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Impulse control disorders in women with eating disorders

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Abstract

We compared symptom patterns, severity of illness, and comorbidity in individuals with eating disorders with and without impulse control disorders (ICD), and documented the temporal pattern of illness onset. Lifetime ICD were present in 16.6% of 709 women with a history of eating disorders. The most common syndromes were compulsive buying disorder and kleptomania. ICD occurred more in individuals with binge eating subtypes, and were associated with significantly greater use of laxatives, diuretics, appetite suppressants and fasting, and with greater body image disturbance, higher harm avoidance, neuroticism, cognitive impulsivity, and lower self-directedness. In addition, individuals with ICD were more likely to have obsessive-compulsive disorder, any anxiety disorder, specific phobia, depression, cluster B personality disorder, avoidant personality disorder, and to use psychoactive substances. Among those with ICD, 62% reported the ICD predated the eating disorder and 45% reported the onset of both disorders within the same 3-year window. The presence of a lifetime ICD appears to be limited to eating disorders marked by binge eating and to be associated with worse eating-related psychopathology, more pathological personality traits, and more frequent comorbid Axis I and II conditions. Untreated ICD may complicate recovery from eating disorders.

Keywords: Anorexia nervosa; Bulimia nervosa; Comorbidity

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1. Introduction

Impulse control disorders (ICD) are characterized by the repetitive occurrence of impulsive behavior. Included among the core features of these disorders are repetitive or compulsive engagement in a behavior despite adverse consequences, failure to resist the impulse, urge or craving state before engagement in the impulsive act, and sense of pleasure and gratification or release at the time the behavior is committed. In DSM-IV (American Psychiatric Association, 1994), ICD are classified as pathological gambling, kleptomania, intermittent explosive disorder, trichotillomania, pyromania, and ICD not otherwise specified, which may include compulsive internet use, compulsive sexual behavior, and compulsive buying.

Although accurate figures for the prevalence of ICD in the general population are not available, there is some evidence to suggest that these disorders are not rare. For example, estimates of the prevalence of pathological gambling approximate those of bipolar disorder and schizophrenia, with a lifetime prevalence of 1.6% (Schaffer et al., 1999). Preliminary data for the lifetime prevalence of kleptomania and compulsive buying suggest prevalence estimates of 0.6% and 1.1%–5.9%, respectively (Goldman, 1991; McElroy et al., 1994). A recent study on the prevalence of intermittent explosive disorder with a nationally representative sample of 9282 individuals 18 years and older indicated lifetime and 12-month prevalence estimates of 7.3% and 3.9%, respectively (Kessler et al., 2006).

ICD are commonly observed in several psychiatric disorders. In a recent study with 204 adult psychiatric inpatients, Grant et al. (2005) reported that although one-third of the adult patients admitted for inpatient psychiatric treatment suffered from a co-occurring ICD, only 1.5% of the inpatients carried an admission diagnosis of an ICD, suggesting that these disorders frequently go unrecognized. In a report from the Rhode Island Methods to Improve Diagnosis and Services (MIDAS) project, the lifetime prevalence of pathological gambling was examined in a sample of 1709 psychiatric outpatients, with a rate of 2.3% (Zimmermann et al., 2006). Lejoyeux et al. (2002) reported a frequency of 29% of all ICD among 107 depressed patients. This same group of authors reported a prevalence of 38% of ICD in a sample of 79 alcoholic patients (Lejoyeux et al., 1999a,b), and showed that 21 out of 52 patients with major depressive disorder were diagnosed as compulsive buyers (Lejoyeux et al., 1999a,b). In addition, Christenson and Crow (1996) observed that 52% of patients with major depressive disorder had trichotillomania. In individuals with major depressive or obsessive-compulsive disorder, those who also present with ICD tend to report earlier age of onset and greater severity of the primary disorder, greater comorbidity, and poorer prognosis (Lejoyeux et al., 2002; Fontenelle et al., 2005).

Our knowledge on the relation between eating disorders and diagnosed ICD is limited to a few case studies on kleptomania (Leygraf and Windgassen, 1990; Bayle et al., 1996) and trichotillomania (Hall and McGill, 1986), as well as isolated case series examining compulsive buying disorder (Mitchell et al., 2002). Several studies have reported high rates of binge eating and a higher prevalence of bulimia nervosa (BN) in a series of compulsive buyers compared with controls (Christenson et al., 1994; Black, 1996; Black et al., 1998; Lejoyeux et al., 1999a,b). More recently, Mitchell et al. (Mitchell et al., 2002) failed to demonstrate significant differences between healthy controls and compulsive buyers in prevalence of current or lifetime eating disorders and eating-related psychopathology. The few studies where this topic was examined specifically (Fernandez-Aranda et al., 2006) showed that those with BN and lifetime ICD presented more extreme personality profiles, especially on novelty seeking and impulsivity, and greater general psychopathology than individuals with BN without ICD. The observed prevalence of lifetime ICD among 227 BN patients in the aforementioned study was 23.8%, with compulsive buying and intermittent explosive disorder as the most frequently reported ICD. Furthermore, an analysis of personality profiles in individuals with BN and ICD revealed that while some personality traits were shared between pathological gambling and BN (low self-directedness, higher harm avoidance and cooperativeness), sex- and diagnosis-specific personality traits also emerged (higher novelty seeking in ICD) (Alvarez-Moya et al., submitted for publication).

However, knowledge regarding the extent to which ICD complicate the clinical picture of eating disorders and the distribution of these disorders across eating disorder subtypes remains limited.

Even though research on ICD in eating disorders is scarce, a vast literature exists on the relation between eating disorders and impulsivity (Lacey, 1993; Newton et al., 1993; Bulik et al., 2004; Cassin and von Ranson, 2005; Duncan et al., 2005). Briefly, impulsivity has been defined as a person's predisposition to proceed rapidly, without being cautious or weighing the outcomes of actions. Previous research has examined the association between eating disorders and impulsivity either as a behavior or a personality trait, focusing on a subgroup of

individuals described as having multi-impulsive bulimia nervosa. This group was characterized by extreme deficits in impulse regulation that extend beyond the domain of appetite and feeding behavior, including propensities for affective and interpersonal instability, poor frustration tolerance, drug and alcohol misuse, and suicidality (Lacey and Evans, 1986; Lacey, 1993; Fichter et al., 1994). These individuals also displayed more general psychopathology and had less favorable outcomes. Consistent with these observations is the evidence that in anorexia nervosa (AN) the presence of binge eating is similarly associated with an elevated risk of greater familial morbidity for substance use disorders, and a higher risk for future alcohol-related problems (Casper et al., 1980; Garfinkel et al., 1980; Toner et al., 1986; Da Costa and Halmi, 1992; Strober et al., 1995). Although the underlying psychosocial and biological variables contributing to deficient impulse control are not entirely known, substantial data exist to assert that impulsivity is a comorbid psychiatric trait that negatively affects the course and prognosis of eating disorders (Keel et al., 2000; Fichter and Quadflieg, 2004; Fichter et al., 2006).

Befitting the nature of eating disorders as multifactorial illnesses, several lines of evidence suggest that BN is a behaviorally diverse syndrome (Sullivan et al., 1998; Keel et al., 2004; Striegel-Moore et al., 2006), composed of subgroups likely to have distinct genetic underpinnings with developmentally unique and behaviorally specific characteristics. A principal ongoing challenge in the study of its causative biology and the nature of gene–environment interplay is identifying aspects of the BN phenotype that may inform its subclassification. Since evidence is substantial that heritable factors underlie variation in impulse control and the self-administration of reward (Coccaro et al., 1993; Caspi et al., 2002; Barr et al., 2003; Davies et al., 2003; Foley et al., 2004; Schuckit et al., 2004; Passmonti et al., 2006), and that specific molecular variants mediate neuroadaptive responses to both naturally occurring and illicit rewards (Nestler, 2005), investigating ICD in eating disorder subtypes may help to refine diagnostic phenotypes for future molecular studies of vulnerability genes and environmental mediators of the major eating disorders.

The goals of the present study were fourfold to determine: (1) the lifetime prevalence of non-alcohol ICD (data on alcohol use disorders in this sample have been reported previously in Bulik et al., 2004) in a large sample of individuals with eating disorders; (2) the pattern of association of ICD with eating disorder subtypes; (3) the relation of ICD to psychopathological features and overall morbidity associated with disordered eating, and to drug use; and (4) the pattern of onset of eating disorders and ICD. We hypothesized that ICD would cluster among individuals with subtypes of eating disorders that included binge eating and that ICD would be associated with inappropriate compensatory behaviors, and higher novelty seeking and impulsivity scores.

2. Method

2.1. Participants

Participants were drawn from the multisite, international Price Foundation Genetic Studies of Eating Disorders, which seek to identify susceptibility loci involved in risk for anorexia and bulimia nervosa. The sample analyzed for this study comprised affected relative pair families who were identified from a proband with BN ('BN Affected Relative Pair Study'; Kaye et al., 2004b). Informed consent was obtained from all study participants, and all sites received approval from their local Institutional Review Board. A brief description of the study is provided below.

The sample included both probands and affected relatives. Probands met the following criteria: (1) DSM-IV (American Psychiatric Association, 1994) lifetime diagnosis of BN, purging type, with the additional requirement of at least a 6-month period of binge eating and vomiting at least twice a week; and (2) age between 13 and 65 years. Affected relatives were biological family members who (1) were between the ages of 13 and 65 years; and (2) had lifetime eating disorder diagnoses of DSM-IV BN, purging type or nonpurging type, modified DSM-IV anorexia nervosa (AN) (i.e., criterion D not required), or EDNOS [eating disorder not otherwise specified — subthreshold AN, subthreshold BN, or subthreshold mixed (relatives who were normal weight but reported either purging behavior or excessive exercise or periods of fasting due to extreme fear of weight gain or undue influence of body weight on self-esteem)]. For complete inclusion and exclusion criteria for probands and relatives, see Kaye et al. (Kaye et al., 2004b).

2.2. Measures

2.2.1. Demographic and clinical variables

Data relative to eating disorder age of onset and duration, minimum and maximum body mass index (BMI), lowest preferred weight, and mean caloric intake were included in the analyses.

2.2.2. Eating disorder diagnoses, associated features

Lifetime histories of eating disorders in probands and affected relatives were assessed with the Structured Interview of Anorexia Nervosa and Bulimic Syndromes (SIAB; Fichter et al., 1998). The SIAB is a semi-structured clinical interview designed to gather detailed information on weight and eating history to establish DSM-IV and ICD-10 eating disorder diagnoses. The SIAB has satisfactory psychometric properties with good reliability and validity (Fichter and Quadflieg, 2001). Additional information regarding eating disorder recovery status as well as the presence or absence of eating disorder symptoms was obtained by an expanded version of Module H of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID) (First et al., 1996). The diagnostic categories were as follows: (1) modified DSM-IV AN that included three AN subtypes: restricting AN (RAN), bingeing AN regardless of purging behavior (BAN), and purging AN (PAN), purging in the absence of binge eating (amenorrhea was not an inclusion criterion for the study); (2) DSM-IV BN including both purging (PBN) and nonpurging types (NPBN); (3) ANBN, individuals with a history of both AN and BN; and (4) EDNOS, which encompassed subthreshold AN (presence of at least two of the three criterion symptoms of low body weight, extreme fear of fatness, or body image disturbance, undue influence of body weight and shape on self-evaluation, or denial of the seriousness of low body weight), subthreshold BN (the frequency or duration of eating binges and/or purging or other inappropriate compensatory behaviors fell below the specified DSM-IV criterion, which is twice per week for 3 months, respectively), and subthreshold mixed [individuals of normal weight who purged (e.g., vomited or abused laxatives, diuretics, enemas), fasted or exercised excessively due to extreme fear of weight gain, or undue influence of body weight on self-evaluation, in the absence of binges or binge eating]. For the present analysis, males ($n=15$) and 18 other individuals for whom impulsivity data were missing were excluded. The final sample size was 709.

2.2.3. Impulse control disorders

Lifetime diagnosis of ICD (intermittent explosive disorder, pathological gambling, pyromania, compulsive buying disorder, kleptomania, and trichotillomania) was assessed with a module designed by James E. Mitchell, University of North Dakota, US (personal communication, unpublished, 2006), based on the DSM-IV criteria for ICD and McElroy's proposed criteria for compulsive buying disorder (McElroy et al., 1994) (available from authors upon request). In addition, when assessing kleptomania, interviewers were instructed to ask if the stolen item was food. If yes, this answer was not counted toward kleptomania as it was considered part of the eating disorder.

2.2.4. Personality and symptom assessments

Temperament and character dimensions were measured with the Temperament and Character Inventory (TCI) (Cloninger et al., 1993) and the Revised NEO Personality Inventory (NEO-PI-R) (Costa and McCrae, 1992). The TCI measures seven dimensions of personality, comprising the temperament dimensions of novelty seeking, harm avoidance, reward dependence, and persistence, and the character dimensions of cooperativeness, self-directedness and self-transcendence. The NEO-PI-R was developed by Costa and McCrae (1992) and measures five higher-order dimensions of personality, called the Five Factor Model, including neuroticism, extraversion, openness, agreeableness and conscientiousness. It has received much empirical support and is one of the most widely used tests in personality research. Impulsivity was assessed with the Barrett Impulsivity Scale-11 (BIS-11) (Barrett, 1983). The BIS is a 30-item self-report scale that provides measures of impulsivity in the following three domains: motor, cognitive and non-planning. Currently, this scale is in its 11th revision.

2.2.5. Non-alcoholic substance use data

Substance use information was assessed with the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (First et al., 1996) sections E10 and E11. Participants were asked if they had ever taken any of the following substances to get high, to sleep better, to lose weight, or to change mood: sedatives–hypnotics–anxioloytics, cannabis, stimulants, opioids, cocaine, hallucinogens, other, and polysubstance. Frequency for each drug class was reported as at least twice but fewer than 10 times, or more than 10 times in a month period for street drugs; or for prescribed drugs, either becoming dependent or using much more than prescribed.

2.2.6. Axis I and II psychiatric disorders

Axis I disorders were assessed with the SCID (First et al., 1996). Personality disorders (clusters B and C) were assessed with the Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II) (First et al., 1994).

2.3. Statistical analyses

The lifetime prevalence of all ICD in the entire sample and by eating disorder diagnostic subtypes was first

examined using the FREQ procedure in SAS (SAS, 1998).

Logistic regression analysis with ICD as the outcome variable and (1) frequency of eating disorder related behaviors, (2) standardized scores (mean of zero and standard deviation of one) on TCI, NEO-PI-R, and BIS-11, (3) non-alcoholic substance use, and (4) Axis I and Axis II comorbidity as predictors was applied to the data in order to identify variables that differentiated individuals with ICD from those without ICD. Generalized Estimating Equations (GEE) to correct for non-independence (Liang et al., 1986; Zeger et al., 1988; Zeger and Diggle, 1994) were applied in all models. Eating disorder subgroup (AN, BN, ANBN and EDNOS) and age at interview were entered as covariates in all models. In order to identify the temporal proximity between the onset of ICD and the onset of eating disorder, the differences between these two ages of onset were calculated for each individual with ICD (age of onset of ICD − age of onset of eating disorder). Statistical analyses were conducted using the GENMOD procedure of SAS version 8.1 (SAS, 1998). All significance tests were two-tailed ($P<0.05$) with P values adjusted for multiple testing using the method of false discovery rate (Benjamini et al., 2001).

3. Results

3.1. Participants

The final sample included 59 participants with RAN, 33 with PAN, 29 with BAN, 252 with PBN, 22 with NPBN, 251 with ANBN, and 63 with EDNOS (11 with subthreshold AN, 20 with subthreshold BN and 32 with subthreshold mixed).

Table 1
Frequency of eating disorder related behaviors by the presence or absence of impulse control disorder (ICD) •

	No ICD % (*n*)	ICD % (*n*)	χ^2 (*P*-value[a]) *df*=1	Odds ratio * 95% CI
Laxatives	41.8 (246)	66.1 (78)	16.44 (0.001)	2.46 (1.60, 3.78)
Ipecac	10.7 (63)	16.1 (19)	1.26 (0.35)	
Diuretics	15.1 (89)	36.2 (42)	12.62 (0.002)	2.79 (1.73, 4.51)
Enemas	5.6 (33)	11.0 (13)	2.06 (0.22)	
Appetite suppressants	37.2 (220)	62.7 (74)	15.46 (0.001)	2.38 (1.57, 3.61)
Fasting	52.7 (311)	70.3 (83)	13.42 (0.001)	2.17 (1.42, 3.31)
Excessive exercise	30.1 (178)	29.7 (35)	0.13 (0.77)	
Weight phobia	69.2 (409)	74.6 (88)	2.44 (0.20)	
Self-esteem	90.9 (537)	94.9 (112)	3.03 (0.15)	
Body image	59.4 (351)	65.2 (77)	5.82 (.0038)	1.78 (1.11, 2.87)
	Mean (S.D.)	Mean (S.D.)	χ^2 (*P*-value[a])	Odds ratio* 95% CI
Temperament and Character Inventory				
Harm avoidance	18.8 (7.6)	20.3 (7.7)	6.69 (0.032)	1.34 (1.07, 1.69)
Novelty seeking	20.6 (6.5)	22.1 (6.5)	4.00 (0.08)	
Reward dependence	16.7 (4.0)	17.1 (3.7)	0.85 (0.43)	
Persistence	5.1 (2.1)	5.4 (2.0)	2.65 (0.15)	
Cooperativeness	33.7 (6.0)	33.9 (5.1)	0.00 (0.95)	
Self-directedness	26.7 (9.4)	24.3 (9.0)	9.93 (0.010)	0.70 (0.56, 0.87)
Self-transcendence	14.9 (6.7)	16.5 (6.1)	4.41 (0.07)	
NEO				
Extraversion	109.9 (20.2)	109.1 (23.4)	0.11 (0.81)	
Neuroticism	109.5 (25.6)	116.9 (22.5)	11.10 (0.010)	1.44 (1.14, 1.81)
Barratt Impulsivity Scale				
Cognitive	17.4 (4.1)	18.8 (2.9)	6.52 (0.032)	1.42 (1.10, 1.83)
Motor	21.8 (4.6)	23.9 (3.7)	4.95 (0.06)	
Nonplanning	25.3 (5.1)	26.5 (4.6)	1.60 (0.28)	

•Age at interview and eating disorder group (AN, BN, ANBN, EDNOS) status were entered as covariates.
[a] *P*-values are adjusted using False Discovery Rate.
* Odds ratios are indicated if significant.

3.2. Prevalence of impulse control disorders

The lifetime prevalence of all ICD in the entire sample was 16.6% ($n=118$). Compulsive buying disorder was the most common diagnosis ($n=84$; 11.8%) followed by kleptomania ($n=32$; 4.5%), with 17 participants having both. Remaining diagnoses were trichotillomania ($n=13$; 1.8%), intermittent explosive disorder ($n=4$; 0.6%), compulsive gambling ($n=2$; 0.3%), and pyromania ($n=2$; 0.3%).

3.3. Prevalence of impulse control disorders by subtype of eating disorder

Impulse control disorders were observed in only one participant with RAN (1.7%), and were rare among those with PAN (6.1%, $n=2$). Thus, of the 118 cases of ICD, all but three were associated with eating disorders subtypes that included binge eating. The difference in prevalence between non-binge eating and binge eating participants was statistically significant ($\chi^2=20.1$, $P<0.0001$). The lifetime prevalence of ICD among binge eating subtypes were as follows: BAN 20.7%, $n=6$; PBN 21.8% $n=55$; NPBN 13.6% $n=3$; ANBN 17.9%, $n=45$. Among the EDNOS, 20 individuals reported binge eating (subthreshold BN) and six of those had ICD (20%).

3.4. Association among ICD, eating disorder characteristics, and psychological/personality features

All analyses from this point forward compare individuals with eating disorders who also have ICD to individuals with eating disorders who do not have ICD. Table 1 presents the frequency of eating disorder related behaviors by the presence of ICD. Those with a diagnosis of ICD reported greater use of laxatives (OR: 2.46; 95% CI: 1.60–3.78), diuretics (OR: 2.79; 95% CI: 1.73–4.51), appetite suppressants (OR: 2.38; 95% CI: 1.57–3.61), and fasting (OR 2.17, 95% CI: 1.42–3.31), and greater body image disturbance (OR: 1.78; 95% CI: 1.11–2.87 compared with participants without ICD.

The presence of ICD was associated with higher scores on harm avoidance (OR: 1.34; 95% CI: 1.07–1.69), neuroticism (OR: 1.44; 95% CI: 1.14–1.81), cognitive impulsivity (OR: 1.42; 95% CI: 1.10–1.83), and lower self-directedness (OR: 0.70; 95% CI: 0.56–0.87).

3.5. Association between the presence of ICD and non-alcoholic substance abuse

Table 2 presents results from the logistic regression analysis predicting ICD from non-alcoholic substance abuse. In comparison to women without ICD, women with eating disorders and ICD reported significantly greater use of sedatives (OR: 2.32; 95% CI: 1.30–4.14), cannabis (OR: 1.97; 95% CI: 1.29–3.01), stimulants (OR: 1.98; 95% CI: 1.19–3.31), opioids (OR: 3.11; 95% CI: 1.68–5.79), cocaine (OR: 1.93; 95% CI: 1.22–3.05), hallucinogens (OR: 2.33; 95% CI: 1.48–3.65), other non-alcoholic substance (OR: 1.97; 95% CI: 1.19–3.25), and any substance use (OR: 2.01; 95% CI: 1.27–3.16).

3.6. Association between ICD and Axis I and II disorders

Table 3 presents the results from the logistic regression analysis predicting ICD from Axis I and II disorders. Women with ICD had significantly greater comorbidity of any anxiety disorders (OR: 3.00; 95% CI: 1.86–4.83), specific phobia (OR: 2.61; 95% CI: 1.56–4.36), OCD (OR: 2.55; 95% CI: 1.70–3.83), depression (OR: 2.01; 95% CI: 1.21–3.35), cluster B personality disorder (OR: 3.29; 95% CI: 1.89–5.72), borderline personality disorder (OR: 3.49; 95% CI: 1.95–6.24), and avoidant personality disorder (OR: 2.33; 95% CI: 1.42–3.82).

Table 2
Results from logistic regression analyses (using GEE) predicting impulse control disorder from non-alcoholic substance use*●

Variable	No ICD % (*n*)	ICD % (*n*)	χ^2 (*P*-value[a]) *df*=1	OR (95% CI)**
Sedatives	8.8 (52)	20.3 (24)	5.83 (0.023)	2.32 (1.30, 4.14)
Cannabis	51.1 (302)	68.6 (81)	10.18 (0.005)	1.97 (1.29, 3.01)
Stimulants	15.6 (92)	30.5 (36)	5.46 (0.023)	1.98 (1.19, 3.31)
Opioids	6.1 (36)	19.5 (23)	7.86 (0.011)	3.11 (1.68, 5.79)
Cocaine	14.9 (88)	28.8 (34)	6.26 (0.022)	1.93 (1.22, 3.05)
Hallucinogens	17.3 (102)	33.9 (40)	10.24 (0.005)	2.33 (1.48, 3.65)
Other	13.9 (82)	25.4 (30)	5.36 (0.023)	1.97 (1.19, 3.25)
Polysubstance	2.4 (14)	8.5 (10)	3.77 (0.052)	–
Any	56.4 (333)	74.6 (88)	9.70 (0.005)	2.01 (1.27, 3.16)

*Frequency use is defined as at least twice but fewer than 10 times, or more than 10 times in a month period for street drugs; or for prescribed drugs, either becoming dependent or using much more than prescribed.
●Age and eating disorder group (AN, BN, ANBN, EDNOS) status were entered as covariates.
[a] *P*-values are adjusted using False Discovery Rate.
** Odds ratios are indicated if significant.

3.7. Temporal pattern of onset of ICD and eating disorders

As shown in Fig. 1, we calculated the difference between the reported age of onset of ICD and the eating disorder. As calculated, negative values indicated those instances in which ICD came first. The figure illustrates that for the total sample with lifetime ICD for whom data on age at onset were available, 62% of the ICD manifested before the onset of the eating disorder. Over forty percent (45%) of individuals experienced the onset of both disorders within the same 3-year window.

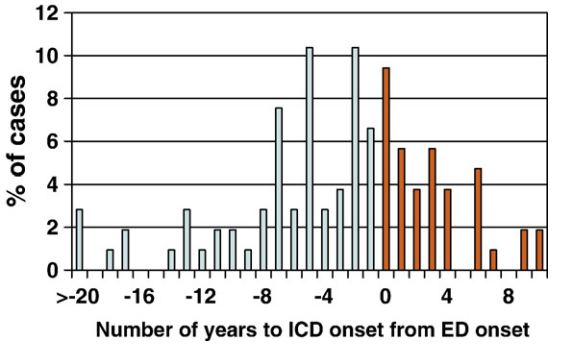

Fig. 1. Relation of age at onset of impulse control disorder (ICD) to age of onset of ED. ICD prior to ED. ICD occurred at the same year or after the ED. Negative numbers indicate ICD came first.

4. Discussion

ICD among individuals with eating disorders are differentially associated with the presence of the symptom of binge eating. In addition, after controlling for subtype of eating disorder, the presence of ICD is significantly associated with greater severity of eating disorder as reflected in the use of maladaptive compensatory behaviors (such as laxatives, diuretics, appetite suppressants, and fasting), greater general psychiatric morbidity and psychopathology (including depression and anxiety disorders, cluster B personality disorder, avoidant personality disorder), and specific personality traits (higher impulsivity, harm avoidance, neuroticism, cognitive impulsivity, and lower self-directedness). This reflects research in other areas of psychiatry in which the presence of ICD is commonly associated with greater overall severity of illness (Potenza et al., 2002).

In the present study, although ICD occurred almost exclusively in individuals who presented with binge eating, our hypothesis that individuals with ICD would score higher on novelty seeking than those without ICD was not supported. In contrast, individuals with ICD scored higher on harm avoidance than those without. High harm avoidance has been reported in individuals with ICD (specifically pathological gambling) (Alvarez-Moya et al., submitted for publication). These differential patterns may suggest that ICD may emerge from multiple sources—one a more impulsively driven source marked by high novelty seeking and impulsivity and another more strongly associated with higher harm avoidance. In addition, the diagnostic category of ICD is heterogeneous. Differences in findings in personality traits could be related to inherent heterogeneity in mixed ICD samples with varying diagnostic make-up (e.g. samples with greater proportions of individuals with pathological gambling may show higher novelty seeking than samples with higher proportions of compulsive buying).

The prevalence of ICD (16.6%) in this sample concurs with estimates reported in smaller clinical

Table 3
Results from logistic regression analyses (using GEE) predicting impulse control disorder from Axis I and Axis II (DSM-IV) •

Variable	No ICD % (*n*)	ICD % (*n*)	χ^2 (*P*-value [a]) *df*=1	OR (95% CI) *
Axis I disorder				
Agoraphobia	2.0 (12)	5.1 (6)	2.41 (0.20)	
GAD	7.6 (45)	14.7 (17)	4.97 (0.06)	
OCD	33.9 (198)	55.9 (66)	18.31 (0.001)	2.55 (1.70, 3.83)
Panic disorder	8.4 (49)	13.7 (16)	2.55 (0.20)	
PTSD	10.1 (56)	24.5 (26)	7.59 (0.06)	
Social phobia	18.0 (105)	17.8 (21)	0.00 (0.96)	
Specific phobia	9.4 (55)	20.5 (24)	8.55 (0.012)	2.61 (1.56, 4.36)
Any anxiety disorder	54.0 (319)	78.0 (92)	24.50 (0.001)	3.00 (1.86, 4.83)
Depression	66.6 (378)	81.0 (94)	8.28 (0.012)	2.01 (1.21, 3.35)
BPI	0.8 (5)	2.6 (3)	1.00 (0.46)	
BPII	1.9 (11)	2.6 (3)	0.11 (0.78)	
Axis II disorder				
Cluster B	9.5 (52)	24.8 (26)	11.06 (0.005)	3.29 (1.89, 5.72)
BPD	9.2 (45)	22.9 (24)	10.77 (0.005)	3.49 (1.95, 6.24)
ASPD	0.9 (5)	1.9 (2)	0.71 (0.50)	
HPD	0.6 (3)	1.9 (2)	0.84 (0.48)	
NPD	1.5 (8)	1.0 (1)	0.20 (0.72)	
Cluster C	26.5 (145)	37.1 (39)	4.68 (0.06)	
APD	14.4 (79)	25.7 (27)	8.16 (0.012)	2.33 (1.42, 3.82)
DPD	2.6 (14)	3.8 (4)	0.43 (0.60)	
OCPD	14.3 (78)	20.0 (21)	1.71 (0.29)	

Note. OR=odds ration; CI=confidence interval; GAD=generalized anxiety disorder; OCD=obsessive-compulsive disorder; PTSD=post-traumatic stress disorder; BPI=bipolar disorder I; BPII=bipolar disorder II; BPD=borderline personality disorder; ASPD=antisocial personality disorder; HPD=histrionic personality disorder; NPD=narcissistic personality disorder; APD=avoidant personality disorder; DPD=dependent personality disorder; OCPD=obsessive-compulsive personality disorder.

•Age at interview and eating disorder group (AN, BN, ANBN, EDNOS) status were entered as covariates.

[a] *P*-values are adjusted using False Discovery Rate.

* Odds ratios are indicated if significant.

cohorts (McElroy, 1999; Grant and Kim, 2002), and the prevalence of 21.8% in our binge-purge BN subgroup is consistent with the 23.8% prevalence in a large sample of individuals with BN reported by Fernandez-Aranda et al. (2006). Lifetime prevalence of ICD as high as 30% has been reported in psychiatric populations with major depression and alcohol dependence. (Lejoyeux et al., 1999a,b, 2002; Grant et al., 2005). These higher rates are likely to reflect elevated occurrences of multiple psychiatric disorders among treatment-seeking individuals (Berkson, 1950). Additionally, the low observed prevalence of pyromania and pathological gambling, compared with kleptomania, compulsive buying and trichotillomania, is in concordance with the results obtained in a previous study (Fernandez-Aranda et al., 2006). As recently suggested (Alvarez-Moya et al., submitted for publication), this result might be due to some differential personality traits between eating disorders and pathological gambling (higher novelty seeking in the latter. The extent to which other specific neurobiological vulnerabilities might account for this observation remains unclear.

That ICD were associated with pathological compensatory behaviors such as use of laxatives, diuretics, appetite suppressants, and fasting, and with higher lifetime Axis I and II comorbidity even after controlling for eating disorder subtype concurs with other studies (Christenson et al., 1994; McElroy et al., 1994; Schlosser et al., 1994; Faber et al., 1995; Mitchell et al., 2002), supports the notion that use of multiple purging methods is associated with greater impulsivity (Favaro and Santonastaso, 1998; Vervaet et al., 2004; Solano et al., 2005), and may distinguish a unique subgroup of BN. Our results suggest that both anxiety and impulsivity may contribute to liability to the combined presence of ICD and eating disorders in this sample. More specifically, ICD individuals were almost three times more likely to have comorbid OCD in this sample. Myers et al. (2006) reported a higher prevalence of OCD in a group of 61 multi-impulsive bulimics (19.7%) when compared with 77 non-multi-impulsive women with BN (6.5%). Frost et al. (1998, 2002) also observed the association of compulsive buying and symptoms of OCD. Problems with removing unwanted thoughts and impaired decision making may be a link between OCD and ICD (McElroy et al., 1994), and may, at least partially, explain the association of ICD and OCD observed in our sample. In addition, binge eating and purging behaviors can be present for different reasons in women with eating disorders. For example, in women with eating disorders and no ICD, these behaviors could be the result of extreme dietary restriction, whereas in women with comorbid ICD, they could represent an effort to regulate negative affect and anxiety.

With reference to personality disorders, our finding that ICD participants were three times more likely to have comorbid borderline personality disorder is also supported in the literature (Cassin and von Ranson, 2005), and by studies that show that features of impulsivity are more likely to be present in individuals with certain psychiatric disorders such as personality disorders, mania, and substance dependence (Moeller et al., 2001).

We also found that ICD commonly appeared prior to the onset of eating disorder. This observation lends itself to several possible interpretations: that a disorder of impulse control plays a causal role in the subsequent development of binge eating; that a multi-impulsive syndrome is mediated by specific genetic variants with pleiotropic effects; or that an interplay of adverse environmental exposures and genetic factors predisposes to general multi-impulsivity with broadly expressed behavioral sequelae. Engaging in impulsive behaviors prior to the development of BN was also reported by Nagata et al. (2000), who reported that 80% of BN patients with multi-impulsivity had a history of suicide attempts or self-mutilation prior to the onset of BN.

Insofar as the most common chronology of onset was for ICD to precede ED, careful examination of the developmental progression of multiple illness onsets may shed light on variations in risk or liability factors that can be inferred from lifetime comorbid associations. The present observation of temporal precedence of the non-eating disorder syndrome is similar to our previously reported findings for anxiety disorders, which also predated the onset of eating disorder in the majority of cases (Kaye et al., 2004a), but different from observations of comorbidity of major depression where 67% of the onsets occurred within the same 3-year window (Fernandez-Aranda et al., 2007). It is indeed plausible that a subform of BN exists whose development in association with ICD, affective disturbance, substance use, and personality disturbances is an expression of genetic variants that predispose to high levels of disinhibition and impulsivity. Of relevance to this hypothesis, Steiger et al. (2005) documented reduced density of platelet-paroxetine binding, and elevated “trait” disturbances (affective instability, impulsivity, and BPD) in bulimic 5HTTLPR s-allele carriers. Furthermore, Bruce et al. (2004, 2005) assessed implications of 5HTTLPR on treatment response. Preliminary findings show 5HTTLPR s-allele carriers showed poorer response

than non-s cases after roughly 8 months of therapy on indices of anxiety/depression, dieting behavior, and relationship problems. Although the relation between serotonin (5HT) and ICD has been the subject of various investigations, ICD share other common neurobiologic markers of vulnerability including norepinephrine and dopamine (DA) imbalance. Recently, Winstanley et al. (2005) reported a significant role for 5HT:DA interaction within the nucleus accumbens in the control of impulse control behaviors. Since several lines of evidence have raised the possibility that serotonin pathways contribute to the pathophysiology of AN and BN (Kaye et al., 2005), a better understanding of the nature of 5-HT:DA interactions may further elucidate the neurochemical basis of impulsive behavior, and the relationship of ICD and eating disorders.

The present study should be evaluated within the context of several limitations. Although not a clinical sample per se, participants included familial cases ascertained for a genetic study of eating disorders. When cases are ascertained from enriched pedigrees, differences might exist in severity and comorbidity as compared with sporadic cases. As an example, reflecting our sampling strategy, EDNOS accounts for 9% of the participants in the present sample, as opposed to almost half of cases observed in clinical settings (Ricca et al., 2001; Turner and Bryant-Waugh, 2004). For this reason, the generalizability of our findings remains uncertain. Second, our data are retrospective and prone to the unreliability of individual recall and potential memory bias. Third, although data were available for psychoactive substance use, we did not have abuse and dependence diagnoses, relevant comorbidities in individuals with ICD. Furthermore, since our results point to the association of ICD and binge eating behavior, future studies should explore ICD in samples of individuals with binge eating disorder. And finally, impulsivity as a symptom is present in a number of psychiatric disorders, and although it constitutes a diagnostic criterion in DSM-IV for various disorders, it is not well defined and lacks specificity.

Given that ICD are relatively common yet understudied conditions, as in other psychiatric disorders in which the presence of ICD are associated with poorer prognosis (Lejoyeux et al., 1999a,b; Fontenelle et al., 2005), unrecognized and untreated ICD could compromise effective interventions for eating disorders.

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