychotic disorder, current drug dependence, or current suicidality). All participants provided written informed consent and study protocols were institutional review board approved.

Overall, participants' mean age was 45.6 years (s.d. = 9.8) and mean BMI was 37.9 (s.d. = 7.6). Of the 688 participants, 88% ($n = 604$) were white, and 86% ($n = 591$) had at least some college education. Table 1 summarizes demographic (age, gender, education) and clinical (BMI, binge-eating frequency, and EDE subscales) variables across the three sites. Although analyses revealed statistically significant group differences on most variables, inspection of the effect size measures (right column) reveals very small effect sizes (all <4% of the variance). This indicates that the observed statistically significant differences are due to high power because of the large sample sizes but do not reflect meaningful clinical differences.

Assessment and measures

All participants provided written informed consent and study protocols were institutional review board approved. Assessments were administered by experienced research clinicians who were trained in the administration of the study instruments. BED diagnoses were determined using the Structured Clinic Interview for DSM-IV Axis I Disorders (18) and the EDE interview (1).

The EDE interview (1) focuses on the previous 28 days, except for the diagnostic items that are rated for duration stipulations of the DSM-IV-TR (17). The EDE assesses the frequency of different forms of overeating, including objective bulimic episodes (i.e., binge eating defined as unusually large quantities of food with a subjective sense of loss of control), and different forms of inappropriate weight compensatory behaviors. The EDE also comprises four subscales: Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern. The items assessing the features of eating disorders for the four EDE subscales are rated on a 7-point forced-choice format (0–6), with higher scores reflecting greater severity or frequency.

The EDE interview requires considerable training even with clinicians experienced in working with eating-disordered groups. The collaborators on this study have extensive experience in training and monitoring research clinicians in the administration of the EDE. EDE training involved review of the instrument (including all concepts, questions, probing, and scoring), role playing, observation of interviews, practice interviews with review of interview process and coding, continued supervision of interviews, and ongoing monitoring via taped interviews to prevent drift over time. These procedures have resulted in good inter-rater and test–retest reliability findings for the EDE by the collaborators (19–21).

Statistical analysis

The original subscale structure of the EDE was first analyzed using internal consistency (coefficient α) and reliability analyses and through CFA (MPlus version 5; Muthén & Muthén, Los Angeles, CA). Model estimation was based on maximum likelihood. Imputation of missing data was based on full information maximum likelihood; the proportion of missing data in EDE variables for the full study group was minimal, ranging from 0 to 2.8%. Model fit was evaluated on the basis of recommended standards (22) for tests of model fit: comparative fit index (criteria >0.900), Tucker–Lewis index (criteria >0.900), root-mean-square error of approximation (criteria <0.060), and standardized root mean square residual (criteria <0.080).

On the basis of the literature, it was expected that fit indices would be unacceptable for the original EDE subscales. Thus, a two-step procedure was planned for the EDE subscale (all 22 items) data. First, data from one-half of the sample ($n = 344$) were randomly selected via computer-generated random seed and used to conduct an EFA using maximum likelihood extraction and promax nonorthogonal rotation. Items were retained if they had a factor loading of 0.40 or higher and if they loaded on one factor. Factors were retained if they had an eigen-value >1.00 and accounted for at least 5% of the total variance. Second, a CFA (MPlus, version 5) was performed using the data of the second half ($n = 344$) of the sample to statistically evaluate the fit of the structure suggested by the EFA.

RESULTS

Psychometric characteristics of the original EDE interview

Table 2 summarizes internal consistency reliability analyses and the correlations among the four original EDE subscales. Internal consistency of the EDE subscales was not adequate as suggested by coefficient α , which ranged from 0.51 to 0.68. CFA performed on the EDE data from the entire study group ($N = 688$) to test the original EDE scale structure revealed a poor fit. Fit indices were unacceptable for the original four scales: comparative fit index = 0.665, Tucker–Lewis index = 0.617, root-mean-square error of approximation = 0.096, and standardized root mean square residual = 0.083.

EFA and CFA of the EDE interview data

Exploratory factor analysis—Data from a random split-half ($n = 344$) of the study group were used to conduct an EFA using maximum likelihood extraction and promax nonorthogonal rotation. In the first EFA, all of the subscale items ($n = 22$) were entered. The EDE data met basic appropriateness criteria for factor analysis: Kaiser–Meyer–Olkin measure of sampling adequacy was 0.785 and the Bartlett’s test (Bartlett’s = 1,865.2, $df = 231$, $P < 0.001$) was significant. Based on standard criteria (factor loading of 0.40 and loading on only one factor), three factors were identified, consisting of 7 items, and accounting for 80.3% of the total variance. The EFA is summarized in Table 3. The first factor, labeled Dietary Restraint, consisted of three items assessing attempts to restrict food intake and dietary rules. The second factor, labeled Shape/Weight Overvaluation, consisted of two items that assess degree of importance placed on shape and weight for defining self-worth. The third factor, labeled Body Dissatisfaction, consisted of two items that assess dissatisfaction with weight or with shape.

Confirmatory factor analysis—A CFA was performed using the data of the second random split-half ($n = 344$) of the study group. The CFA indicated that the 3-factor model suggested by the EFA produced an acceptable fit based on recommended standards (22). The factor loadings of the CFA are shown in Table 3.

A second CFA was performed to control for recruitment site given the statistically significant (albeit small effect size) differences between sites on a number of variables (see Table 1). Fit statistics again revealed an adequate fit even after controlling for recruitment site: comparative fit index = 0.932, Tucker–Lewis index = 0.895, root-mean-square error of approximation = 0.053, and standardized root mean square residual = 0.037.

DISCUSSION

This study examined the factor structure of the EDE interview in a series of 688 adult patients with BED. Internal consistency and confirmatory factor analyses failed to support the adequacy of the original EDE interview subscale structure. This study then examined the factor structure of the EDE interview using EFA and CFA on two split-half study groups ($n = 344$ each) randomly selected from the larger series of 688 patients with BED. The EFA of EDE data from the first group of BED patients revealed a brief 7-item, 3-factor structure. The CFA of EDE data from the second group of BED patients strongly supported this alternative structure. The three factors were interpreted as Dietary Restraint, Shape/Weight Overvaluation, and Body Dissatisfaction.

Our findings converge with the three previous studies in failing to support or replicate the original EDE subscale structure (11–13). Our findings (7-item, 3-factor structure), however, did not replicate any of the previous three reports, each of which also reported different solutions for the different and diverse study groups. Two of the three previous factor analytic studies of the EDE interview did converge to some degree in suggesting the utility of a brief 8-item 1-factor scale consisting of an admixture of weight and shape concerns (11–13). Our brief 3-factor solution was comparable in several respects to the findings from two-factor analytic studies of the EDE-Q (15,16). Most notably, this study and those two studies identified a similar body dissatisfaction factor (which consisted of both shape- and weight-related dissatisfaction) and found that overvaluation of shape and weight items loaded together but separately from the body dissatisfaction items. Lastly, the factor studies of the EDE and EDE-Q suggest that a psychometric distinction regarding questions about shape vs. questions about weight is unnecessary as argued initially by Cooper *et al.* (3).

Our findings here represent additional support for the distinction between body (shape/weight) dissatisfaction and overvaluation of shape/weight (23). Although body dissatisfaction is common, far fewer persons define themselves on the basis of their shape/weight (overvaluation), which is viewed as more pathological and as a core cognitive feature of eating disorders (e.g., it is a required criterion for bulimia nervosa). Empirically, overvaluation of shape/weight is more closely related to self-esteem than is body dissatisfaction (24,25) and has demonstrated clinical significance within and across diverse patients with weight and eating problems (26–28).

We note several strengths and limitations of our study as context for interpreting the findings. One strength of this study lies in the study group that was assessed similarly by experienced research groups at three different centers that should enhance generalizability to some degree. Although the participants were similarly recruited at the three research sites, statistically significant differences were observed across sites on several variables. We emphasize, however, that these site differences reflect high statistical power rather than meaningful clinical differences (all effect size measures reflected <4% of the variance). Moreover, a CFA that controlled for site differences revealed adequate and slightly improved fit indices. A second strength was the large sample size, which allowed for performing both EFA and CFA with randomly selected split-halves of subjects. This rigorous method allowed for CFA to test a solution identified via EFA. The importance of such “replication” is highlighted by the Wade *et al.* (13) study that found an unstable factor

structure within a twin study. Our findings pertain to adults with BED who presented to university-based specialty programs for treatment. Thus, the findings may not generalize to nontreatment seekers or to patients with BED who seek treatment at other types of health facilities and may differ in their clinical characteristics. Moreover, our findings may not generalize to different eating disorder patient groups (e.g., bulimia nervosa or anorexia nervosa) or to younger persons. Although our study group included men and minority groups, we could not evaluate whether the factor structure was invariant across such demographic characteristics. Lastly, our study addressed only one aspect of the construct validity of the EDE and future research must continue to address other aspects of its validity.

Future research must evaluate further the psychometric properties, including the factor structure, of the EDE interview and other assessment methods in similar and diverse eating-disordered groups. Clinically, the EDE items, regardless of the factor structure, appear to offer a potential wealth of information for clinicians and researchers alike. However, psychometric studies of instruments, as well as studies of other aspects of their validity (29) are essential to improve assessment methods in order to increase knowledge. The present findings might suggest that for research purposes that this factor structure—or other empirically derived factor structures—be used along with the original EDE scales. If these findings are replicated and their construct validity supported then this might allow for efficient research use.

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Table 1

Demographic and clinical characteristics by site

Variable	Data collection site			Significance	Effect size
	Fargo (n = 158)	Minneapolis (n = 107)	New Haven (n = 423)		
Age (M, s.d.)	46.1 ± 10.6 ^{ab}	48.3 ± 10.0 ^a	44.7 ± 9.3 ^b	$F = 6.22, df = 2, 685, P = 0.002$	$\eta^2 = 0.018$
Female (n, %)	139 (88.0%) ^a	94 (87.9%) ^a	324 (76.6%) ^b	$\chi^2 = 13.56, df = 2, P = 0.001$	$\phi^2 = 0.020$
White (n, %)	154 (97.5%) ^a	101 (94.4%) ^a	349 (82.5%) ^b	$\chi^2 = 29.18, df = 2, P < 0.001$	$\phi^2 = 0.042$
Some college education (n, %)	139 (88.0%) ^{ab}	100 (93.5%) ^a	352 (83.2%) ^b	$\chi^2 = 8.13, df = 2, P < 0.017$	$\phi^2 = 0.036$
BMI (M, s.d.)	39.3 ± 7.6 ^a	38.3 ± 8.1 ^{ab}	37.2 ± 7.4 ^b	$F = 4.39, df = 2, 685, P = 0.013$	$\eta^2 = 0.013$
OBE days (M, s.d.)	16.3 ± 6.6 ^a	16.5 ± 7.2 ^a	14.3 ± 6.8 ^b	$F = 7.59, df = 2, 685, P = 0.001$	$\eta^2 = 0.022$
EDE Restraint (M, s.d.)	1.49 ± 1.25 ^a	1.68 ± 1.41 ^{ab}	1.89 ± 1.29 ^b	$F = 5.83, df = 2, 685, P = 0.003$	$\eta^2 = 0.017$
EDE Eating Concern (M, s.d.)	1.79 ± 1.27	2.09 ± 1.19	2.08 ± 1.33	$F = 3.16, df = 2, 685, P = 0.043$	$\eta^2 = 0.009$
EDE Shape Concern (M, s.d.)	3.51 ± 1.04 ^a	3.68 ± 1.02 ^a	3.98 ± 1.05 ^b	$F = 12.90, df = 2, 685, P < 0.001$	$\eta^2 = 0.036$
EDE Weight Concern (M, s.d.)	3.35 ± 1.15	3.47 ± 1.01	3.28 ± 1.01	$F = 1.47, df = 2, 685, P = 0.230$	$\eta^2 = 0.004$

Different superscripts denote groups that differ significantly based on Tukey-b post hoc tests.

EDE, Eating Disorder Examination; OBE, Objective Bulimic Episodes.

Table 2

Internal consistency and correlations of the original EDE factors

Factor	α	Mean $\pm$ s.d.	Correlations		
			2	3	4
Original EDE					
Restraint	0.63	1.77 $\pm$ 1.31			
Eating Concern	0.60	2.02 $\pm$ 1.30	0.27***		
Shape Concern	0.68	3.83 $\pm$ 1.06	0.29***	0.57***	
Weight Concern	0.51	3.32 $\pm$ 1.05	0.30**	0.53***	0.69***

α Denotes coefficient α , a measure of internal consistency.

EDE, Eating Disorder Examination.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

Table 3

EFA and CFA of EDE items

EDE item	Factor loading					
	Factor 1		Factor 2		Factor 3	
	EFA	CFA	EFA	CFA	EFA	CFA
Restraint over eating	0.764	1.000	0.115		−0.051	
Food avoidance	0.700	1.017	0.030		−0.015	
Dietary rules	0.466	0.767	0.198		−0.040	
Importance of shape	0.103		0.912	1.000	−0.172	
Importance of weight	0.124		0.865	1.259	−0.203	
Dissatisfaction with weight	0.091		0.429		−1.957	1.000
Dissatisfaction with shape	0.024		0.267		−0.842	1.499

Fit statistics revealed an adequate fit. Observed Fit statistics values and criteria for adequacy are as follows: CFI = 0.950 (criteria >0.900), TLI = 0.905 (criteria >0.900), RMSEA = 0.058 (criteria <0.060), and SRMR = 0.036 (criteria <0.080). Three variables (dietary rules, dissatisfaction with weight, and dissatisfaction with shape) had a significant skew. A CFA that specified ordinal variables also revealed an adequate (slightly improved) fit: CFI = 0.998, TLI = 0.997, and RMSEA = 0.048 (SRMR is not available for ordinal models). Boldface represents the items on each factor.

CFA, comparative fit index; EDE, Eating Disorder Examination; EFA, exploratory factor analysis; RMSEA, root-mean-square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker–Lewis index.