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Identifying Unstable and Empty Phenotypes of Borderline Personality Through Factor Mixture Modeling in a Large Nonclinical Sample

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Borderline personality disorder (BPD) is serious, prevalent, and symptomatically heterogeneous. Identifying distinct phenotypes of BPD features promises useful diagnostic and treatment implications. Although a series of subtyping studies exist, only two have examined BPD symptom configurations while taking into account BPD severity. We used factor mixture modeling to identify discrete subtypes of BPD features, simultaneously considering symptom severity, in the largest nonclinical young adult sample to date. Undergraduates (N = 20,010; 63.86% women; M_{age} = 18.75, SD = 1.73) completed the McLean Screening Instrument for BPD, which was condensed to measure the 9 *Diagnostic and Statistical Manual of Mental Disorders* BPD criteria dichotomously. We used a model comparison approach to determine the optimal latent factor and class structure of BPD symptoms and validated classes via BPD-relevant constructs. The sample consisted of three subtypes: Asymptomatic (70%), Unstable (19%), and Empty (11%). The Unstable and Empty classes displayed elevated BPD symptomatology along a single continuum of BPD severity. Individuals in the Empty class displayed the highest levels of emptiness and dissociation, emotional distress, and attachment avoidance, whereas individuals in the Unstable class displayed a high frequency of reckless and self-damaging behaviors. Our results suggest the importance of a hybrid dimensional/categorical conceptualization of BPD as displayed in a nonclinical sample. Unstable and Empty classes may be associated with different treatment targets for subthreshold BPD presentations. The findings are discussed in terms of their clinical implications regarding diagnosis, treatment, and theoretical conceptualization of BPD.

Keywords: borderline personality disorder, factor analysis, latent class analysis, latent variable modeling, subtypes

Borderline personality disorder (BPD) is a common psychiatric illness, characterized by emotion dysregulation, impulsivity, self-damaging behaviors, chaotic relationships, and identity disturbance (American Psychiatric Association, 2013). BPD is one of the most prevalent personality disorders (PDs): 1–5% of the general population (median = 2.2%), 10–20% of psychiatric outpatients, and 20–40% of psychiatric inpatients meet diagnostic criteria for BPD (Levy & Johnson, 2016).

Symptoms of BPD impair social and occupational functioning (Javaras, Zanarini, Hudson, Greenfield, & Gunderson, 2017; Miller, Lewis, Huxley, Townsend, & Grenyer, 2018), even when they are diagnostically subthreshold (Gunderson et al., 2011). For instance, Zimmerman and colleagues (Ellison, Rosenstein, Chelminski, Dalrymple, & Zimmerman, 2016; Zimmerman, Chelminski, Young, Dalrymple, & Martinez, 2012) found that outpatients with just a single BPD symptom showed significantly worse psychosocial functioning (e.g., suicidality, hospitalization, and work problems) compared with those with no BPD symptoms. BPD symptoms also differ in terms of likelihood of endorsement (Cooper, Balsis, & Zimmerman, 2010), and longitudinal data have shown different prevalence and remission rates of the BPD criteria over time, as well as continued functional impact of subthreshold "remitted" BPD (Gunderson et al., 2011; Zanarini, Frankenburg, Reich, & Fitzmaurice, 2010).

Together, this body of research suggests that looking at specific symptoms of BPD or subthreshold profiles of BPD features may predict different clinical or behavioral outcomes and may provide tailored treatment recommendations (e.g., individuals with a more impulsive subtype might respond better to mindfulness training). Furthermore, the polythetic, dichotomous diagnostic rules outlined by the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*; American Psychiatric Association, 2013) for the PDs are largely arbitrary and do not successfully "carve nature at its joints," nor do they consider research on the clinical significance of subthreshold presentations of BPD (Ellison et al., 2016; Tyrer et al., 2011; Yang, Coid, & Tyrer, 2010; Zimmerman et al., 2012), differential item functioning of the BPD criteria (Cooper et al., 2010), or dimensional conceptualizations of the PDs (Clarkin, Yeomans, & Kernberg, 2006; Costa & McCrae, 1990; Eaton, Krueger, South, Simms, & Clark, 2011; Sharp et al., 2015).

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These issues have motivated research exploring the latent structure of BPD. Two common themes arise in BPD subtype research. First, individuals seem to exist on a spectrum of BPD severity, especially in nonclinical samples (Bornovalova, Levy, Gratz, & Lejuez, 2010; Clifton & Pilkonis, 2007; Shevlin, Dorahy, Adamson, & Murphy, 2007; Thatcher, Cornelius, & Clark, 2005). The majority of individuals (both clinical and nonclinical) appear to present with little to no BPD features, a subset fall into classes of moderate severity, and a relatively distinct few endorse nearly all of the *DSM* BPD criteria. These findings emphasize the importance of taking into account a latent BPD severity dimension, rarely done in past latent class research, which may account for quantitatively—but not qualitatively—distinct "subtypes." On the other hand it is possible that truly distinct subtypes are being masked by severity-driven groupings. Second, some studies point to the presence of impulsive/dysregulated (Thatcher et al., 2005) and identity disturbed/empty (Slavin-Stewart, 2015) classes of individuals. Dysregulated individuals are largely characterized in terms of the BPD criteria of anger and impulsivity, although two studies (Lenzenweger, Clarkin, Yeomans, Kernberg, & Levy, 2008; Ramos, Canta, de Castro, & Leal, 2014) suggest a broader understanding of externalizing behavior, including antisocial acts and aggression. Identity disturbed individuals appear to experience both identity diffusion and emptiness as core BPD features, along with various internalizing features (Ramos et al., 2014).

However, none of this research has taken into account the latent dimension of BPD severity that also underlies covariation in BPD symptoms. Failing to account for the latent dimension(s) of a construct threatens to produce spurious latent classes that are in fact misadaptations of the model to a continuous latent space. For instance, the common finding of unaffected, low, moderate, and high severity subtypes of people in terms of BPD symptoms (Bornovalova et al., 2010; Shevlin et al., 2007) is potentially an artifact of a latent severity factor that is unaccounted for. In fact, the dimensionality of the PDs has been found to be quite robust, to such a degree that many have called for a purely dimensional PD model (Hopwood et al., 2018).

A related body of research, using taxometric analysis (Meehl & Golden, 1982), has aimed to directly compare the relative applicability of a dimensional versus categorical model of BPD. Taxometric analysis provides certain advantages over the latent class analysis (LCA) used by most of the aforementioned subtype research, such as being agnostic to the distribution of measure items. This research has generally found that a dimensional model of BPD outperforms a categorical one (Haslam, Holland, & Kuppens, 2012). However, taxometric analysis may provide inconclusive results in cases where a set of indicators may reflect *both* dimensional and categorical properties (Ruscio, Ruscio, & Meron, 2007). Further, it may suggest a dimensional interpretation in cases where a strong severity continuum exists (such as in BPD), overlooking fuzzy or overlapping taxa. Given the likelihood that BPD displays both dimensional and categorical aspects (Asnaani, Chelminski, Young, & Zimmerman, 2007; Zimmerman, Chelminski, Young, Dalrymple, & Martinez, 2013), and the possibility that multiple symptomatically overlapping, yet etiologically distinct, BPD patterns may exist, statistical approaches that incorporate dimensional and categorical features simultaneously are warranted.

Only two studies have used a combined trait-based and class-based analysis of BPD symptoms (Conway, Hammen, & Brennan, 2012; Hallquist & Pilkonis, 2012), employing factor mixture modeling (FMM; Muthén & Shedden, 1999), which is able to simultaneously identify the optimal configuration of latent dimensions and classes of BPD. Conway and colleagues (2012) found that a single-factor latent trait model outperformed both a latent class and factor mixture model in a sample of 700 twenty-year-olds at risk for depression. However, Conway and colleagues' (2012) use of FMM was restricted only to models in which the BPD factor structure was maintained strictly invariant across classes, which makes detecting unique latent classes unlikely (Clark et al., 2013). Hallquist and Pilkonis (2012) used a similar model-comparison approach in a mixed clinical sample ($N = 362$), identifying a symptomatic (27.6%) and an asymptomatic (72.4%) class of individuals via a one-factor, two-class FMM, and using flexible model parameterization unlike Conway et al. (2012). Unlike previous latent class research, which assumes no spectrum of severity, this finding suggests a hybrid model in which BPD symptoms are expressed along a severity dimension and *at the same time* individuals who fall into an affected (likely BPD-diagnosed) group are qualitatively distinct from individuals with no BPD, not simply quantitatively more severe. However, Hallquist and Pilkonis's sampling strategy involved explicitly recruiting BPD (i.e., three or more symptoms) versus non-BPD individuals, which is likely to produce latent classes arising from the sampling procedure itself, rather than reveal true person-level differences in the population (Markon & Krueger, 2006).

The present study attempts to fill several gaps in the literature by employing FMM of BPD symptoms in a sufficiently sized nonclinical sample to approximate a comprehensive range of patterns of BPD symptoms across the entire spectrum of severity. This approach will allow for the identification of both asymptomatic and symptomatic subtypes, while taking into account underlying dimensional severity, thus ensuring qualitative differences between the classes (rather than spurious proxies for BPD severity). Such an approach is timely, given recent propositions for hybrid dimensional/categorical models of PDs in the psychiatric nosology (e.g., *DSM–5*, *International Classification of Diseases*, 11th Revision [*ICD-11*]).

Hypotheses

We hypothesize that a factor mixture model will outperform a factor model and latent class model in representing the latent structure of BPD. Specifically, we expect an Asymptomatic class comprising the majority of the sample, along with up to two Symptomatic classes, one characterized by anger and impulsivity, and the other characterized by identity disturbance and emptiness. We expect these classes to fall along a single latent BPD dimension. Finally, we expect that validity indicators related to anger and impulsivity will be elevated in the first Symptomatic class, and those related to identity disturbance and emptiness will be elevated in the second.

Method

Participants

The sample consisted of 20,010 undergraduate students from a large rural public mid-Atlantic/northeastern university who partic-

ipated in subject pool screening between 2006 and 2016. The sample was predominantly women (63.4%) and ranged in age from 18 to 55 ($M = 18.75$; $SD = 1.73$; mode/median = 18). Complete BPD symptom data were gathered on 19,833 participants.

Procedure

Between the spring of 2006 and the spring of 2016, participants completed a battery of self-report measures as part of an undergraduate psychology subject pool online screening process to identify participants for other studies. For completing measures, participants received credit toward a course research participation requirement. Participants completed the McLean Screening Instrument for BPD (MSI-BPD; Zanarini et al., 2003), determining the presence of self-reported BPD symptoms. Subsets of participants also completed additional measures at that time, which serve as validity measures in the current study. All procedures were approved by the university's institutional review board and were consistent with the American Psychological Association's ethics guidelines.

Measures

McLean Screening Instrument for BPD. The MSI-BPD is a 10-item clinician administered/patient self-report screening measure for BPD (Zanarini et al., 2003). Items are rated Yes/No and correspond to the nine *DSM–5* criteria for BPD (two items for paranoia/dissociation); examples include "Have you chronically felt empty?" and "Have you been extremely moody?" As a screening instrument, the MSI-BPD has shown good sensitivity (0.81) and specificity (0.85), which is higher in young adult samples (0.90 and 0.93, respectively), using a cutoff sum score of 7. It also displays adequate internal consistency (0.77; 0.80 in the present study) and test–retest reliability ($\rho = 0.72$), and adequate criterion validity with semistructured interviews in community and clinical samples (Melartin, Häkkinen, Koivisto, Suominen, & Isometsä, 2009; Patel, Sharp, & Fonagy, 2011; Zanarini et al., 2003).

Validity measures. We used a set of psychometrically sound self-report screening, symptom, personality, and interpersonal functioning measures to examine differences among classes. These measures assessed BPD symptoms (a Likert-type adaptation of the International Personality Disorder Examination—Screening Questionnaire [IPDE-SQ]; Loranger, Janca, & Sartorius, 1997), negative affectivity (The Revised NEO Personality Inventory [NEO]—Anxiety, Anger Hostility, Depression, and Positive Emotions [reversed] facets; Costa & McCrae, 1992; Depression Anxiety Stress Scales; Lovibond & Lovibond, 1995), impulsivity (NEO Impulsivity facet; Reckless Behavior Questionnaire; Shaw, Wagner, Arnett, & Aber, 1992), affect lability (Affect Lability Scale; Harvey, Greenberg, & Serper, 1989), affect intensity (Affect Intensity Measure; Larsen, 1985), self-harm (Deliberate Self-Harm Inventory; Gratz, 2001), self-concept clarity (Self-Concept Clarity Scale; Campbell et al., 1996), other borderline personality characteristics (Borderline Personality Inventory [BPI]; Leichsenring, 1999; Inventory of Personality Organization; Lenzenweger, Clarkin, Kernberg, & Foelsch, 2001), and attachment insecurity (Experiences in Close Relationships—Revised Questionnaire; Fraley, Waller, & Brennan, 2000). Further detail on these measures is available from the authors.

Data Analytic Plan

We used a model comparison approach to determine the optimal latent variable model for understanding the variability of BPD symptoms, specifically comparing common factor, latent class, and factor mixture models. (a) We conducted exploratory factor analysis (EFA) of one to five factors, using the tetrachoric correlation matrix as input, as appropriate for binary indicators, and Geomin (oblique) rotation for multifactor solutions. (b) We also tested LCA models of two to four latent classes. Finally, (c) we used FMM (Muthén & Shedden, 1999) to simultaneously model latent factors and classes of BPD symptoms, from one to five factors and two to four classes. We tested models with the four forms of parameterization outlined by Clark and colleagues (2013), which consecutively free up factor variances/covariances, item thresholds, and factor loadings across classes. Both latent class and factor mixture models were run with 600 random starts and 120 final stage iterations to ensure identification of global, not local, maxima in the likelihood function. We selected the best EFA, LCA, and FMM using the Bayesian information criterion (BIC), sample size-adjusted BIC, and Akaike's information criterion, and then determined the best overall model also using these criteria, as well as substantive evaluation.[1] The BIC was preferred, as the Akaike's Information Criterion is downwardly biased by increasing model complexity. Maximum likelihood estimation with robust standard errors was used across all models. All analyses were conducted in Mplus Version 8.1 (Muthén & Muthén, 2017).

Results

Factor Analysis

The results of the EFA suggested that a three-factor solution best represented the data, $\chi^2(12) = 1{,}30.10$, $p < .001$; comparative fit index = 1.00, Tucker–Lewis index = 1.00, root mean square error of approximation = .02, standardized root mean square residual = .02, explaining 65.5% of the variance in the indicators (Table 1). Factor 1 reflected affective/impulsive problems ($\lambda_{Anger} = 1.26$, $\lambda_{Affect} = .68$, $\lambda_{Impulsivity} = .43$, $\lambda_{Paranoia/Dissociation} = .42$), Factor 2 reflected emptiness/identity disturbance ($\lambda_{Empty} = .92$, $\lambda_{Identity} = .91$), but only the abandonment item loaded above .40 on Factor 3 ($\lambda_{Abandonment} = .53$). No other loadings exceeded .40. Factors were correlated between .65 and .81. Given the lack of simple loading structure and high intercorrelation among the factors, as well as the body of literature suggesting a single dimension likely underlies BPD criteria, we also tested and reported a single-factor model (Table 1), $\chi^2(27) = 1{,}653.10$, $p < .001$; comparative fit index = .98, Tucker–Lewis index = .97, root mean square error of approximation = .06, standardized root mean square residual = .06. This model fit the data well, although meaningfully less well

[1] As symptom data are usually positively skewed (average indicator skew = 1.89 in our data), we wished to ensure that mixture models were not simply functioning to model this skew via the identification of spurious latent "classes" (Bauer & Curran, 2003). Thus, we also examined whether modeling skew directly using *skewnormal* distributions (Muthén & Asparouhov, 2015) in our EFA and FMM would improve model fit over and above the mixture models assuming multivariate normality within classes. None of these models outperformed those we report in the text.

Table 1
Factor Analytic, Latent Class, and Factor Mixture Model Comparisons (N = 19,833)

Analysis	Factors	Classes	Parameters	Log-likelihood	AIC	BIC	BIC_{adj}
Factor analysis	1	—	18	−65,298	130,632	130,775	130,717
Factor analysis	3	—	33	−64,605	129,277	129,538	129,433
Latent class analysis	—	4	39	−64,844	129,766	130,073	129,950
Factor mixture model (FMM-3)	1	3	38	−64,629	129,333	129,633	129,512

Note. Models are derived via maximum likelihood estimation with robust standard errors. FMM-3 refers to a factor mixture model in which factor variance and loadings are equal across classes, but item thresholds are freely estimated across classes. AIC = Akaike's information criterion; BIC = Bayesian information criterion; BIC_{adj} = sample size-adjusted BIC.

than the three-factor model (Δfit $>$ .01; Graham & Connell, 2014). Standardized loadings for the one-factor model varied from .56 (relationship chaos) to .84 (emptiness), with all loadings being significant, suggesting the presence of a relatively cohesive single BPD factor.

Latent Class Analysis

A four-class LCA provided best fit to the data (Table 1). Class 1 (65.2%) reflected asymptomatic individuals, with no item endorsement probability greater than impulsivity (.12).

Class 2 (19.6%) reflected affective/impulsive individuals, with impulsivity (.66), anger (.56), paranoia/dissociation (.50), and affect (.49) being endorsed by roughly a 50% of this class. Class 3 (7.1%) reflected empty/identity disturbed individuals, with identity disturbance (.60), paranoia/dissociation (.58), and emptiness (.52) being endorsed by roughly 50% of this class. Finally, Class 4 (8.1%) reflected a "BPD" class, in which all symptoms except relationships (.46) and self-harm (.43) had a .70 or greater probability of being endorsed.

Factor Mixture Modeling

FMM pointed to a one-factor, three-class model as the optimal representation of the data (Table 1). Specifically, parameterization in which item thresholds were freed across classes while factor variance and loadings were held equal across classes (FMM-3) provided the best fit among the models.[2] Results suggested that an Asymptomatic class (70.0%) displayed virtually no symptoms of BPD, and two smaller groups displayed significant BPD symptoms, an Unstable group (18.8%) with elevated BPD symptoms except low levels of emptiness and identity disturbance and the other, an Empty group (11.3%), with elevated BPD symptoms including high levels of emptiness and identity disturbance (Table 2).

Comparing Models

When comparing the FMM-3 with the optimal EFA and LCA models described earlier, the three-factor EFA produced the lowest values across all three information criteria (Table 1). However, given the concerns regarding the interpretability of this model noted earlier, we determined the more interpretable FMM-3 to be the optimal representation of the data.

Validity of the FMM-3 Model

On average, the Empty class endorsed significantly more BPD symptoms on the MSI-BPD and IPDE-SQ than the Unstable class, and both exceeded the Asymptomatic class (Table 3). Using the published cutoff of seven endorsed criteria as a positive screen for BPD (Zanarini et al., 2003), 6.0% of the Unstable class (1.1% of the sample) and 26.8% of the Empty class (3.0% of the sample) screened positive for BPD, similar to published prevalence rates of BPD in the community (1–5%).

Compared with the two symptomatic classes, Asymptomatic class membership was associated with less BPD, better interpersonal functioning, greater self-concept clarity and identity coherence, less defensiveness, and less distress (Table 3). Symptomatic class membership was generally associated with worse functioning and symptoms. Specifically, several variables differentiated these two classes in terms of the magnitude of class separation on Cohen's *d* (as *p* values are differentially influenced by the varying sample sizes across subsets of validity measures). Those in the Empty class reported greater emptiness and dissociation (IPDE-SQ), more depression and anxiety and less positive affect (NEO and Depression Anxiety Stress Scales), and more avoidant attachment (Experiences in Close Relationships—Revised Questionnaire), and those in the Unstable class reported greater frequency of lifetime self-injurious behaviors/activities (Deliberate Self-Harm Inventory) and more types of reckless behavior in the past year (Reckless Behavior Questionnaire), as well as greater anger-related affective lability and maladaptive defensive reactions (BPI). However, contrary to expectations, those in the Unstable and Empty classes did not differ in their level of identity diffusion (BPI and Inventory of Personality Organization) or self-concept clarity (Self-Concept Clarity Scale). They also did not differ on other aspects of affective lability (besides anger) or intensity.

Discussion

Our study provides an examination of the latent structure and typology of BPD phenomenology with the largest nonclinical sample to date. Largely in line with our hypotheses, results suggested that three subgroups of individuals exist in terms of the types of BPD symptoms they endorse: an asymptomatic group and two symptomatic groups, one displaying low levels of emptiness and elevated risky behavior and anger dysregulation and the other, high levels of emptiness and other emotional distress. These groups fell along a single dimension of BPD severity, with the Empty group being most severe (roughly a quarter likely meeting

[2] We also reanalyzed all of the aforementioned models on 10 randomly selected subsamples of n = 2,001, to ascertain the stability of results. The one-factor, three-class FMM-3 outperformed all other models on all information criteria, except for the BIC in four trials, in which the one-factor EFA was superior.

Table 2
Probability of Class Membership, Item Response, and Factor Structure of a One-Factor, Three-Class Factor Mixture Model

Assigned class label		Latent class				Latent class		
		Asymptomatic	Unstable	Empty		Asymptomatic	Unstable	Empty
Class prevalence % (*n*)	Marginal probabilities	70% (13,881)	19% (3,720)	11% (2,232)	Factor loadings	Unstandardized item thresholds		
Conditional probability								
Fear of abandonment	.16	*.00*	**.56**	**.48**	.59	11.08	0.88	0.58
Relationship chaos	.13	*.04*	**.39**	.25	.46	3.21	1.27	1.72
Identity disturbance	.12	*.01*	.09	**.83**	.73	5.14	3.38	−0.21
Impulsivity	.30	*.15*	**.72**	.56	.65	2.26	−0.04	0.47
Suicidality/self-harm	.07	*.00*	**.22**	**.26**	.59	5.15	2.56	1.81
Affective instability	.19	*.08*	**.47**	**.46**	.82	4.13	1.36	1.46
Paranoia/dissociation	.26	*.12*	**.53**	**.64**	.67	2.67	0.83	−0.10
Anger	.23	.15	.40	.40	.86	3.60	1.61	1.90
Emptiness	.10	*.01*	.07	**.75**	.82	6.59	4.37	0.05

Note. Class prevalence refers to the percentage of individuals who would be assigned to each class based on their most likely latent class membership. Marginal probabilities refer to the overall proportion of the entire sample endorsing each item. Conditional item response probabilities refer to the likelihood that individuals in a given class (column) will endorse a given item (row). Item response probabilities twice the marginal probability are indicated in bold font, and probabilities half the marginal probability are indicated in *italic* font for interpretability.

diagnostic threshold for BPD). Nevertheless, class membership cannot solely be explained by BPD severity but by unique configurations of symptoms as well, primarily differences in the emptiness and identity disturbance criteria. However, although the symptomatic groups differed substantially in terms of their endorsement of the identity disturbance BPD criterion, this difference was not manifested across several validity variables.

These two symptomatic classes appear to confer risk for externalizing (Unstable) and internalizing (Empty) symptoms, although notably *both* classes displayed elevations in both internalizing and externalizing symptoms compared with the Asymptomatic class. This finding is consistent with a growing body of research suggesting that BPD is characterized by both internalizing and externalizing dimensions (James & Taylor, 2008; Zanarini & Frankenburg, 1997; Zanarini et al., 2003), although our findings add further nuance to such research in that two distinct phenotypes of BPD were identified in terms of internalization and externalization.

Interestingly, validity variables related to self-concept and identity disturbance did not clearly differentiate the two classes. Both identity disturbance and emotion dysregulation (except anger, which was highest in the Unstable class) were elevated in both symptomatic classes, consistent with multiple theoretical models of BPD positing these features at the core of the disorder (Kernberg, 1967; Linehan, 1993). It is possible that Unstable individuals deny aspects of identity disturbance that are face valid, as on the MSI-BPD (i.e., "Have you often felt that you had no idea of who you are or that you have no identity?"), but report identity issues in other ways, perhaps giving rise to the increased reports of risky behavior among this group, which may serve as a response to identity disturbance in everyday life (Scala et al., 2018). Further research might explore ways in which aspects of identity disturbance may differ across various measures and, consequently, across groups of individuals with BPD symptoms.

These findings build on the foundation of BPD dimensions and subtyping literature and help to resolve some of the discrepancies present in this body of research. They also build on and contextualize the FMM results of Conway et al. (2012) and Hallquist and Pilkonis (2012). Conway and colleagues chose a single BPD dimension as best representing their data, arguing for the consideration of BPD as a continuous construct without qualitative differences between individuals in terms of their BPD presentation. However, Conway et al. only examined strict measurement invariance in their FMM analyses, allowing only factor means to vary across classes. Although a growing body of evidence argues for a dimensional consideration of PDs (Costa & McCrae, 1990; Trull & Durrett, 2005; Widiger & Costa, 2012), factor mixture results from analyses of other psychiatric conditions (Clark et al., 2013) suggest it is reasonable to evaluate whether the definition of the BPD construct (i.e., its factor structure) might differ depending on an individual's symptom severity or presentation (i.e., latent class). Thus, our testing of various forms of measurement invariance in the FMM models seems merited and is an advance over the more restricted analytic plan of Conway and colleagues. Although the model with the best fit to the data was a three-factor model, it both proved problematic in interpretability and still did not support prior BPD factor analysis research (even those studies that have suggested three-factor solutions; Sanislow et al., 2002). It would appear, then, that the primary reason a three-factor solution fit our data well was in its attempt to model item variability better explained by Unstable and Empty types of people, leading to Factors 1 and 2 in this model.

Although only a portion of the two symptomatic classes of individuals identified in our sample likely meet diagnostic criteria for BPD, individuals in these classes may be at increased risk for problems in functioning or psychological distress that are unique to their BPD symptom presentation. As evidenced by a growing body of research (Ellison et al., 2016; Zimmerman et al., 2012), even individual symptoms of BPD may confer significant risk for functional impairment, consistent with our findings. Our findings suggest that even beyond single BPD items, specific *patterns* of BPD items may occur in individuals among "normal" samples and be associated with a variety of problematic and theoretically predicted outcomes. Symptomatic individuals who report elevated

Table 3
Class Comparisons Across Validity Indicators

Model		Asymptomatic	Unstable	Empty				Pairwise comparisons	Pairwise effect sizes (*d*)			Phenotype discrimination
Outcome	*N*	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*	η^2		1v2	1v3	2v3	2v3
MSI-BPD	19,833	0.58 (1.00)	3.46 (1.77)	4.64 (2.37)	22,992.31	<.001	.53	1 < 2 < 3	2.00	2.23	0.56	Moderate
IPDE-SQ	2,731	0.38 (0.31)	0.81 (0.46)	1.06 (0.55)	1,196.02	<.001	.30	1 < 2 < 3	1.09	1.51	0.49	Small
Fear of abandonment	2,731	0.09 (0.33)	0.52 (0.78)	0.59 (0.82)	392.80	<.001	.13	1 < 2 = 3	0.71	0.79	0.09	Negligible
Relationship chaos	2,731	0.20 (0.48)	0.60 (0.83)	0.63 (0.85)	231.53	<.001	.08	1 < 2 = 3	0.59	0.63	0.04	Negligible
Impulsivity	2,731	0.66 (0.67)	1.12 (0.87)	1.12 (0.94)	188.28	<.001	.06	1 < 2 = 3	0.59	0.57	0.00	Negligible
Suicidality/self-harm	2,731	0.77 (1.25)	1.19 (1.31)	1.28 (1.30)	71.16	<.001	.03	1 < 2 = 3	0.32	0.40	0.07	Negligible
Affective instability	2,731	0.47 (0.64)	1.06 (0.92)	1.27 (1.01)	459.12	<.001	.14	1 < 2 = 3	0.74	0.95	0.22	Small
Dissociation	2,731	0.29 (0.55)	0.60 (0.78)	1.10 (1.00)	433.92	<.001	.14	1 < 2 < 3	0.45	1.00	0.55	Moderate
Anger	2,731	0.29 (0.52)	0.78 (0.84)	0.86 (0.91)	350.49	<.001	.11	1 < 2 = 3	0.71	0.78	0.09	Negligible
Emptiness	2,731	0.26 (0.50)	0.60 (0.70)	1.59 (0.93)	1,224.84	<.001	.31	1 < 2 < 3	0.57	1.79	1.20	Large
NEO												
Anxiety	11,438	1.87 (0.64)	2.27 (0.63)	2.45 (0.64)	1,269.30	<.001	.10	1 < 2 < 3	0.63	0.91	0.28	Small
Angry hostility	11,444	1.54 (0.62)	2.01 (0.64)	2.01 (0.66)	1,060.29	<.001	.08	1 < 2 = 3	0.74	0.73	0.01	Negligible
Depression	11,423	1.44 (0.67)	2.02 (0.69)	2.58 (0.65)	3,830.02	<.001	.25	1 < 2 < 3	0.86	1.72	0.83	Large
Positive emotions	11,459	2.79 (0.61)	2.68 (0.64)	2.41 (0.71)	414.04	<.001	.03	1 > 2 > 3	0.18	0.58	0.41	Small
Impulsivity	11,444	1.83 (0.56)	2.24 (0.56)	2.26 (0.62)	1,099.59	<.001	.09	1 < 2 = 3	0.75	0.73	0.03	Negligible
DASS												
Depression	1,126	3.54 (4.98)	8.56 (8.51)	14.41 (10.71)	352.19	<.001	.24	1 < 2 < 3	0.72	1.30	0.61	Moderate
Anxiety	1,130	4.89 (5.42)	9.86 (8.02)	12.77 (8.92)	229.77	<.001	.17	1 < 2 < 3	0.73	1.07	0.34	Small
Stress	1,126	6.98 (6.75)	14.32 (8.76)	15.95 (9.65)	250.00	<.001	.18	1 < 2 = 3	0.94	1.08	0.18	Negligible
ALS total	230	1.92 (0.60)	2.24 (0.56)	2.24 (0.53)	10.95	.001	.05	1 = 2 = 3	0.56	0.57	0.00	Negligible
Depression	257	2.08 (0.63)	2.41 (0.61)	2.42 (0.57)	12.02	<.001	.04	1 = 2 = 3	0.53	0.56	0.01	Negligible
Anxiety	262	1.86 (0.69)	2.27 (0.65)	2.24 (0.67)	13.27	<.001	.05	1 = 2 = 3	0.62	0.56	0.05	Negligible
Anxiety–depression	265	1.79 (0.72)	2.23 (0.62)	2.29 (0.74)	19.74	<.001	.07	1 = 2 = 3	0.66	0.69	0.09	Negligible
Elation	256	2.11 (0.64)	2.45 (0.57)	2.36 (0.53)	7.96	.005	.03	1 = 2 = 3	0.57	0.43	0.17	Negligible
Depression–elation	265	1.96 (0.64)	2.32 (0.63)	2.21 (0.68)	7.85	.005	.03	1 = 2 = 3	0.57	0.38	0.17	Negligible
Anger	263	1.67 (0.69)	2.01 (0.70)	1.87 (0.62)	5.14	.02	.02	1 = 2 = 3	0.50	0.31	0.22	Small
AIM total	228	3.69 (0.46)	3.92 (0.40)	3.87 (0.55)	5.98	.02	.03	1 = 2 = 3	0.54	0.35	0.12	Negligible
SCCS total	261	3.66 (0.81)	3.09 (0.53)	3.07 (0.84)	22.57	<.001	.08	1 < 2 = 3	0.82	0.71	0.03	Negligible
DSHI												
Yes/no	251	0.13 (0.33)	0.41 (0.50)	0.33 (0.48)	14.66	<.001	.06	1 = 2 = 3	0.68	0.50	0.16	Negligible
Frequency	251	0.88 (6.47)	1,515.79 (8,150.49)	3.27 (10.18)	0.79	.38	.003	1 = 2 = 3	0.26	0.28	0.26	Small
RBQ												
Any	261	0.87 (0.34)	0.90 (0.31)	0.82 (0.39)	0.24	.62	<.001	1 = 2 = 3	0.10	0.12	0.22	Small
Sum	261	2.75 (1.98)	4.50 (2.69)	2.65 (2.44)	1.16	.28	.004	1 = 2 = 3	0.74	0.05	0.72	Moderate
ECR-R												
Anxiety	13,892	3.08 (1.07)	3.97 (1.13)	4.12 (1.19)	1,109.30	<.001	.14	1 < 2 < 3	0.81	0.92	0.13	Negligible
Avoidance	13,898	2.87 (1.10)	3.11 (1.17)	3.53 (1.24)	244.51	<.001	.03	1 < 2 < 3	0.21	0.56	0.34	Small
BPI												
Primitive defenses	268	0.95 (1.42)	2.03 (1.56)	2.00 (1.58)	12.97	<.001	.09	1 < 2 = 3	0.72	0.70	0.02	Negligible
Identity diffusion	262	1.61 (1.76)	2.48 (1.74)	2.84 (2.31)	15.75	<.001	.06	1 = 2 = 3	0.50	0.60	0.17	Negligible
Reality testing	270	0.17 (0.59)	0.42 (0.81)	0.29 (0.72)	2.83	.09	.01	1 = 2 = 3	0.36	0.20	0.16	Negligible
Fusion	266	1.09 (1.45)	2.23 (1.70)	1.76 (1.73)	11.23	<.001	.04	1 = 2 = 3	0.72	0.42	0.28	Small
IPO												
Primitive defenses	242	42.12 (10.85)	53.74 (7.34)	51.24 (10.82)	31.73	<.001	.12	1 < 2 = 3	1.25	0.84	0.27	Small
Identity diffusion	233	45.22 (11.79)	56.82 (6.10)	55.58 (9.50)	33.97	<.001	.13	1 < 2 = 3	1.23	0.97	0.14	Negligible
Reality testing	241	34.10 (11.36)	43.90 (13.00)	40.00 (12.37)	13.30	<.001	.05	1 = 2 = 3	0.80	0.50	0.31	Small

Note. Most likely class membership is assigned based on item probabilities applied to individuals' patterns of MSI-BPD item endorsement. Three-group comparisons (i.e., *F* tests) are conducted via one-way analysis of variance (ANOVA). Post hoc pairwise comparisons are conducted via independent samples *t*-tests. We also conducted the appropriate nonparametric tests of count and dichotomous variables (i.e., DSHI and RBQ) and found no qualitative differences compared with the ANOVA tests above. Thus, we report the latter for consistency across validity variables. Phenotype discrimination thresholds are based on Cohen's (1988) effect size thresholds. *M* = mean; *SD* = standard deviation; MSI-BPD = McLean Screening Instrument for BPD; IPDE-SQ = International Personality Disorder Examination—Screening Questionnaire (without the identity disturbance item, see footnote 3); BPD = borderline personality disorder; NEO = Revised NEO Personality Inventory; DASS = Depression Anxiety Stress Scales; ALS = Affect Lability Scale; AIM = Affect Intensity Measure; SCCS = Self-Concept Clarity Scale; DSHI = Deliberate Self-Harm Inventory; RBQ = Reckless Behavior Questionnaire; ECR-R = Experiences in Close Relationships—Revised Questionnaire; BPI = Borderline Personality Inventory; IPO = Inventory of Personality Organization.

BPD symptoms but without BPD emptiness and identity disturbance criteria are likely to engage in reckless, self-damaging, or otherwise maladaptive behavior, and have difficulty regulating their anger. On the other hand, symptomatic individuals most likely to report BPD identity disturbance and emptiness criteria may be at risk for a series of internalizing symptoms and negative affectivity, as well as difficulties relying on others in close relationships. These findings are generally consistent with a set of studies finding both impulsive, angry, externalizing individuals and empty, identity disturbed, internalizing individuals within the population of BPD manifestations (Lenzenweger et al., 2008; Ramos et al., 2014; Slavin-Stewart, 2015; Thatcher et al., 2005).

Theoretical Considerations

Our results concur with the extensive body of evidence for the dimensional nature of BPD (Costa & McCrae, 1990; Trull & Durrett, 2005; Widiger & Costa, 2012), as incorporating the latent

dimension of BPD into analyses (i.e., FMM vs. LCA) eliminated apparently spurious latent classes of disorder presentation (e.g., the mild, moderate, and severe effect). However, clearly an entirely dimensional view of BPD does not fully explain the preference for a three-class FMM over a single-factor EFA in our sample. Given that the clinical severity of the two symptomatic subtypes was similar (although more elevated in the Empty class), we tentatively suggest the possibility that unstable versus empty manifestations of BPD may derive from distinct developmental trajectories of BPD (Zanarini & Frankenburg, 1997). However, it is also possible that these types are part of a multifinal process and that individuals share common risk factors present in BPD (e.g., trait emotion sensitivity). The present study by no means tests these possibilities, though it provides a useful framework through which such research can proceed. To test the veracity of such a hypothesis, future research would need to assess for similar subtypes of BPD presentation among adolescents and older adults and explore shifts in presentation longitudinally (see Becker, Grilo, Edell, & McGlashan, 2000).

Assessment

The identification of an Unstable subtype and a somewhat more severe Empty subtype is somewhat similar to the categorizations subsumed under emotionally unstable PD in the *ICD-10* (World Health Organization, 1992). The *ICD-10* outlines an "impulsive" type as presenting primarily with impulsivity and affective lability, and a "borderline" type as additionally displaying identity disturbance, emptiness, chaotic relationships, and suicidality/self-injury. Although several features of these types do not align entirely with the subtypes identified in our sample (e.g., the classes displayed similar endorsement of the BPD suicidality/self-harm criterion), our findings generally corroborate the typology outlined by the *ICD*. This suggests that specific patterns of *DSM* BPD criteria may also correspond to the two subtypes of *ICD* emotionally unstable PD, which may aid comparisons between diagnostic systems.

Our study, like those of Conway et al. (2012) and Hallquist and Pilkonis (2012), emphasizes the importance of using FMM to simultaneously understand the latent dimensions and subtypes of psychological disorders. For instance, we were able to identify four distinct BPD symptom classes through LCA, but these were reduced to three after taking into account the latent BPD severity dimension. We argue that studies that only evaluate the dimensional structure of the BPD construct may miss important subpopulations in the data, and research using LCA may identify spurious classes that are better understood purely as differences in disorder severity. FMM may help to resolve the diagnostic heterogeneity of other PDs and psychiatric disorders (e.g., attention-deficit/hyperactivity disorder; Clark et al., 2013).

Clinical Implications

Given that we recruited a young adult sample, our findings highlight the possibility that those who develop BPD may have a distinct pattern of either internalizing or externalizing problems in young adulthood. Interestingly, despite differentiating two subthreshold subtypes of BPD, our study supports both Kernberg and Linehan's approaches to the conceptualization of BPD, in that both identity disturbance and emotion dysregulation were elevated among these individuals, and largely not responsible for differences among them. Although the literature is sparse, several preventative treatment studies have begun to focus on presyndromal BPD, employing cognitive, behavioral, psychoanalytic, and systemic approaches (Chanen & McCutcheon, 2013). Our findings suggest that tailoring such approaches to externalizing or internalizing subthreshold manifestations of BPD may prove fruitful. The *DSM–5* alternative model for personality disorders (American Psychiatric Association, 2013) may enhance the assessment and detection of such individuals, as it desegregates personality-related symptom severity from personality pathology type, which are combined in the traditional polythetic *DSM* PD model via the requirement of five of nine BPD-specific criteria for a diagnosis. The *ICD-11* will also consider subthreshold personality pathology to be clinically meaningful (Chanen & McCutcheon, 2013; Levy & Johnson, 2016), marking a shift toward a broadly defined view of psychiatric problems.

Clinical practice with individuals with personality pathology may be enhanced by using preliminary screening of BPD symptomatology. Specifically, clinicians may be forewarned of problems related to depression, anxiety, and distanced interpersonal relationships when their clients endorse BPD identity disturbance and emptiness criteria. On the other hand, young adults denying emptiness or identity disturbance on a BPD screener, but who endorse other symptoms of BPD, may be at risk for reckless or self-damaging behaviors or anger dysregulation. These different presentations may be especially detectable among college populations, given that our data are derived from a large undergraduate population. Notably, up to 30% of our sample fell into distinct classes with elevated BPD symptoms, potentially meriting increased resources directed toward assessment and treatment of these individuals (e.g., in college counseling centers).

Strengths and Limitations

The study has several important strengths. First, we use the largest sample to date assessed on BPD symptoms. Second, use of FMM addresses several limitations of past research, namely, the use of construct-focused techniques such as factor analysis to address person-specific subtype questions, and the risk of artificial subtypes in LCA when not taking into account a latent severity dimension. Third, validation of identified subtypes increases the reliability and generalizability of our findings.

Despite these strengths, there are a number of limitations that warrant mention. First, our sample was nonclinical in nature. On the one hand, nearly 10% of students use college counseling centers, with a third reporting lifetime suicidality, and a quarter lifetime self-injury (Center for Collegiate Mental Health, 2016), and more use psychotherapy more broadly, and the relative prevalence of BPD is high in community samples (~1–5%; Levy & Johnson, 2016). Nonetheless, further exploration of BPD phenotypes using FMM in a large clinical sample is needed to ascertain generalizability to this population. Second, the current study used a self-report measure of BPD symptoms, potentially limiting the reliability of assessment, although collecting structured interview data from such a large sample is relatively unfeasible, indicative of the balance often needed between rigorous assessment and sample size. Relatedly, use of a multimethod approach would be prefer-

able to reliance on a single measure of BPD symptoms.[3] Third, moderate skew among the BPD indicator variables, a common issue in psychopathology research, may have led to spurious classes in our mixture models, despite our efforts to account for and limit this concern (see footnote 1). Finally, results of our analyses, which used dichotomous indicators, are best corroborated through the use of measures with continuous indicators.

Future Directions

Future research should replicate and aim to further resolve the latent landscape of BPD in terms of criteria assessed via structured interview and continuous indicators in both large nonclinical and clinical samples. The clinical implications of identified BPD phenotypes should also be explored, with retrospective and prospective treatment research evaluating differential effects of existing BPD treatments for individuals with different phenotypic presentations. Finally, treatment targets for individuals with BPD symptoms may be able to be enhanced by matching intervention strategies to the specific configuration of symptoms a patient displays, maximizing gains.

Conclusions

We suggest that BPD is a unidimensional construct that may take on unstable or empty types in the general population. Future literature surrounding the use of the *DSM–5* alternative model for personality disorders and the upcoming *ICD-11* will be critical to determine whether or not these classification systems will be able to identify various putative BPD subsyndromal subtypes. Capturing the range of individuals with functional impairments associated with their BPD symptoms is an important step toward providing optimal clinical care and preventing development of pathological symptoms. Furthermore, identifying different subthreshold subtypes of disorders such as BPD may have important clinical significance in terms of treatment referral for those in distress. Future research using FMM should explore and validate potential subtypes of BPD and their progression over time to further delineate ideographic treatment targets and the temporal progression of the disabling condition of BPD.

[3] To increase reliability of our findings using the MSI-BPD, we also conducted analyses on the IPDE-SQ and on a combination of the IPDE-SQ and MSI-BPD as indicators. Model comparison again preferred the one-factor, three-class FMM-3 solution, although the two symptomatic classes appeared to differ primarily in their endorsement of self-harm, perhaps due to this item being reverse scored in the IPDE-SQ. Removing this item from the IPDE-SQ analysis led to a one-factor, two-class FMM-3 as the most preferred, with Unaffected and Affected classes being identified. However, the relevance of these findings are limited, as the identity disturbance item was missing from the IPDE-SQ at the time of data collection due to an issue with the published measure.

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