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Personality traits among currently eating disordered, recovered and never ill first-degree female relatives of bulimic and control women

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ABSTRACT

Background. A combined family study and recovered study design was utilized to examine several hypothesized relationships between personality and bulimia nervosa (BN).

Methods. We studied 47 women with a lifetime history of DSM-III-R BN (31 currently ill and 16 recovered), 44 matched control women (CW) with no history of an eating disorder (ED), and their first-degree female relatives ($N = 89$ and $N = 100$, respectively), some of whom had current or previous EDs.

Results. BN probands' relatives with no ED history had significantly elevated levels of perfectionism, ineffectiveness, and interpersonal distrust compared to CW probands' relatives with no ED history. In contrast, diminished interoceptive awareness, heightened stress reactivity and perfectionistic doubting of actions were found among the previously eating disordered relatives of bulimic probands compared to their never ill relatives. Finally, a sense of alienation and emotional responsivity to the environment were elevated among currently ill compared to recovered bulimic probands.

Conclusions. The fact that perfectionism, ineffectiveness and interpersonal distrust are transmitted independently of an ED in relatives suggests that they may be of potential aetiological relevance for BN. In contrast, diminished interoceptive awareness, heightened stress reactivity and perfectionistic doubting of actions are more likely consequent to, or exacerbated by, previously having experienced the illness. Finally, a sense of alienation and emotional responsivity to the environment are more likely to be associated with currently having BN.

INTRODUCTION

The aetiology of eating disorders (EDs) likely involves complex interactions among genetic, biological, psychological, familial, social and cultural variables (Jimerson *et al.* 1996). Of recent note is the increased attention given to the hypothesized role of personality traits in predisposing to anorexia nervosa (AN) and bulimia nervosa (BN) (Vitousek & Manke, 1994; Strober, 1995). Cross-sectional studies of ill individuals have found that personality traits such as impulsivity, stress reactivity, novelty seeking and affective dysregulation are common among individuals with BN specifically (Casper *et al.* 1992; Vitousek & Manke, 1994; Bulik *et al.* 1995; Pryor & Wiederman, 1996), whereas perfectionism, obsessionality, harm avoidance,

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neuroticism and social isolation have been associated with both BN and AN (Rosch *et al.* 1991; Vitousek & Manke, 1994; Pryor & Wiederman, 1996).

A major drawback to the assessment of personality in EDs is that these evaluations may, at least in part, reflect the effects of chronic malnutrition or repeated cycles of binge eating and purging (Keys *et al.* 1950; Vitousek & Manke, 1994). One methodological approach that has been used to avoid this confound is a recovered study design. Personality traits that persist after recovery from an ED are assumed to be either a potential vulnerability factor contributing to the development of the ED or a 'scar' (i.e. consequence) of the illness. Whereas several studies have compared personality traits of long-term recovered AN patients to non-ED controls (Casper, 1990; Srinivasagam *et al.* 1995; Pollice *et al.* 1997), to our knowledge only one study has examined personality traits in long-term recovered BN patients (Kaye *et al.* 1998). The studies converge in showing that perfectionism, obsessionality, restraint, ineffectiveness, interpersonal distrust and decreased interoceptive awareness persist in individuals who have recovered from either AN or BN. Thus, an inhibited and over-controlling personality phenotype evident after recovery from BN appears to stand in sharp contrast to the impulsivity and affective instability often seen during the active stage of this illness (Vitousek & Manke, 1994). In accord with this contrast, several reports indicate that emotional lability and other indices of behavioural disinhibition decrease following reductions in binge eating and purging (Kennedy *et al.* 1990; Ames-Frankel *et al.* 1992), suggesting that impulsive traits may partially reflect the erratic consummatory patterns and emotional instability secondary to active BN.

Twin, adoption and non-twin family designs have established the familial nature of many personality traits (Tellegen *et al.* 1988; Heath *et al.* 1992), with some 40–60% of measured variation of a wide range of distinctive personality characteristics attributed to genetic diversity (Rushton *et al.* 1986; Tellegen *et al.* 1988; Bouchard, 1994; Benjamin *et al.* 1997). Substantial evidence also supports the familiality (Kassett *et al.* 1989; Stein *et al.* 1999; Strober *et al.* 2000) and heritability (Kendler *et al.* 1991; Bulik *et al.* 1998) of BN itself.

Given that personality traits exhibit moderate heritability and there is mounting evidence that EDs cluster in families, a family-study design can be used to examine several competing hypothesized relationships between personality and BN. The key assumption when utilizing this design is that because BN has been shown to aggregate in families, this implies that family members have, on average, greater liability for the illness of the proband. Therefore, traits or disorders that aggregate in relatives suggest a potential aetiological relationship between those traits or disorders and the illness of the proband (Klein & Riso, 1993; Ouimette *et al.* 1996).

We are aware of two published studies that have specifically focused upon the personality traits among relatives of BN probands (Carney *et al.* 1990; Steiger *et al.* 1995). Neither study found significant differences between the relatives of BN probands and the relatives of controls on any eating-related concerns or personality traits. The Carney *et al.* (1990) study was limited by low response rates and no direct contact with relatives, while the Steiger *et al.* (1995) study involved assessment of relatively few personality traits.

As part of a larger family study of EDs (Lilenfeld *et al.* 1998), the present study investigated personality traits in the first-degree female relatives of bulimic and never-eating disordered control probands to explore hypothesized relationships between personality and BN. A 'predisposition model' would be favoured for those personality traits in which the never-eating disordered relatives of bulimic probands have elevated levels compared with the never-eating disordered relatives of control probands. This pattern of findings would support the assumption that these personality traits predispose to the development of the ED. A 'co-occurrence model' would be supported for those personality traits in which the currently eating disordered probands or relatives have elevated levels compared with the previously eating disordered (i.e. recovered) probands or relatives, respectively. This pattern of findings would support the assumption that these personality traits are a consequence of currently having an ED. Finally, a 'scar model' would be supported for those personality traits in which the previously eating disordered relatives of BN probands have elevated levels compared with the never eating

disordered relatives of BN probands, thereby indicating that the personality trait was a long-term consequence of the ED.

METHOD

Probands

We studied 47 women with a lifetime history of DSM-III-R (APA, 1987) bulimia nervosa (BN) and 44 control women (CW) with no history of an eating disorder (ED). All BN probands were recruited from the in-patient and out-patient ED programmes at Western Psychiatric Institute and Clinic, and from advertisements in a campus newspaper. The advertisements described our 'family research study' that involved completing questionnaires and interviews focused on 'medical, developmental, psychological and family background'. Although such a recruitment approach is common, potential sampling biases must be acknowledged. Those who are currently or have previously been in treatment may be more severely ill and/or have greater comorbidity than other eating disordered individuals. Likewise, respondents to an advertisement may be more willing to discuss problems, which could potentially create an unrepresentative group.

Because a sizable minority of anorexic individuals eventually develop binge eating (Bulik *et al.* 1997; Strober *et al.* 1997), selection criteria were employed to ensure that we obtained a diagnostically 'pure' bulimic group. Specifically, all bulimic probands must have had the onset of BN at least 3 years prior to study entry and had no history of AN. Approximately half of all BN subjects were in treatment at the time of the study.

BN probands were further stratified into those with a current BN diagnosis ($N = 31$) and those who had recovered from BN ($N = 16$). To be considered recovered, for the year prior to the study, subjects must have: maintained a stable weight between 90% and 120% Ideal Body Weight (IBW; Metropolitan Life Insurance, 1959); had regular menstrual cycles; and, not binged, purged, or engaged in restrictive eating patterns.

Control probands were recruited from a commercial mailing list and were matched by age and zip code to the bulimic probands. The study advertisement described 'our research study comparing families of women in the community with families of women who have a psychiatric problem'. They were selected to have never had a history of an ED. Only initial respondents to our advertisement were included in the control group; no further recruitment efforts were made. Potential control probands were excluded if they had a history of weighing $< 90\%$ or $> 125\%$ IBW since menarche. Because control probands were chosen to otherwise be a representative community sample, they were not screened for a lifetime history of any other psychiatric disorder, aside from an ED, before entering the study.

Currently ill BN probands ranged in age from 17 to 38 (24 ± 6 years); recovered BN probands ranged in age from 21 to 42 (27 ± 6 years); CW probands ranged in age from 17 to 41 (26 ± 6 years) (Table 1). The three proband groups did not differ in age or weight at the time of the study; however, BN probands had experienced a greater range of weight. That is, both currently ill and recovered BN probands weighed significantly more when at their highest weight (at their adult height) and currently ill BN probands also weighed significantly less when at their lowest weight (at their adult height), compared with CW probands.

All probands gave informed consent to participate in the study according to institutional guidelines, and to permit research staff to contact first-degree relatives to solicit participation in the study. All subjects were paid for participating in the study.

First-degree female relatives

ED diagnostic information was obtained on 89 female relatives of BN probands and 100 female relatives of CW probands. Relatives of the BN probands included 47 mothers (age 51 ± 9 years) and 42 sisters (age 30 ± 12 years). Relatives of the CW probands included 44 mothers (age 53 ± 9 years) and 56 sisters (age 30 ± 8 years).

The relatives of BN probands were further stratified into those without an ED history ($N = 59$); those who had recovered from an ED ($N = 15$); and those with a current ED ($N = 15$). To be considered recovered, for the year prior to the study, relatives must have: maintained a stable weight between 90% and 120% IBW; had regular menstrual cycles; and, not binged, purged, or engaged in restrictive eating patterns.

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Table 1. *Proband characteristics*

	BN-currently ill	BN-recovered	CW	*F* (df = 2, 88)	*P*
Number, *N*	31	16	44		
Age at study (years)	24±6	27±6	26±6	1·32	0·30
Age at eating disorder onset (years)	16±3	18±4	—		
IBW, %					
At study entry	104±10	111±11	108±10	2·08	0·13
Lowest	90±9[a]	94±7	95±10[a]	3·37	0·04
Highest	116±13[a]	123±10[b]	109±9[ab]	3·95	0·0002

BN, Bulimia nervosa probands; CW, control women.
IBW, Ideal body weight (Metropolitan Life Table, 1959); all IBW calculations are for subjects at their adult height.
Rates with the same superscripts differ significantly from each other at $P < 0{\cdot}05$; rates without any superscript do not differ significantly from any other rate in that row.
Values are means±standard deviations.

Of the BN probands' relatives with a current ED, one was diagnosed with BN, four with binge-eating disorder (BED) and 10 with eating disorder not otherwise specified (ED-NOS). All those diagnosed with ED-NOS were judged to have significant impairment in functioning as a result of their eating problems. Further evaluation of the types of ED-NOS diagnoses revealed five with a purging-type disorder, three with a restricting-type disorder, and two with combined symptomatology. Of the BN probands' relatives with a prior ED, one was diagnosed with AN, one with BN, four with BED, six with ED-NOS 'purging type', two with ED-NOS 'restricting type', and one with ED-NOS with combined symptomatology.

Eating disorder diagnostic assessment

The Eating Disorders Family History Interview (Strober, 1987) is a structured clinical interview designed to gather detailed information on weight and eating history. We used this instrument to obtain ED diagnostic and related information from all probands and directly interviewed relatives. These interviewed subjects also provided information about their relatives who were not directly interviewed, as described in the Procedure section in more detail.

Personality assessment

Eating Disorder Inventory (*EDI*)

The EDI (Garner *et al*. 1983*a*) is a standardized self-report measure consisting of eight subscales that assess specific cognitive and behavioural dimensions of EDs: Drive for Thinness; Bulimia; Body Dissatisfaction; Ineffectiveness; Perfectionism; Interpersonal Distrust; Interoceptive Awareness; and, Maturity Fears. The EDI has been shown to demonstrate good internal consistency, as well as good convergent and discriminant validity (Garner *et al*. 1983*a*). Alpha coefficients for the eight subscales range from 0·82 to 0·90. The EDI has been used in numerous studies and has been found to successfully discriminate between subjects with and without EDs (Garner *et al*. 1983*a*; Srinivasagam *et al*. 1995). Only the latter five scales that assess personality-relevant constructs were examined in the current study.

Multidimensional Perfectionism Scale (*MPS*)

The MPS (Frost *et al*. 1990) is a factor-analytically developed self-rating scale that consists of an overall assessment of perfectionism, as well as six subscales designed to assess various dimensions of perfectionism. These scales are: Personal Standards; Concern over Mistakes; Parental Expectations; Parental Criticism; Doubting of Actions; and, Organization. The coefficients of internal consistency for the factor scales range from 0·77 to 0·93 and the reliability of the overall perfectionism scale is 0·90 (Frost *et al*. 1990). The MPS has been found to successfully discriminate between subjects with and without EDs, with ED subjects demonstrating elevations compared to non-ED subjects on nearly all MPS scales (Srinivasagam *et al*. 1995).

Multidimensional Personality Questionnaire (*MPQ*)

The MPQ (Tellegen, 1982) is a factor-analytically developed self-report instrument. Its

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scales represent 11 primary personality dimensions and three higher order factors, with alpha coefficients ranging from 0·76 to 0·89. The primary scales were developed to be relatively independent from each other. The higher order factors, Positive Emotionality, Negative Emotionality and Constraint, describe basic parameters of emotional and behavioural regulation. The personality scales are: Well-Being; Social Potency; Achievement; Social Closeness; Stress Reaction; Alienation; Aggression; Control; Harm Avoidance; Traditionalism; and Absorption. The MPQ has been found to successfully discriminate between subjects with and without EDs (Casper *et al*. 1992), with ED subjects typically having elevated scores on Stress Reaction, Control, Harm Avoidance and Traditionalism, and lower scores on Well-Being and Social Closeness, compared with non-ED subjects.

Procedure

Lifetime ED diagnostic assessments were obtained with the Eating Disorders Family History Interview for all probands and relatives. All probands were interviewed directly, in person. Sixty-seven per cent of BN probands' relatives ($N = 60$) and 59% of CW probands' relatives ($N = 59$) were directly interviewed. These direct interview rates did not differ significantly across groups ($\chi^2 = 1{\cdot}43$, $P = 0{\cdot}23$). Among those relatives who were directly interviewed, 33% of BN and 44% of CW probands' relatives were interviewed in person; the remainder were interviewed by phone. These group differences were also non-significant ($\chi^2 = 1{\cdot}45$, $P = 0{\cdot}23$).

These directly interviewed relatives, as well as those who were unable to be interviewed, had multiple informants (i.e. the proband and all other participating first-degree relatives) from whom ED diagnostic information was obtained. For those relatives who were not directly interviewed, their ED diagnostic information was obtained solely from family history interviews with family member informants. Typically, these relatives were not interviewed because the proband did not give us permission to contact that relative to enlist participation. The average number of informants per subject was four. Interviewers were kept blind to the identity and diagnosis of the proband whose relative they were assessing. Their report on the proband was obtained last, in order to keep the interviewer blind as to the identification of the family. In all cases, final ED diagnoses were reached in clinical team meetings, based upon consideration of all diagnostic information obtained from the direct and informant interviews. Interviewers presented their diagnoses to the team of interviewers and the principal investigator (W.H.K.) and supporting evidence for these diagnoses was discussed. Members of the same family were not presented consecutively, in order to prevent diagnostic bias which may have resulted from hearing any ED diagnoses of other family members. Probands were presented after all other relatives in the family were completed.

All interviewers were master's or doctoral level psychologists with diagnostic assessment experience. Interviewers underwent training with each assessment instrument. Initial training of the five interviewers involved didactic instruction and reviews of taped and live interviews. All scored interviews were reviewed by a senior member of the research team.

All CW probands and the majority of BN probands completed the self-report assessments (45 of 47 BN probands completed the EDI and MPS; 44 completed the MPQ). Sixty-eight of 89 BN probands' relatives completed the EDI and MPS; 70 completed the MPQ. The five CW probands' relatives with an ED history were excluded from the behavioural and personality trait analyses so that this was a 'pure' group which directly paralleled the group of BN probands' relatives with no ED history. Seventy-four of the CW probands' 95 relatives with no ED history completed the EDI and MPS; 75 completed the MPQ.

Statistical analysis

Proband groups were compared first with MANOVAs and then ANOVAs for individual scale comparisons after the overall multivariate test for mean differences was determined to be significant. Three separate MANOVAs were run for the EDI scales, the scales that constitute the multidimensional measure of perfectionism (MPS), and the MPQ personality scales. Scheffé's *post-hoc* tests were used for individual group comparisons. We chose not to apply a Bonferroni correction, as this may in fact have 'over-corrected' our data. That is, this correction

factor is based upon the assumption that subscales within a measure are independent, which is not the case with many of our trait measures. These analyses were performed using BMDP statistical software (Dixon, 1985).

When assumptions of homogeneity of variance were not met, appropriate transformations of the data were performed. To assess for equality of variances, we used the Bartlett test (Neter *et al*. 1990). For those scales in which heteroscedasticity of variance appeared problematical across groups, the scale scores were transformed so that group variances were more nearly equal. In these cases, the same pattern of significant group differences was obtained as with untransformed scores, indicating that heteroscedasticity was not problematical.

To evaluate whether personality traits differed between relatives of BN and control probands, we examined the trait data using generalized linear models. These models were utilized because family members are not independent from each other. Importantly, generalized linear models can handle this violation of the assumption of independent observations, which would otherwise be problematical with traditional linear models.

Specifically, within these models we examined whether the variance in trait values was significantly reduced by group (i.e. BN probands' relatives with a current ED, BN probands' relatives with a previous ED, BN probands' relatives with no ED history, CW probands' relatives with no ED history), relationship (i.e. mother, sister), or a group × relationship interaction. To account for correlated data among individuals within a family, we employed a standard analytical procedure, namely Generalized Estimating Equations (GEE) (Liang & Zeger, 1986; Zeger & Liang, 1986). GEE focuses on the 'regression' parameters or βs (often means) of the general linear model and treats the variance/covariance structure of the data Y_i as a nuisance, which is estimated. Estimation of β is efficient under reasonable conditions and is consistent even if the covariance structure of Y_i is incorrectly specified. Significance tests account for dependence using the estimated covariance matrix. Because all of the individuals in the family are first-degree relatives, we assumed a constant correlation between any pair of individuals within families. This assumption makes implementation of the analysis quite straightforward (using the exchangeable option of SAS, 1999), but it could be anti-conservative if the correlation between sisters is notably larger than the mother–daughter correlation. To evaluate the sensitivity of statistical inference to the magnitude of the correlation, we followed the advice of Diggle *et al*. (1990) to inflate the correlation and re-evaluate test statistics. Typically the residual family correlation was small, $< 0{\cdot}02$; in such instances, we arbitrarily set the correlation to 0·3 (again implemented using SAS and a user-specified covariance matrix). We used SAS 6.12 with patch TS055 (SAS, 1999), which implements proper GEE analysis.

RESULTS

Comparison of bulimic and control probands

Eating Disorder Inventory personality traits

As expected, compared with controls, currently ill BN probands scored significantly higher on all personality trait-related EDI scales, with the exception of Maturity Fears (see Table 2). Recovered BN probands scored significantly higher than controls on Perfectionism and Interoceptive Awareness.

Perfectionism

Compared with control probands, currently ill and recovered BN probands had significant elevations on the overall MPS perfectionism score and the MPS subscales of Personal Standards, Concerns over Mistakes, Parental Criticism, and Doubting of Actions (see Table 3). Parental Expectations was significantly elevated only among the currently ill BN probands compared to control probands. There were no group differences for the Organization subscale.

Other personality traits

Currently ill ($15{\cdot}20 \pm 5{\cdot}9$) and recovered BN probands ($14{\cdot}86 \pm 6{\cdot}3$) had significantly lower scores than control probands ($19{\cdot}82 \pm 4{\cdot}1$) on the MPQ Well-Being scale ($F = 9{\cdot}70$; $P = 0{\cdot}0002$). Currently ill ($15{\cdot}30 \pm 7{\cdot}6$) and recovered BN probands ($11{\cdot}64 \pm 5{\cdot}9$) had significantly higher scores than control probands ($5{\cdot}86 \pm 5{\cdot}3$) on the MPQ Stress Reaction scale ($F = 20{\cdot}74$; $P = 0{\cdot}0000$). Only, currently ill BN probands ($134{\cdot}55 \pm 17{\cdot}3$) had significantly higher scores

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Table 2. *Differences among currently ill bulimic women, recovered bulimic women, and control women on personality trait-like scales from the Eating Disorder Inventory*

EDI	BN-currently ill ($N = 31$)	BN-recovered ($N = 14$)	CW ($N = 44$)	F (df = 2, 86)	P
Ineffectiveness	5·39 (5·4)[a]	2·86 (3·8)	1·14 (3·5)[a]	17·68	0·0000
Perfectionism	6·68 (3·9)[a]	5·93 (3·7)[b]	2·80 (2·7)[ab]	13·67	0·0000
Interpersonal Distrust	3·58 (3·8)[a]	2·71 (2·6)	1·50 (2·6)[a]	4·55	0·01
Interoceptive Awareness	6·61 (6·10)[a]	4·64 (5·1)[b]	0·89 (2·0)[ab]	25·33	0·0000
Maturity Fears	3·52 (4·1)	2·14 (3·4)	1·80 (2·2)	1·83	0·17

BN, Bulimia nervosa probands; CW, control women; EDI, Eating Disorder Inventory.
Rates with the same superscripts differ significantly from each other at $P < 0·05$; rates without any superscript do not differ significantly from any other rate in that row.
Values are means (standard deviations).

Table 3. *Differences among currently ill bulimic women, recovered bulimic women and control women on dimensions of perfectionism*

MPS	BN-currently ill ($N = 31$)	BN-recovered ($N = 14$)	CW ($N = 44$)	F (df = 2, 86)	P
Overall Perfectionism	85·55 (25·0)[a]	77·79 (16·3)[b]	58·36 (12·0)[ab]	18·05	0·0000
Personal Standards	23·55 (6·1)[a]	25·00 (4·7)[b]	19·68 (5·2)[ab]	7·26	0·001
Concerns over Mistakes	24·55 (8·8)[a]	22·29 (5·8)[b]	15·04 (4·3)[ab]	20·04	0·0000
Parental Expectations	15·29 (5·7)[a]	12·21 (4·7)	11·09 (3·9)[a]	7·30	0·001
Parental Criticism	10·87 (4·8)[a]	9·21 (3·9)[b]	5·82 (2·6)[ab]	19·49	0·0000
Doubting of Actions	11·29 (3·8)[a]	9·07 (2·9)[b]	6·73 (2·1)[ab]	20·90	0·0000
Organization	23·71 (5·0)	23·86 (5·3)	22·54 (4·6)	0·69	0·50

BN, Bulimia nervosa probands; CW, control women; MPS, Multidimensional Perfectionism Scale.
Rates with the same superscripts differ significantly from each other at $P < 0·05$; rates without any superscript do not differ significantly from any other rate in that row.
Values are means (standard deviations).

Table 4. *Differences among female relatives of bulimic and control women on personality trait-like scales from the Eating Disorder Inventory*

	BN probands' relatives					
EDI	With a current ED ($N = 10$)	With a past ED ($N = 15$)	With no ED history ($N = 43$)	CW probands' relatives with no ED history ($N = 74$)	χ^2 (df = 3)	P
Ineffectiveness	6·90 (6·1)[ab]	3·93 (4·7)[c]	1·67 (2·7)[ad]	0·76 (1·5)[bcd]	37·43	0·0001
Perfectionism	3·00 (2·2)	4·87 (5·0)	4·07 (3·9)[a]	2·66 (2·6)[a]	8·40	0·04
Interpersonal Distrust	4·70 (4·5)[ab]	2·87 (3·7)	2·35 (2·5)[ac]	1·62 (1·9)[bc]	13·98	0·003
Interoceptive Awareness	4·10 (5·1)[ab]	4·07 (5·2)[cd]	0·56 (1·3)[ac]	0·47 (1·3)[bd]	39·64	0·0001
Maturity Fears	3·30 (2·8)	1·53 (2·6)	1·53 (2·0)	1·54 (2·5)	7·47	0·06

BN, Bulimia nervosa; CW, control women; ED, eating disorder; EDI, Eating Disorder Inventory.
Generalized Estimating Equation Modelling was used to assess for overall group differences.
All contrasts are obtained through likelihood-ratio tests.
Rates with the same superscripts differ significantly from each other at $P < 0·05$; rates without any superscript do not differ significantly from any other rate in that row.
Values are means (standard deviations).

than control probands ($117·39 \pm 12·1$) on the MPQ higher order factor of Negative Emotionality ($F = 13·11$; $P = 0·0001$). In support of the 'co-occurrence model', currently ill BN probands ($4·80 \pm 4·3$) had significantly higher scores than recovered BN probands ($1·71 \pm 2·9$) on the MPQ Alienation scale ($F = 8·02$; $P = 0·0006$). Also in support of this model, currently

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Table 5. *Differences among female relatives of bulimic and control women on dimensions of perfectionism*

MPS	BN probands' relatives			CW probands' relatives with no ED history ($N = 74$)	χ^2 (df = 3)	P
	With a current ED ($N = 10$)	With a past ED ($N = 15$)	With no ED history ($N = 43$)			
Overall Perfectionism	67·00 (10·8)	76·20 (25·1)[a]	67·28 (20·4)[b]	58·53 (14·1)[ab]	12·74	0·005
Personal Standards	17·40 (4·9)	22·27 (7·0)	20·33 (6·1)	19·00 (5·0)	6·64	0·08
Concerns over Mistakes	17·20 (5·0)	21·27 (8·8)[a]	17·84 (7·5)[b]	14·93 (4·4)[ab]	13·15	0·004
Parental Expectations	12·10 (3·7)	13·20 (5·1)	12·63 (5·2)	10·89 (4·1)	5·85	0·12
Parental Criticism	10·10 (4·1)[a]	9·87 (4·9)[b]	8·63 (4·5)[c]	6·41 (2·5)[abc]	18·99	0·0003
Doubting of Actions	10·20 (3·6)[ab]	9·60 (3·8)[cd]	7·86 (3·1)[ac]	7·30 (2·8)[bd]	12·0	0·007
Organization	20·80 (4·2)	21·80 (5·9)	22·65 (4·7)	23·26 (4·7)	3·16	0·37

BN, Bulimia nervosa; CW, control women; ED, eating disorder; MPS, Multidimensional Perfectionism Scale.
Generalized Estimating Equation Modelling was used to assess for overall group differences.
All contrasts are obtained through likelihood-ratio tests.
Rates with the same superscripts differ significantly from each other at $P < 0·05$; rates without any superscript do not differ significantly from any other rate in that row.
Values are means (standard deviations).

ill BN probands ($16·23 \pm 7·5$) had significantly higher scores than recovered BN probands ($11·79 \pm 7·3$) on the MPQ Absorption scale ($F = 4·54$; $P = 0·01$).

Comparison of first-degree female relatives

Eating Disorder Inventory personality traits

There were significant group differences on all personality trait-related EDI scales, with the exception of Maturity Fears (see Table 4). In support of the 'predisposition model', the never ill relatives of BN probands had significantly higher scores than the never ill relatives of control probands on Ineffectiveness, Perfectionism, and Interpersonal Distrust. In support of the 'scar model', the previously ill relatives had significantly higher scores than the never ill relatives of BN probands on Interoceptive Awareness.

Perfectionism

There were significant group differences on the following MPS scales: Concerns over Mistakes, Parental Criticism, and Doubting of Actions (see Table 5). In support of the 'predisposition model', the never ill relatives of BN probands had significantly higher scores than the never ill relatives of control probands on the overall measure of perfectionism and the subscales Concerns over Mistakes and Parental Criticism. In support of the 'scar model', the previously ill relatives had significantly higher scores than the never ill relatives of BN probands on the subscale Doubting of Actions.

Other personality traits

Stress Reaction ($\chi^2 = 17·51$; $P = 0·0006$) and Traditionalism ($\chi^2 = 8·71$; $P = 0·03$) were the only MPQ scales for which there were significant overall group differences. In support of the 'scar model', the previously ill relatives ($12·87 \pm 8·0$) had significantly higher scores than the never ill relatives of BN probands ($7·11 \pm 6·0$) on Stress Reaction. There were no significant between group differences on Traditionalism.

Comparison between sisters and mothers of probands

On the MPQ, we found that mothers had higher levels of harm avoidance ($23·05 \pm 4·4$ *v.* $19·79 \pm 5·1$; $z = 2·79$; $P < 0·01$) and constraint ($168·60 \pm 13·8$ *v.* $161·81 \pm 13·5$; $z = 2·36$; $P < 0·02$) than sisters. Conversely, sisters had higher levels of social potency ($11·76 \pm 5·0$ *v.* $8·97 \pm 8·8$; $z = -2·82$; $P < 0·01$) and aggression ($3·70 \pm 3·1$ *v.* $2·68 \pm 2·9$; $z = -2·10$; $P < 0·04$) than mothers. On the EDI, we initially found that sisters had higher scores (i.e. diminished levels) of interoceptive awareness ($2·84 \pm 2·5$ *v.* $0·97 \pm 0·7$; $z = -2·26$; $P < 0·03$) than mothers, but this finding was non-significant after the conservative correlation adjustment (as described in the statistical analysis section).

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DISCUSSION

To our knowledge, the present study is the first to investigate personality traits among currently ill and recovered diagnostically 'pure' groups of bulimic individuals (i.e. those with no history of AN) and their first-degree female relatives who were also evaluated for current and past EDs. Our study examined three hypothesized relationships between personality and EDs: (1) are certain personality traits predisposing factors for EDs? ('predisposition model'); (2) do certain personality traits co-occur with the ED? ('co-occurrence model'); and, (3) does the experience of having had an ED have a lasting effect on personality functioning? ('scar model').

Our findings support the 'predisposition model' for the personality trait of perfectionism in particular, as well as ineffectiveness and interpersonal distrust. The bulimic probands' relatives with no ED history scored higher than the control probands' relatives with no ED history on each of these trait measures. Perfectionism is well-known to occur in AN (Bruch, 1973; Sours, 1979; Strober, 1991; Fairburn *et al.* 1999), but has only more recently been recognized as also associated with BN. In a cross-sectional study of female college students, Joiner and colleagues (1997) found that perfectionism predicted bulimic symptoms among those women who perceived themselves as overweight. Fairburn and colleagues (1997) also found evidence of elevated perfectionism prior to the onset of BN, as obtained through retrospective reports by the subjects themselves. Likewise, although clinical theorists have long emphasized the paramount significance of a pervasive sense of ineffectiveness as one of the core defects in the anorexic patient's ego development (Bruch, 1973; Selvini-Palazzoli, 1974; Strober, 1980), there has been much less emphasis upon the potential importance of this factor in the development of BN. In further support of perfectionism and ineffectiveness as potential predisposing personality traits, not only have they been shown to be elevated in anorexic and bulimic patients during the acute stages of their illness (Vitousek & Manke, 1994) and during recovery (Casper, 1990; Bastiani *et al.* 1995; Srinivasagam *et al.* 1995; Kaye *et al.* 1998), but they are among the few personality traits that are also elevated in 'at risk' populations (Garner *et al.* 1983*b*; Leon *et al.* 1993; Dancyger & Garfinkel, 1995). Finally, 'interpersonal distrust' reflects a general feeling of alienation and reluctance to form close relationships (Garner *et al.* 1983*b*). This was also implicated as a potential predisposing factor in the current study. The need to keep others at a distance has long been described as important in the development and maintenance of EDs (Selvini-Palazzoli, 1974; Goodsitt, 1977).

Traits that were best explained as co-occurring with BN are a sense of alienation (i.e. feeling mistreated by others) and 'absorption' (i.e. being emotionally responsive to environmental stimuli). These traits were elevated among currently ill compared to recovered BN probands, which suggests that they may be a consequence of the current illness. Indeed, the experience of having BN may produce a sense of alienation, in which shame over one's eating and the need for secrecy intensify social withdrawal and separation from others (Fairburn *et al.* 1993; Pryor & Wiederman, 1996). With regard to 'absorption', Pryor & Wiederman (1996) found that women with BN scored higher on this trait than women with AN. This suggests that during the active phase of their illness, bulimic women may be more liable to stray into fantasy or become intensely absorbed into sensory experiences.

Those traits with results suggestive of a 'scar' effect included increased stress reactivity, diminished interoceptive awareness (i.e. confusion in accurately identifying and responding to emotional states and visceral sensations), and perfectionistic doubting of actions. Previously eating disordered relatives had elevated levels of these traits compared to the never eating disordered relatives of BN probands. Thus, it appears that these traits may be consequent to, or exacerbated by, having experienced the ED. Importantly, there may be interaction effects, such that an episode of illness could accentuate these trait phenomena that may have existed pre-morbidly. This may be particularly true for diminished interoceptive awareness, which is often considered a core factor in the development of EDs (Bruch, 1973; Garner *et al.* 1983*a*), but may be further reduced by the erratic consummatory patterns of BN (Fairburn *et al.* 1993).

Comparison between mothers and sisters of probands yielded several significant differences.

We found that mothers had higher levels of harm avoidance and constraint than sisters. The positive correlation between age and harm avoidance is well-known (e.g. Tellegen, 1982). In contrast, we found that sisters had higher levels of social potency and aggression. That is, sisters were more forceful, decisive, persuasive and aggressive than their mothers. Thus, there appear to be several interesting generational differences on the personality dimensions of risk-taking and assertiveness.

The resemblance of the majority of personality findings between both groups of recovered subjects (i.e. probands and relatives) is notable. The groups differed in their selection criteria, as probands were directly recruited primarily through identification from current or prior treatment, whereas their previously eating disordered relatives were not. Secondly, the relatives had a history of a broad range of EDs, encompassing both the restricting and bingeing/purging spectrums. These findings suggest that the personality traits observed among these two groups of recovered subjects are not specific to a treatment sample and are not specific to BN. While individuals with AN and BN differ in symptom and personality presentation during the active phase of the disorder (Vitousek & Manke, 1994; Bulik *et al*. 1995), the resemblance in enduring traits following recovery suggests the possibility of some shared vulnerability for both disorders (Srinivasagam *et al*. 1995; Kaye *et al*. 1998). Further support for a shared vulnerability comes from recent twin studies which have found increased rates of both AN and BN among co-twins in whom the affected twin had either one of these disorders (Kendler *et al*. 1991). Furthermore, several family studies have shown that the relatives of probands with either AN or BN demonstrate elevated rates of both disorders compared to relatives of non-eating disordered controls (see review by Lilenfeld & Kaye, 1998).

There are several limitations to this study. First, we assessed a relatively small number of recovered BN probands and relatives, although our numbers do not differ substantially from those of previous similar studies (Strober, 1980; Casper, 1990; Srinivasagam *et al*. 1995). Secondly, not all relatives were directly interviewed, nor completed all assessment questionnaires. However, in the majority of cases, ED diagnoses were obtained through both direct and indirect informant interviews, and there were no group differences in the percentage of those not directly interviewed. Although a direct interview with relatives is likely to yield the most accurate information, the family history/informant method has been used extensively to study many disorders, including depression, anxiety disorders, substance use disorders, personality disorders, and EDs (e.g. Hudson *et al*. 1983; Andreasen *et al*. 1986; Klein *et al*. 1995). Thirdly, although there were clear advantages to the selection of a diagnostically 'pure' group of bulimic probands, our findings may not be completely generalizable to families of bulimic probands with a history of AN. Fourthly, a family study does not allow for any discrimination of the degree to which potential vulnerability factors may be due to genetic *versus* environmental variation. Finally, the only conclusive test of the 'predisposition hypothesis' can be obtained through longitudinal research. There are inherent limitations in the extent to which conclusions regarding vulnerability can be drawn using a cross-sectional and correlational design. Any true 'risk factor' must precede the outcome variable of interest and, therefore, is best identified in a longitudinal, prospective study (Kazdin *et al*. 1997; Kraemer *et al*. 1997). Unfortunately, such a design is logistically difficult, given the early-onset and relatively low incidence of EDs. Future research in this area should, nevertheless, seek to employ prospective studies to further investigate personality traits that may be vulnerability factors for EDs.

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