Personality Disorder Symptoms in Intermittent Explosive Disorder: A Latent Class Analysis

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Abstract

Intermittent explosive disorder (IED) is characterized by recurrent reactive aggression. IED is associated with significant personality pathology which is suggestive of higher levels of general personality disorder (PD). However, little is known about how personality factors impact severity and presentation of IED. The present study employed a latent class analysis to assess for distinct PD symptom classes within IED and evaluate whether these classes differed in terms of severity and behavioral presentation. Statistical and clinical indicators revealed a four-class model, with latent classes distinguished primarily on general levels of PD symptoms (low, high, moderate). However, the two moderate PD symptom classes distinguished from other classes on avoidant PD. Additionally, classes differed in terms of severity and presentation, suggesting important implications for both general PD and avoidant PD comorbidity within IED. Results provide further insight into the heterogeneity within IED and suggest a more nuanced approach in treating this serious condition.

Keywords

intermittent explosive disorder; personality disorder; aggression; latent class analysis; external validation

Though occasional acts of mild aggression (e.g., arguments) are normative (Kulper et al., 2015), frequent and/or severe aggression may warrant a mental health diagnosis. Intermittent Explosive Disorder (IED) is a psychological condition characterized by recurrent and excessive aggression (APA, 2022). As such, IED is the sole diagnosis for which aggression is the cardinal symptom, with individuals exhibiting either minor (verbal, non-damaging physical) aggression multiple times a week for three or more months, or major (resulting in physical injury or damage) aggression three or more times within a year. Furthermore, the aggression must be reactive/anger-based, disproportionate to any provocation, result in significant distress and/or impairment, and not be better accounted for by another psychiatric or medical condition (APA, 2022). Despite these stringent criteria, IED is relatively common, existing in about 2% - 4% of the population (Coccaro & McCloskey, 2019). Sex differences in IED across clinical and community studies generally suggest that

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IED occurs more often in males than females, though the magnitude of such differences is debated (i.e., between 1.00–1.00 and 2.00–1.00 male-female odds ratios; Coccaro & McCloskey, 2019). Relatedly, males tend exhibit a higher degree of physical aggression than women (Coccaro et al., 1997) which may contribute to the higher rates of diagnosis among men and higher prevalence of males in some IED samples, but otherwise few consistent sex differences have been found in the symptom presentation of IED (e.g., Coccaro & McCloskey, 2019).

The limited research on IED has highlighted the significant impact of the disorder. IED is also associated with considerable psychosocial impairment, including increased interpersonal problems, legal difficulties, work problems, and a poorer overall quality of life even relative to individuals with other psychiatric conditions (Kulper et al., 2015; Rynar & Coccaro, 2018). Individuals with IED are at increased risk of hypertension, stroke, headaches, and several other health problems (McCloskey et al., 2010). Those with IED are also more likely to engage in self-harm including non-suicidal self-injury (Jenkins et al., 2015) and suicide attempts (Coccaro & McCloskey, 2019).

IED is also associated with considerable psychiatric comorbidity. A large epidemiological study of IED based on criteria from the Diagnostic and Statistical Manual of Mental Disorders-Fourth Revision (DSM-IV) showed that 38.1% of individuals with IED also met criteria for a lifetime mood disorder, whereas 60.2% met for an anxiety disorder and 39.6% met for a substance use disorder, with IED typically originating before the comorbid disorder (Kessler et al., 2006). However, comorbidity between IED and personality disorders (PD) is even higher (Coccaro, 2012), with a recent study of 650 participants diagnosed with IED finding that 92% met general criteria for a personality disorder, including 48% meeting criteria for a cluster B disorder (i.e., borderline, antisocial, narcissistic, and histrionic PDs), 27% meeting criteria for a cluster C disorder (avoidant, obsessive-compulsive, and dependent PDs), and 18% meeting criteria for a cluster A disorder (i.e., paranoid, schizoid, and schizotypal PDs; Coccaro et al., 2018). Among these, the PDs with highest comorbidity rates among IED were antisocial, borderline, paranoid, and obsessive-compulsive PDs, all of which are independently associated with anger and/or aggression (APA, 2022; Lee, 2017; Villemarette-Pittman et al., 2004). Furthermore, PD comorbidity predicted more severe anger and aggression among those with IED (Coccaro et al., 2018). Thus, PD symptoms appear to be associated with IED severity.

Notably, the association between IED and PD symptoms is also consistent with newer, dimensional models of personality pathology, developed in part to address some of the limitations of the current PD classification system such as high levels of comorbidity between PDs and high prevalence of PD-not otherwise specified (PD-NOS; Monaghan & Bizumic, 2023). These models suggest a general personality disorder factor (PD-g) that may account for much of the variability within and across personality disorders, along with some other more specific dimensions (Oltmanns et al., 2018; Sharp et al., 2015). Individuals diagnosed with IED have increased risk for several different personality disorders compared to psychiatric controls (Coccaro et al., 2018). Those with IED also have an increased likelihood of receiving a PD-NOS diagnosis (Coccaro et al., 2018), which is reflective of significant personality psychopathology that does not fit into a specific DSM PD. Both

aforementioned findings are suggestive of higher levels of PD-g. Similarly, the deficits shown among those with IED (e.g., emotion dysregulation, negative urgency) overlap with the several key dimensions proposed in the alternative dimensional models for personality disorders by the DSM-5, such as negative affectivity, antagonism, and disinhibition (APA, 2022; Dunne et al., 2021; Fettich et al., 2015; Puhalla et al., 2016). Given the chronic and characterological nature of IED (Coccaro & McCloskey, 2019), such personality factors may play an important role in the heterogeneity observed in IED presentation and also may explain the significant overlap between IED and PDs.

Despite the prevalence and comorbidity associated with IED, the research on heterogeneity within IED is limited. A few variable-centered studies focused on aggression differences have shown that individuals with IED who meet criteria only for verbal aggression did not differ from those who met IED criteria only for physical aggression with regard to measures of trait aggression or psychosocial impairment (McCloskey et al., 2006; McCloskey et al., 2008). Similarly, those who met DSM-5 IED criteria only for minor aggression did not differ from those who met IED criteria only for major aggression (Look et al., 2015). However, those who met both IED aggression criteria showed greater impairment and a poorer quality of life than those who met criteria for only one of the two aggression criteria (Coccaro et al., 2014; Look et al., 2015). Though informative, this finding that greater impairment is associated with a broader pathological aggression repertoire is somewhat limited in utility by the fact that over 70% of individuals with IED meet both major and minor aggression criteria (Coccaro & McCloskey, 2019). Thus, the need remains to better understand heterogeneity within the diagnosis of IED.

A person-centered approach can be used to identify distinct subgroups of individuals within a larger group that vary in meaningful ways based on other factors. To date, only one study has used this approach to examine heterogeneity within IED. Ciesinski et al (2022) conducted a latent class analysis (LCA) of cognitive-affective impairments among individuals with IED, finding four distinct subgroups that were differentiated largely by the severity of emotion dysregulation, but also by the combination of the level of empathy and the level of planfulness among those with moderate emotion dysregulation. Furthermore, high and low emotion dysregulation subgroups differed in the expected direction on measures of aggression, interpersonal problems, and suicidal thoughts and behaviors, but the less empathic, more planful moderate emotion dysregulation subgroup was highest on substance use problems and comorbidity (Ciesinski et al., 2022). Many of these cognitive-affective impairments (e.g., emotional dysregulation, trait anger), map onto higher-order pathological personality dimensions (e.g., negative affectivity, antagonism) that have been implicated in aggressive behavior (e.g., Dunne et al., 2021), suggesting that personality variables may explain the distinct IED subgroups found by Ciesinski and colleagues. Such a person-centered approach could help identify how variability in personality factors is associated with heterogeneity in IED.

In the present study we conducted a LCA to examine PD symptoms within individuals who meet criteria for a lifetime diagnosis of DSM-5 IED. We sought to determine whether latent subgroups of IED with distinct personality profiles emerge that may further characterize the heterogeneity within IED. As no prior study has conducted an analysis of the latent

personality disorder symptom profiles within IED, we did not have *a priori* predictions regarding the number or nature of the latent subgroups we might find. Following the LCA, we conducted an external validation analysis to investigate the extent to which the subgroups may differ on various demographic and clinical characteristics.

Method

Participants

The full sample consisted of 221 adults (56.6% women, 0% transgender) aged 18 to 55 years old ($M = 30.65$, $SD = 11.40$) who identified as predominantly Caucasian (44.3%), Black American (38.5%), or Asian (collapsed across East/Southeast and South Asian, 7.2%); non-Hispanic/Latinx (85.5%); with highest level of education obtained being partial college training (52.5%). Participants were included in the study if they received a lifetime (either current or past) DSM-5 IED diagnosis. There were no exclusionary criteria. Participants were either undergraduate students recruited from a large urban Northeastern University (33%), or members of the ethnically and socioeconomically diverse surrounding community (67%).

Procedure

Temple University's Institutional Review Board reviewed and approved all study procedures. Written informed consent was obtained from all participants prior to completing study procedures. As a part of a larger ongoing study assessing the affective, cognitive, and behavioral correlates of impulsive other- and self-directed aggression, participants were invited to complete a diagnostic interview conducted by one of several graduate-level diagnosticians who were trained and supervised by the senior author, a licensed clinical psychologist. All interviewers were blind to the current study's hypotheses. The interview began with an assessment of the participant's demographic characteristics and relevant personal history, then a diagnostic assessment of IED, personality disorders, and other major DSM-5 diagnoses. Subsequently, comprehensive assessment of lifetime history of aggression, non-suicidal self-injury (NSSI), and suicidal behaviors was conducted. After completion of the diagnostic interview, participants received either research credit (students only) or monetary compensation (students and community members) for their involvement. Diagnoses were confirmed using a best estimate procedure wherein following the clinical interview, a diagnostic report for each participant was written by the diagnostician who conducted the interview, then the report was presented to and reviewed by a team of diagnosticians under the supervision of a licensed clinical psychologist (Dr. McCloskey), after which formal diagnoses were determined (Klein et al., 1994). The best estimate procedure yields strong inter-rater reliabilities in previous studies (kappa = .79–.93) across psychiatric diagnoses (Klein et al., 1994; Leckman et al., 1982). This team also assessed each participant's Global Assessment of Functioning (GAF; Jones et al., 1995), which is a single-score evaluation of symptom severity and functional impairment.

Measures

Demographics Interview.—Participants answered questions relating to demographic information such as age, gender identity, race, and highest level of education obtained.

Intermittent Explosive Disorder Interview-Modified (IED-M).—The IED-M (Coccaro & McCloskey, 2004) is a semi-structured clinical interview used to diagnose lifetime (either current or remitted) DSM-5 IED. The IED-M obtains quantitative (e.g., frequency) and qualitative (e.g., description of most severe events) information regarding verbal aggression, aggression against property, and aggression against others, as well as aggression-related distress and psychosocial impairment. Finally, potential exclusionary information (i.e., aggressive acts occurring solely within the context of another Axis I disorder, substance use, or a medical condition) is assessed. Published studies have shown the IED-M to have excellent inter-rater reliability for IED diagnoses (k = 0.82) and convergent validity (Coccaro et al., 2017), as well as construct validity (Kulper et al., 2015).

Structured Interview for DSM-IV Personality Disorders (SID-P).—The SID-P (Pfohl et al., 1995) is a semi-structured clinical interview which was employed to assess personality psychopathology, operationally defined as Axis II DSM-IV personality disorders. It has demonstrated adequate inter-rater reliability (Pfohl et al., 1995).

Structured Clinical Interview for the DSM-5 (SCID-5).—The SCID-5 (First et al., 2015) is a semi-structured clinical interview that was used to assess for non-IED, non-personality psychiatric disorders; specifically, lifetime alcohol, cannabis, and other illicit substance use disorders. It has demonstrated good to excellent (kappa = 0.70–1.0) inter-rater reliability for all diagnoses (Osório et al., 2019).

Life History of Aggression (LHA).—The LHA (Coccaro et al., 1997) is an interview designed to assess several facets of lifetime aggressive behavior on a scale from 0 ("no events") to 5 ("so many events that they can't be counted [i.e., over 100]"). The LHA produces 3 subscales, including lifetime frequencies of other-directed aggression, self-aggression, and antisocial behavior / social consequences. As the self-aggression scale is only two items and does not provide distinct scores for suicidal behavior and NSSI, we omitted this scale in favor the of the SASII (see below). Also, for the purposes of this study, we divided the other-directed aggression subscale into lifetime frequencies of verbal and physical aggression to elucidate potential differences in aggressive expression among classes. Previous studies show that the LHA demonstrates excellent inter-rater (kappa = 0.84–0.95) and retest (kappa = 0.80–0.97) reliability, as well as adequate concurrent and discriminant validity (Coccaro et al., 1997).

Suicide Attempt Self-Injury Interview (SASII).—The SASII (Linehan et al., 2006) assesses lifetime history of suicide attempts and NSSI. It has demonstrated excellent inter-rater reliability (kappa = 0.85–0.93) and adequate construct validity (Linehan et al., 2006).

Life Satisfaction.—The Quality of Life Enjoyment and Satisfaction Questionnaire (QLESQ; Stevanovic, 2011) is a 16-item self-report instrument assessing overall life satisfaction and enjoyment in a variety of domains. Domains include, but are not limited to, physical health, social relationships, living/housing situation, mood, and overall sense of wellbeing, which are rated on a scale of 1 ("Very Poor") to 5 ("Very Good"). The QLESQ total score has demonstrated excellent internal consistency (α = .90) and retest reliability

(ICC = .93; (Stevanovic, 2011), as well as excellent internal consistency in the present sample (α = .91).

Data Analytic Plan

All continuous variables met assumptions of normality and linearity. See Table 1 for raw mean, median, standard deviation, and interquartile range for each variable included in the analysis. Mplus [Version 8.3] statistical software was used to complete the latent class and external validation analyses. Mplus employs Full Information Maximum Likelihood (FIML) estimation to handle missing data. FIML involves using all available data without imputing missing values to estimate model parameters. The procedure keeps participants with missing data in the model estimation, which leads to smaller parameter estimates and standard errors relative to other missing data handling methods (Enders, 2001; Graham, 2009). After assessment of the variables in the final LCA dataset, it was determined that the requirements for FIML (i.e., data missing at random or missing completely at random) were fulfilled, with 0% of missing data for the predictor variables (i.e., number of PD criteria met for each PD diagnostic category) and 0% to 35% for the external validators. As the predictor variables were zero-inflated count variables, rather than continuous, a zero-inflated Poisson model was used to conduct the LCA.

Latent Class Analysis—LCA (Muthén & Muthén, 2000) was used to identify subgroups of individuals diagnosed with IED based on the number of PD symptoms they endorsed for each PD diagnostic category. Unlike variable-centered approaches (e.g., factor analysis, multiple regression), LCA is a person-centered approach, which considers relations among individuals to classify them into homogeneous groups that differ in terms of their predictor variable profiles. LCA is an iterative model-building procedure that utilizes a variety of statistical fit indices to identify the best-fitting model for the data (Nylund et al., 2007). Statistical, practical, and conceptual considerations are considered when determining the best-fitting model for the data. The LCA procedure begins with a one-class (i.e., unconditional) model, after which the number of classes increases by one until there are no additional improvements to model fit based on the statistical fit indices, or the results are no longer conceptually sound or easily interpretable. Several statistical fit indices are examined to assess model fit, such as the Akaike Information Criteria (AIC; Akaike, 1987), the Bayesian Information Criterion (BIC; Schwarz, 1978) and the sample size adjusted BIC (ABIC; (Sclove, 1987). Smaller values on these indices indicate better-fitting models. Additionally, the Bootstrap Likelihood Ratio Test (BLRT; Nylund et al., 2007) is examined to compare the fit of the model with k classes versus that with k-1 classes. A significant BLRT index indicates that the k class model is a better fit for the data than the k-1 class model (Nylund et al., 2007). Entropy, which is also considered, is an indicator of class separation wherein entropy values closer to 1 indicate clearer delineation among classes. Additionally, models that contain class sizes smaller than 5–10% of the sample suggest overfitting of the data and issues with generalizability, thus such models are not considered (Weller et al., 2020). Finally, interpretability and practical/clinical utility are considered to determine the optimal number of classes.

Following determination of the best-fitting model, tests of equality of means were used to examine the external validity of the identified latent classes. The test of equality of means holds class membership constant and provides χ^2 statistics for omnibus and pairwise comparisons across the latent classes. Analyses considered demographic variables (i.e., age, gender), lifetime history of substance use disorders, aggression, and self-harm, as well as interviewer-rated functional impairment and self-reported life satisfaction. If omnibus tests were significant ($p < .05$), pairwise comparisons were interpreted.

Results

Descriptive Statistics

See Table 1 for overall sample raw means, medians, standard deviations, and interquartile ranges for the predictor and auxiliary variables.

Latent Class Analysis

Results of the LCA indicate that although the BIC was minimized in the three-class model, the AIC and ABIC were minimized in the four-class model (Table 2), suggesting this model fit the data best. Further supporting this conclusion, the 5-class model did not return a fifth class. The four-class model demonstrated good delineation among classes as indexed by its entropy value (0.778). Lastly, the smallest class size (n = 37, 16.7% of sample) was adequate for continued analysis. Overall, multiple statistical fit indices as well as qualitative examination of the classes suggest that the four-class model best fit the data.

Figure 1 displays the 4-class model means (λ) for each of the personality disorder categories using the zero-inflated Poisson model. Consistent with conventional LCA procedures, we named these classes based on the qualitative differences observed among the four classes regarding the PD symptomatology patterns among individuals with a lifetime diagnosis of IED. The *low PD symptoms (L-PDS)* class ($n = 76$) exhibited few PD symptoms across all categories relative to other classes. Conversely, the *high PD symptoms (H-PDS)* class (n = 37) endorsed high PD symptoms across categories compared to other groups, notably surpassing other classes in Cluster B PD (i.e., histrionic, narcissistic, borderline, and antisocial) symptomatology. The *moderate PD symptoms-high avoidance (M-PDS-HA)* class (n = 39) exhibited moderate PD symptomatology with notably high endorsement of avoidant PD symptoms relative to other classes ($\lambda = 2.697$). Finally, the *moderate PD symptoms-low avoidance (M-PDS-LA)* class ($n = 69$) also demonstrated moderate levels of PD symptomatology but contrarily scored low across classes in avoidant PD symptoms ($\lambda = 0.093$).

External Validation

The four classes differed on several variables related to demographics, adverse outcomes, and functional impairment, supporting the external validity of the four-class model. Table 3 contains class means for each external validator, as well as omnibus and follow-up pairwise comparisons of means across the four classes. We highlight below the significant results of the external validation.

Demographics—The M-PDS-HA class had a greater percentage of women than other classes, though no other gender differences were observed. Classes did not significantly differ on age.

Aggression and Antisocial Behavior—Individuals in the M-PDS-HA and L-PDS classes reported engaging in significantly less verbal and physical aggression than those in the H-PDS and M-PDS-LA classes. Those in the H-PDS class surpassed all other classes in antisocial behavior consistent with their high scores on antisocial PD symptoms. Similarly, those in the M-PDS-LA class also reported more antisocial behavior than those in the M-PDS-HA or L-PDS classes.

Suicidal Behavior and NSSI—The M-PDS-HA and H-PDS classes were more likely to engage in NSSI than were the L-PDS and M-PDS-LA classes. The H-PDS class was also more likely than the L-PDS class to have a lifetime suicide attempt.

Substance Use Disorders—The H-PDS class was more likely than the L-PDS class to be diagnosed with a lifetime (current or past) alcohol use disorder (AUD), whereas the other classes did not differ on the presence of lifetime cannabis or other drug use disorders.

Diagnostic Remission Status—Classes did not significantly differ on the extent to which they comprised current versus past diagnoses of IED.

Functional Impairment and Life Satisfaction—The L-PDS class was rated as having the highest global functioning, whereas the H-PDS class was rated as having the lowest global functioning by diagnostic interviewers than other classes (GAF score). Consistent with this, the L-PDS class reported the highest quality of life and satisfaction compared to all other classes.

Discussion

The present study sought to investigate heterogeneity in personality profiles in IED using a LCA of personality disorder (PD) symptoms and examine how the classes differ on clinical outcomes. Results of the LCA suggest that four distinct PD symptom classes exist within IED—one class that exhibited generally high PD symptoms (H-PDS) across categories, one class that demonstrated generally low PD symptoms (L-PDS) across PD categories, and two classes that exhibited moderate levels of PD symptomatology. These two moderate classes were distinguished notably on their endorsement of avoidant PD symptoms, with one moderate class showing more avoidant PD symptoms than other classes (M-PDS-HA), while the other moderate class endorsed fewer avoidant PD symptoms than other classes (M-PDS-LA). Interestingly, the findings of low, moderate, and high PD symptom classes in IED also support the notion of a general factor of personality pathology (e.g., PD-g) on a single continuum ranging from 'mild' to 'severe' PD (Sharp et al., 2015; World Health Organization, 2022). The four PD symptom classes within IED differ on several important clinical outcomes, supporting the external validity of the classes and suggesting potentially different clinical implications for each.

The *high PD symptoms* (H-PDS) class exhibited high overall PD symptomatology for all but three personality disorders (schizoid, avoidant, and dependent), with notable elevations across all cluster B PD symptoms (i.e., antisocial, borderline, histrionic, narcissistic PDs) as well as paranoid and obsessive-compulsive PDs. Relatedly, the H-PDS class tended to endorse the highest levels of adverse clinical outcomes. Most notably, the H-PDS class endorsed more antisocial behavior than any other class, which is likely with associated with the high number of cluster B (especially antisocial PD) symptoms in this class (Dellazizzo et al., 2018; Warren & South, 2009). The H-PDS class also reported more aggression (verbal and physical) than the L-PDS and M-PDS-HA classes. Aggression is associated with several PDs including antisocial, borderline, obsessive-compulsive and paranoid PDs (APA, 2022; Lee, 2017; Villemarette-Pittman et al., 2004), and the H-PDS class endorsed symptoms of each of these PDs more than other classes. Accordingly, the highest endorsed symptoms of this class were 'inappropriate/intense anger or difficulty controlling anger' and 'affective instability' from borderline PD, 'reads hidden demeaning or threatening meanings into benign remarks or events' from paranoid PD, 'shows rigidity and stubbornness' from obsessive-compulsive PD, and 'irritability and aggressiveness as indicated by repeated physical fights or assaults' from antisocial PD. Similarly, the H-PDS class was most likely of all classes to have a lifetime suicide attempt and among the most likely to have engaged in NSSI, again consistent with their high symptom endorsement on several PDs associated with self-harm behavior such as borderline PD (Soloff et al., 1994) and antisocial PD (Verona et al., 2001). Moreover, this class had the highest diagnostician-rated global impairment scores across all classes. Poorer overall functioning is associated with almost all PDs (Skodol, 2018); thus, this finding in the H-PDS class may be a function of the overall number of PD symptoms endorsed. Finally, the H-PDS class had a higher rate of AUD than the L-PDS class, mirroring the comorbidity of AUD and several personality disorders, particularly cluster B PDs (Long et al., 2017).

Conversely, the *low PD symptoms* (L-PDS) class endorsed low overall PD symptomatology across all PD categories and tended to show the least adverse clinical outcomes relative to other classes. These outcomes included the least diagnostician-reported impairment and highest self-reported quality of life of all the classes, again suggesting that overall PD symptomatology has a similar relationship with global functioning in IED than it has in other disorders (Nakao et al., 1992; Skodol et al., 2007). Those with L-PDS also reported less aggression and antisocial behavior than those with H-PDS or M-PDS-LA. This finding is consistent with studies showing that lesser PD symptomatology within IED is associated with lower levels of anger and aggressive behavior (Coccaro et al., 2018). However, similar to the H-PDS class, the highest endorsed symptom of this class was 'inappropriate/intense anger or difficulty controlling anger' from borderline PD, suggesting that despite lower aggressiveness relative to other classes, this class still experiences dysregulated anger meriting the IED diagnosis. Additionally, members of this class were less likely than the H-PDS class to have a lifetime suicide attempt, and they were among the lowest (along with the M-PDS-LA class) in lifetime engagement in NSSI. This result is not surprising given previous research showing that among individuals with IED, those who exhibit little to no comorbid PD (particularly cluster B) symptomatology are significantly less likely to engage in both suicidal behavior and NSSI than individuals with comorbid IED and PD (Jenkins et

al., 2015). Thus, the findings suggest a clear difference in adverse clinical outcomes between individuals with IED who present with high versus low PD symptoms.

The two classes that exhibited moderate PD symptomatology, the *moderate PD symptoms-high avoidance* (M-PDS-HA) and the *moderate PD symptoms-low avoidance* (M-PDS-LA) classes, endorsed (for the most part) a similar pattern of PD symptomatology across Cluster A and B PDs. However, these two moderate PD groups were distinguished from each other with regard to their endorsement of cluster C PD symptoms, most notably avoidant PD symptoms. The M-PDS-HA endorsed high avoidant PD symptoms relative to the other classes. Interestingly, this class resembled the L-PDS class in terms of externalizing behavior—they endorsed among the lowest lifetime frequency of physical and verbal aggression as well as antisocial behavior. This pattern suggests greater avoidant PD symptoms may be, to an extent, a protective factor against the aggressive behavior and conduct problems associated with IED. This is consistent with prior research demonstrating a link between low aggressiveness and avoidant PD (Pellecchia et al., 2018) which may in part be explained by the fear of rejection and inhibited self-assertion observed in avoidant PD (Lampe & Malhi, 2018). However, the M-PDS-HA class endorsed among the highest risk for lifetime NSSI engagement. Studies demonstrate that deliberate self-harm is not uncommon in avoidant PD, with antecedents to self-harm in avoidant PD including emotional avoidance (e.g., shame), perceived rejection, and self-devaluation (Lampe, 2016; Snir et al., 2015), all of which may occur following the (albeit lower frequency than other classes) impulsive aggressive outbursts characteristic of IED. Further evidencing such self-devaluation, the highest endorsed avoidant PD symptom in this class was 'viewing self as socially inept, personally unappealing, or inferior to others.' Thus, although increased anxious/avoidant PD symptoms may serve a protective role with regard to aggression against others, it does not appear to serve that function for aggression toward oneself. This possibility is consistent with research showing that among individuals with IED, a cluster C diagnosis was associated with increased risk of NSSI (Jenkins et al, 2015). Thus, individuals in the M-PDS-HA class tend to engage in NSSI more and other-directed aggression less than other classes.

Conversely, the M-PDS-LA class endorsed a nearly inverse behavioral presentation of the M-PDS-HA class in terms of clinical outcomes. For example, the M-PDS-LA class demonstrated among the highest lifetime frequency of verbal and physical aggression, indistinguishable from that exhibited by the H-PDS class, possibly reflecting the decreased avoidant PD and increased antisocial PD symptoms in this class relative to the M-PDS-LA and L-PDS classes. These findings make sense given that avoidant PD is associated with fear of rejection, shame aversion, emotional suppression, and inhibited assertiveness (Lampe, 2016; Lampe & Malhi, 2018), suggesting that low avoidant PD symptoms may be associated with high emotional expression and self-assertion, all possibly contributing to the reactive-aggressive behavior pathognomonic to IED. In contrast, the M-PDS-LA class demonstrated among the lowest (along with the L-PDS class) lifetime engagement in NSSI across classes, which, as stated above, is consistent with previous literature supporting a positive association between avoidant PD symptoms and NSSI engagement (Klonsky et al., 2003; Snir et al., 2015). Considering NSSI and aggression are both typically responses to negative affect, this may suggest that the M-PDS-LA class tends to exhibit difficulties in

regulating emotion more frequently through engagement in other-directed aggression than self-injurious behavior, suggesting a more externalizing symptom presentation associated with low avoidant PD symptoms in IED when looking at moderate levels of comorbid PD symptoms. This is consistent with the finding that the highest endorsed symptoms in this class were 'inappropriate/intense anger or difficulty controlling anger' from borderline PD and 'impulsivity in at least two self-damaging areas' from antisocial PD. Thus, despite the fact that previous investigations of IED and PD comorbidity found neither increased nor decreased risk of avoidant PD comorbidity among those with IED (Coccaro et al., 2018; Galovski et al., 2002), the present findings suggest that among those with IED, the extent of comorbid avoidant PD symptoms may have significant implications for behavioral presentation and overall impairment in IED, at least among those with moderate overall PD symptoms.

The present study gives further insight into the heterogeneity in the presentation of pathological aggression (IED) and its extensive overlap with personality pathology. Our data suggest that four classes of IED emerge that differ on important clinical outcomes and exhibit distinct PD symptom profiles: one low, two moderate, and one high PD symptom classes. These findings are generally consistent with dimensional models of personality pathology which suggest that a higher-order general PD (e.g., PD-g) factor exists on a continuum of 'mild' to 'severe' (Sharp et al., 2015; World Health Organization, 2022). Supporting this, overall level of PD symptom comorbidity in IED was positively associated with global impairment across clinical outcomes such that greater PD symptom comorbidity was associated with greater global functional impairment and adverse outcomes. Findings regarding the moderate PD symptom classes suggest that cluster C personality disorders and avoidant PD specifically may be an important and understudied comorbidity of IED that is differentially associated with self- and other-directed aggressive behavior, such that those with high avoidance symptoms exhibit a more internalizing behavioral presentation whereas those with low avoidance symptoms exhibit an externalized behavioral presentation. These findings emphasize the importance of assessing personality factors in patients with IED as overall greater PD symptom comorbidity is associated with a more severe presentation. It also highlights the potential utility of identifying avoidant PD symptoms among those with IED and more moderate overall PD comorbidity, especially regarding risk of self-harm.

The present findings also have potential treatment implications. Classes differed on number of PD symptoms with higher PD symptom classes generally showing greater impairment on the external validators. Considering both greater impairment (Chiesa & Fonagy, 2007) and PD comorbidity (Andreoli et al., 1989) are associated with poorer treatment response, this may suggest IED treatment for individuals with greater PD pathology may require more intensive and/or longer treatment. Moreover, though the number of cluster C symptoms seemed to serve a somewhat protective role for classes with moderate PD symptoms on aggression, it was associated with an increased likelihood of NSSI. As such, assessment of overall PD symptomology and avoidant PD specifically (or trait avoidance) would be useful in guiding treatment recommendations among those diagnosed with IED. For example, treatment for individuals with moderate PD symptoms and high avoidance may involve cognitive-behavioral approaches (both traditional and/or third wave, such as dialectical behavior therapy) which have shown to target and reduce the key maladaptive coping

strategy of experiential avoidance in avoidant PD (Lampe, 2016) as well as NSSI (Turner et al., 2014). In sum, these findings suggest that treatment for IED may vary in efficacy due to the heterogeneity of IED with respect to comorbid personality pathology.

This study has several strengths. All participants completed a comprehensive diagnostic assessment of IED and PD symptoms, life history of aggression and self-harm, and related overall functioning and impairment. All diagnoses were evaluated and confirmed by a research team through a well-validated procedure (Leckman et al., 1982) under the supervision of a licensed clinical psychologist. The external validation analysis supports the validity of the four classes found through the LCA, as each class exhibited distinct clinical outcomes that are consistent with the pattern of comorbid IED and PD symptomatology of each class. Because all data were collected via comprehensive diagnostic interview, there were very little (if any) missing data for each of the variables included in the analysis; thus, we are confident that the present findings reflect true patterns of symptomatology found in the current sample, rather than findings biased by large amounts of missing data. For the few data points that were missing, we employed a strong and recommended technique for handling missing data, Full Information Maximum Likelihood.

However, the study's limitations also need to be considered when interpreting the results. Though the sample size was adequate for LCA in detecting true differences among four classes (Dziak et al., 2014), the sample was predominantly non-treatment seeking, which may underestimate the IED and PD symptom severity and limit generalizability to more severe IED presentations. Relatedly, the sample was a majority female (56%), whereas clinical and community studies of IED demonstrate a higher prevalence of IED among men (Coccaro & McCloskey, 2019), suggesting that PD symptomatology in a sample more representative of typical IED may differ from that observed in the present findings. Additionally, individuals with a lifetime diagnoses of DSM-5 IED were included in the sample, and, as such, individuals who met criteria for either a current or past IED diagnosis were included in the study. However, diagnostic remission status was included as an external validator to probe any class differences on current versus past IED diagnoses; no significant class differences were found, suggesting that the nature of the sample containing both past and current IED did not affect study results. Moreover, though all measures included in the analyses were based on a comprehensive clinical interview, all data acquired are based on accurate reporting by the participants of sometimes socially undesirable behaviors (e.g., aggression, self-harm, antisocial behavior), which may lead to possible underreporting of these behaviors. Finally, the though the categorical model of PDs has some advantages (e.g., ease of communication among health professionals, treatment planning), DSM-5 PDs have been criticized for poor construct validity, temporal instability, high PD comorbidity, and high heterogeneity within PD categories, to name a few (Monaghan & Bizumic, 2023). As such, future studies may benefit from investigating heterogeneity within IED on the basis of dimensional personality models (e.g., the Alternative Model of Personality Disorders). Taken together, interpretation and generalization of these results may be limited.

Despite these limitations, the present findings give further insight into the heterogeneity within IED and the extensive comorbidity between IED and personality disorders, suggesting four unique classes of comorbid IED and PD symptomatology. These results

suggest both quantitative and qualitative facets of varying personality profiles that impact overall presentation of IED, with greater comorbid PD symptoms generally suggesting a more severe presentation. Moreover, the level of avoidant PD symptoms specifically discriminated among those with moderate PD comorbidity. These results emphasize the importance of considering personality factors, such as comorbid PD symptoms, when assessing and treating those with IED.

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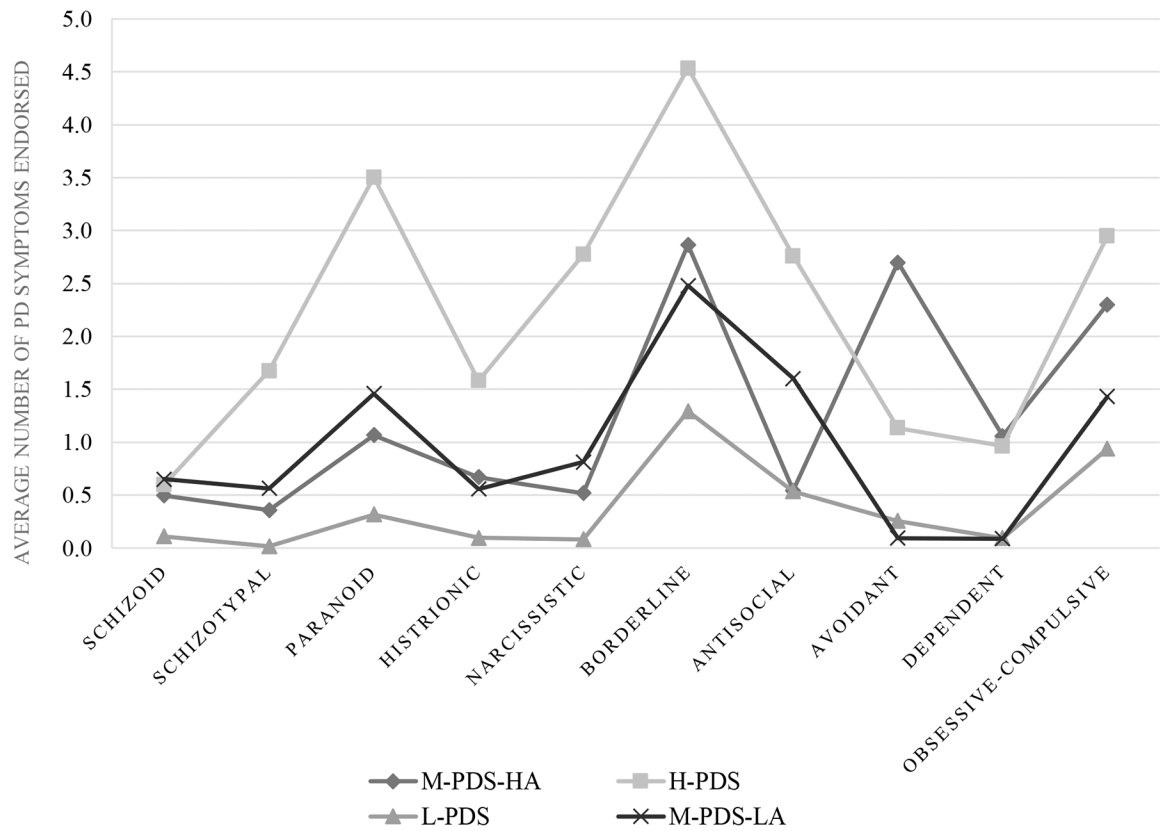
Figure 1.
Mean scores (from zero-inflated Poisson model) for each personality disorder category are presented for each class in the four-class model

Note: PD = personality disorder; M-PDS-HA = moderate PD symptoms-high avoidance; H-PDS = high PD symptoms; L-PDS = low PD symptoms; M-PDS-LA = moderate PD symptoms-low avoidance

Table 1

Descriptive statistics for predictor and external validator variables

Predictors: Number of PD Criteria Endorsed	Mean	SD	Median	IQR
Schizoid	0.43	1.01	0	1
Schizotypal	0.54	0.93	0	1
Paranoid	1.37	1.57	1	2
Histrionic	0.61	1.01	0	1
Narcissistic	0.86	1.42	0	1
Borderline	2.52	1.81	2	3
Antisocial	1.25	1.49	1	2
Avoidant	0.82	1.39	0	1
Dependent	0.43	0.92	0	1
Obsessive-Compulsive	1.70	1.44	2	1
External Validators	**Mean**	**SD**	**Median**	**IQR**
Age	31.29	11.9	27	22
Gender (0 = female, 1 = male)	0.43	0.5	0	1
Current DSM-5 IED	0.22	0.42	0	0
Lifetime Alcohol Use Disorder	0.21	0.41	0	0
Lifetime Cannabis Use Disorder	0.16	0.37	0	0
Lifetime Other Drug Use Disorder	0.13	0.34	0	0
LHA Verbal Aggression	8.5	2	9	2
LHA Physical Aggression	9.75	3.55	10	5.5
LHA Antisocial Behavior	5.67	4.68	5	6
Suicide Attempt History	0.13	0.34	0	0
Non-Suicidal Self-Injury History	0.24	0.43	0	0
GAF Score	58	7.81	58	11
QLESQ Total Score	34.15	9.43	35	13

Note: DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, 5th Edition; GAF = Global Assessment of Functioning; IED = intermittent explosive disorder; IQR = interquartile range; LHA = Life History of Aggression; PD = personality disorder; QLESQ = Quality of Life Enjoyment and Satisfaction Questionnaire; SD = standard deviation

Table 2

Fit indices for latent class analysis models with 1–5 classes

Number of classes	1	2	3	4	5
Number of Free Parameters	**20**	**31**	**42**	**53**	**64**
Log-Likelihood	−2911.778	−2745.144	−2698.698	−2672.752	−2668.657
AIC	5863.555	5552.287	5481.396	5451.505	5465.314
BIC	5931.519	5657.63	5624.119	5631.607	5682.797
ABIC	5868.138	5559.39	5491.019	5463.648	5479.978
BLRT	N/A	0.000	0.000	0.000	0.000
Entropy	1	0.789	0.755	0.778	0.814
Smallest Class	221	84	44	37	0
Size n [%]	[100.0%]	[38.0%]	[19.9%]	[16.7%]	[0.0%]

Note: AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; ABIC = Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.

[a]BLRT is not available for the one-class model

Table 3

Auxiliary analysis results with overall and class means, χ2 omnibus and pairwise results

External Validators	Class 1 (M-PDS-HA)		Class 2 (H-PDS)		Class 3 (L-PDS)		Class 4 (M-PDS-LA)		Omnibus χ2 (p-value)	Pairwise comparisons
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Demographics										
Age	33.460	11.432	32.890	11.517	28.890	10.964	22.810	7.600	4.103 (0.251)	--
Gender (0=female, 1=male)	0.450	0.500	0.571	0.502	0.414	0.496	0.231	0.430	8.775 (0.032)	1 < 2,4
Current DSM-5 IED	0.300	0.461	0.171	0.382	0.286	0.455	0.115	0.326	1.595 (0.660)	--
Lifetime SUD										
Alcohol Use Disorder	0.144	0.354	0.324	0.475	0.129	0.337	0.385	0.496	7.271 (0.064)	3 < 2
Cannabis Use Disorder	0.044	0.207	0.171	0.382	0.157	0.367	0.346	0.485	3.651 (0.302)	--
Other Drug Use Disorder	0.067	0.251	0.086	0.284	0.086	0.282	0.231	0.430	2.118 (0.548)	--
Aggression										
LHA Verbal Aggression	8.803	1.700	9.500	1.001	7.716	2.242	7.423	2.230	29.632 (0.000)	1,3 < 2,4
LHA Physical Aggression	10.074	3.122	11.567	2.788	9.164	3.388	7.808	4.167	14.951 (0.002)	1 < 2,3,4
LHA Antisocial Behavior	5.350	4.267	10.200	5.786	3.970	3.770	4.653	4.724	44.088 (0.000)	1,3 < 4 < 2
Self-Harm										
Suicide Attempt History	0.100	0.302	0.200	0.406	0.086	0.282	0.385	0.496	7.192 (0.060)	3 < 2
NSSI History	0.211	0.410	0.286	0.458	0.200	0.403	0.577	0.504	12.438 (0.006)	3,4 < 1,2
Impairment/Life satisfaction										
GAF Score	57.867	5.856	51.657	5.070	64.486	7.243	52.923	0.496	109.738 (0.000)	2 < 1; 1,2,4 < 3
QLESQ Total Score	34.260	9.640	30.619	8.868	37.918	8.553	29.792	8.367	16.733 (0.001)	1,2,4 < 3

Note: PD = personality disorder; M-PDS-HA = moderate PD symptoms-high avoidance; H-PDS = high PD symptoms; L-PDS = low PD symptoms; M-PDS-LA = moderate PD symptoms-low avoidance; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, 5th Edition; GAF = Global Assessment of Functioning; IED = intermittent explosive disorder; IQR = interquartile range; LHA = Life History of Aggression; NSSI = non-suicidal self-injury; QLESQ = Quality of Life Enjoyment and Satisfaction Questionnaire; SD = standard deviation; SUD = substance use disorder