

A META-STRUCTURAL MODEL OF COMMON CLINICAL DISORDER AND PERSONALITY DISORDER SYMPTOMS

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A large and consistent research literature demonstrates the superiority of dimensional models of mental disorder. Factor analytic research has mapped the latent dimensions underlying separate sets of mental disorders (e.g., emotional disorders), but a common framework—unencumbered by arbitrary historical boundaries between disorder groups—requires additional research. Using empirically derived measures of three key domains of psychopathological variation, the overarching goal of the current study was to explicate dimensions connecting internalizing, externalizing, and personality disorders. Participants included 1,144 racially diverse undergraduates. Exploratory structural equation modeling analyses revealed seven latent dimensions: core internalizing, core externalizing, antagonism, impulsivity, dutifulness, detachment, and suspiciousness. This meta-structure reflects a more comprehensive model of the architecture of mental disorders than accounts derived from less inclusive assessment batteries. Future empirical work is needed to evaluate the utility of this structural model in etiological research, assessment, and treatment arenas.

Keywords: dimensional models, externalizing, factor analysis, internalizing, personality disorder, transdiagnostic

Decades of research have identified serious weaknesses in the categorical approach to psychiatric diagnosis. Observations of excessive comorbidity, within-category heterogeneity, and poor reliability undercut the validity and, by extension, the utility of categorical systems such as that of the *Diagnostic and Statistical Manual of Mental Disorders (DSM; Widiger & Trull, 2007)*. This evidence has prompted investigators to consider dimensional classification schemes that emphasize processes that cut across traditional diagnostic boundaries (e.g., Brown & Barlow, 2009; Insel & Cuthbert, 2015; Kotov et al., 2017).

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The most successful dimensional frameworks have grown out of quantitative analysis of psychiatric symptoms and diagnoses. Latent variable modeling techniques like factor analysis are used to uncover liability dimensions that underlie the development of related disorders (Krueger & Markon, 2006). These dimensions form a hierarchy of individual differences that are theorized to represent the meta-structure of psychopathology (Lahey, Krueger, Rathouz, Waldman, & Zald, 2017a). The most replicable dimensions of this trait framework are the internalizing and externalizing spectra. The internalizing spectrum underlies the anxiety and depressive disorders, whereas the externalizing spectrum reflects liability to substance use and antisocial behavior disorders (Eaton, Rodriguez-Seijas, Carragher, & Krueger, 2015). Other dimensions have emerged from the quantitative analysis of comorbidity, including fear and distress subfactors that explain systematic clustering of disorders within the internalizing spectrum (Clark & Watson, 2006).

Much of the research in this area relies on analyses of disorder constructs, which can be assessed categorically (e.g., diagnosis) or continuously (e.g., symptom count). This approach has led to a provisional outline of the latent dimensions undergirding psychiatric conditions (see e.g., Kotov et al., 2017; Lahey et al., 2017a). Yet, relying on traditional disorder categories limits the precision of dimensional models. Psychiatric diagnoses are heterogeneous, and they may be too coarse to map the more granular, specific elements of a dimensional framework (Markon, 2010). Thus, a new system arguably should be based on more fundamental, homogeneous building blocks of psychopathology (cf. Widiger & Clark, 2000).

Investigators have followed this logic to delineate the latent architecture of personality disorders. In a series of studies, researchers have analyzed the patterns in correlations among homogeneous pathological personality traits (e.g., Bo, Bach, Mortensen, & Simonsen, 2016; Quilty, Ayearst, Chmielewski, Pollock, & Bagby, 2013; Thomas et al., 2013; Wright et al., 2012). Many of these studies involve the Personality Inventory for DSM-5 (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012), an empirically derived measure of the traits (e.g., emotional lability, suspiciousness) underpinning the personality disorder domain. Joint factor analyses of the PID-5 and normal-range personality traits generally reveal five main dimensions (i.e., Negative Affectivity, Detachment, Antagonism, Disinhibition, and Psychoticism) that organize personality and personality disorder, although other factor configurations have also been reported (e.g., Ashton, Lee, de Vries, Hendrickse, & Born, 2012; Morey, Krueger, & Skodol, 2013).

This line of work has identified several traits likely to be foundational to any dimensional classification scheme. Those analyses, however, were limited to personality disorders. Likewise, latent variable modeling of clinical disorder symptoms in the internalizing (e.g., Watson et al., 2007) and externalizing (e.g., Krueger, Markon, Patrick, Benning, & Kramer, 2007; Sellbom, 2016) spectra has generated a set of liability factors for the internalizing and externalizing domains separately. The logical next phase of research in this field is to improve the coverage of psychopathology in such structural analyses in ways that integrate historically separate domains of disorder. That is,

research that simultaneously involves the basic units of clinical and personality disorders has the potential to bridge these research traditions and identify the fundamental structure of common mental disorders.

Although we know that comorbidity among clinical and personality disorders (i.e., across axes I and II of *DSM-IV*) is extensive (e.g., Grant et al., 2005), there is very little research on the patterning of covariation across both clinical and personality disorders. Markon (2010) analyzed self-reported and interviewer-rated symptoms of internalizing, externalizing, and personality disorders in an epidemiological sample. In the best-fitting model, these symptoms reflected four overarching liabilities: internalizing, externalizing, pathological introversion, and thought disorder. In this same vein, Kotov and colleagues (2011) factor analyzed the correlations among 25 clinical and personality disorder diagnoses in a general outpatient sample. There was evidence for a five-factor solution that included internalizing, externalizing, thought disorder, somatoform, and antagonism dimensions. Further analyses of these data elaborated on this initial report via both cluster and factor analytic methods, converging on a hierarchical account (Forbes et al., 2017). Seven spectra (disinhibition, antagonism, core thought disorder, detachment, core internalizing, somatoform, and compulsivity) were delineated using both methods. In turn, these seven spectra were nested under three higher-order spectra: externalizing, broad thought dysfunction, and broad internalizing. These three broad groupings were themselves correlated, forming an overarching domain of individual differences in overall extent of psychopathology (cf. Lahey, Krueger, Rathouz, Waldman, & Zald, 2017b). As datasets incorporating less prevalent mental disorders become available, it is likely that dimensions reflecting eating pathology, body image distortion, and sexual dysfunction—among others—will need to be grafted onto this emerging hierarchy (e.g., Forbes, Baillie, & Schniering, 2015; Forbush et al., 2017; Pezzoli, Antfolk, & Santtila, 2017).

Results from these investigations reveal some consistency in the meta-structure of mental disorders (e.g., internalizing and externalizing dimensions), but they are not conclusive. There is insufficient work combining the personality disorder and clinical disorder domains to outline a meta-structural model of common mental disorders. Even work that incorporated diverse diagnoses is limited by reliance on heterogeneous representation (i.e., *DSM*-defined syndromes) that are unlikely to “carve nature at its joints.” In sum, no studies have integrated the clinical and personality disorder domains by investigating previously validated, transdiagnostic trait dimensions from these areas. Such research is possible (and essential) now that comprehensive assessment instruments are available for the relevant psychopathology domains (Krueger et al., 2007, 2012; Watson et al., 2007).

The current study extended existing structural frameworks of mental disorder “outward,” in that we jointly modeled psychopathology dimensions from domains that historically have been investigated separately: internalizing, externalizing, and personality disorders. We administered trait measures that have been validated independently for each of these domains to a large, diverse university student sample ($N = 1,144$). We also used a novel set of homogeneous indicators that bypassed problems related to diagnostic het-

erogeneity in prior disorder-level factor analyses (Kotov et al., 2017). Based on a wealth of prior evidence, we expected the best-fitting model of these individual differences to include internalizing and externalizing dimensions. Given the novel mixture of individual differences investigated here and variability in results across prior studies, we did not advance hypotheses a priori regarding the number or nature of additional factors.

METHOD

PARTICIPANTS

Participants included 1,144 undergraduates ($M_{\text{age}} = 21.19 \pm 5.04$; 73.4% female) at a large public Southeastern university. Participants were racially diverse, with 34.4% self-identifying as African-American/Black, 33.9% as White, and 14.8% as Asian/Asian-American. Participants were recruited through the university's research study pool and were awarded course credit for their participation. All data were collected electronically during a single session. The university's ethics review board approved all study procedures.

MEASURES

Inventory of Depression and Anxiety Symptoms. Internalizing psychopathology was assessed with the 64-item Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007). Consistent with common clinical approaches to assessing these conditions, the IDAS assesses current levels of symptomatology over the past two weeks. The IDAS contains 10 factor-analytically derived scales assessing various internalizing symptom dimensions (Well-Being, Panic, Lassitude, Insomnia, Suicidality, Social Anxiety, Ill Temper, Traumatic Intrusions, Appetite Loss, and Appetite Gain). It also includes two broader scales: General Depression and Dysphoria. Given that the General Depression scale is made up of items from other scales, it was not included in the current study. Participants rate how much they have experienced the item "during the past two weeks, including today" on a 5-point Likert-type scale ranging from "not at all" to "extremely." The IDAS exhibits good internal consistency, with Cronbach's alpha values across psychiatric, community, and student samples ranging from .67 to .92 (Watson et al., 2007). Moreover, IDAS scales have yielded strong convergent validity with widely used anxiety and depression measures, including the Beck Depression Inventory-II (Beck, Steer, & Brown, 1996), Beck Anxiety Inventory (Beck & Steer, 1990), and corresponding scales on the Interview for Mood and Anxiety Symptoms (Kotov, Gamez, & Watson, 2005; Watson et al., 2007). Internal consistencies (Cronbach's alpha) in the current sample ranged from .79 (Appetite Gain) to .92 (Appetite Loss).

Externalizing Spectrum Inventory. The Externalizing Spectrum Inventory (ESI; Krueger et al., 2007) is a self-report inventory designed to assess 23 specific varieties of externalizing behavior via 23 narrow-band facet scales. These scales tend to organize empirically into three broader groupings: Gen-

eral disinhibition, Callous aggression, and Substance abuse. For the current study, we used the 415-item ESI full form. Items on the ESI are completed using a 4-point Likert-type scale. Internal consistencies for these facets in the current sample ranged from .84 (Drug use) to .97 (Drug problems).

Personality Inventory for DSM-5. The Personality Inventory for DSM-5 (PID-5; Krueger et al., 2012) is a 220-item broad-bandwidth inventory of diverse maladaptive personality facets. The 25 PID-5 scales are arranged hierarchically and tend to organize empirically into five broader groupings, at the lowest level of this general hierarchy: negative affect, detachment, antagonism, disinhibition, and psychoticism. Items are scored on a 4-point Likert-type scale, ranging from 0 (very false) to 3 (very true or often true). Internal consistencies in the current sample ranged from .67 (Suspiciousness) to .95 (Eccentricity).

DATA ANALYSES

We used parallel analysis to determine the maximum number of factors to extract. Next, we used exploratory structural equation modeling (ESEM) to model several factor structures for psychopathology. ESEM is a hybrid of exploratory and confirmatory factor analytic approaches (Wright, 2017). We specified several confirmatory portions of the ESEM on an a priori basis. Based on the consistent observation in the psychometric literature that reverse-keyed factor indicators tend to cohere to some degree—irrespective of substantive overlap—we created a factor on which all reverse-scored scales (i.e., ESI Honesty, Planful control, Dependability, and Empathy; IDAS Well-being) loaded (see Carlson et al., 2011; Zhang, Noor, & Savalei, 2016). To control for other sources of method variance, we specified separate method factors for each assessment instrument (i.e., PID-5, ESI, IDAS). This step was intended to isolate shared method variance among these sets of factor indicators while preserving the substantive meaning of the exploratory factors (see, e.g., Wright, 2017). All method factors were uncorrelated with each other and with all exploratory (i.e., substantive) factors. Additionally, three residual covariances were included ad hoc to adjust for an outstanding local area of strain (see Results).

None of the surveys we administered included traditional validity scales that screen for inconsistent response patterns. Nevertheless, there is preliminary evidence that careless responding on the PID-5 and similar surveys could systematically bias reported symptom rates (e.g., McGee Ng et al., 2016). We therefore adopted a recently published strategy to identifying biased profiles on the PID-5 (Keeley, Webb, Peterson, Roussin, & Flanagan, 2016). This algorithm detects biased cases by flagging discrepant responses to highly correlated PID-5 items (e.g., “I worry a lot about terrible things that might happen” and “I’m always fearful or on edge about bad things that might happen”). Based on this approach, which has been found to have strong specificity and sensitivity (Keeley et al., 2016), we excluded data—on all assessment instruments, not just the PID-5—from 104 potentially biased cases (9% of the sample), leaving a final sample size of 1,040.

ESEMs were carried out with the robust maximum likelihood estimator in Mplus version 8 (Muthén & Muthén, 1998–2014), with an oblique geomin rotation. Model fit was judged to be adequate when the comparative fit index (CFI) and Tucker-Lewis index (TLI) were .90 or above, root mean square error of approximation (RMSEA) was .08 or below, and standardized root mean square residual (SRMR) was .08 or below (Brown, 2015). We also evaluated the Bayesian Information Criterion (BIC), lower values of which indicate better fit (Raftery, 1993). Finally, we judged model fit according to the size and interpretability of factor loadings.

Our dataset and Mplus input files are publicly available at <https://osf.io/vhnds>.

RESULTS

The parallel analysis indicated that up to seven factors could be extracted. Therefore, we evaluated the fit of one- through seven-factor solutions in the ESEM framework. Across all models, we omitted the ESI Drug use and Drug problem scales because of collinearity problems. These two dimensions were highly overlapping with each other ($r = .78$) and with ESI Marijuana use and Marijuana problem scales (r range: $.57$ to $.90$). We were therefore concerned that including these scales in the ESEM would produce a “bloated specific” factor, which is an artifactual dimension that emerges because of a relatively large number of narrowly defined scales (Cattell, 1978). In such cases, the strong intercorrelations among these narrow dimensions cause them to form a separate factor, even though this dimension should probably be subsumed under broader factors—in our case, more broadband externalizing traits (e.g., Impulsivity, Core Externalizing; see below) (DeYoung, 2011).

Consistent with results from the parallel analysis, Table 1 shows that the fit indices favored the seven-factor model, relative to simpler solutions. We allowed a residual covariance between ESI Marijuana use and ESI Marijuana problems that was an area of local strain in the seven-factor model ($r = .63$); likewise, residual covariances for ESI Alcohol problems and ESI Alcohol use ($r = .48$), and ESI Excitement seeking and PID-5 Risk taking ($r = .53$) were freely estimated. In the final model including those modifications, fit was acceptable according to all indices (with the possible exception of TLI, which was somewhat below traditional cutoff values; see final row of Table 1). Table S1 in the supplemental material presents the factor correlations, which suggested that the seven dimensions were reasonably interrelated (mean $r = .22$; r range = $-.06$ to $.42$).

Results from two- to six-factor solutions are provided in the supplemental materials (Tables S2–S7). In short, the two-factor model distinguished Internalizing (two highest [by absolute value] loading indicators: IDAS Dysphoria, PID-5 Anxiousness) versus Externalizing (ESI Destructive aggression, ESI Theft) pathology. In the three-factor model, the Externalizing dimension bifurcated into Core Externalizing and Impulsivity (ESI Excitement seeking, PID-5 Risk taking). The four-factor solution featured an Antagonism (PID-5 Grandiosity, PID-5 Manipulativeness) dimension that broke away from

TABLE 1. Comparison of Exploratory Structural Equation Models

Model	df	χ^2	CFI	TLI	RMSEA	SRMR	BIC
1-factor	1423	15304.02	.702	.678	.097	.092	233444.29
2-factor	1368	12300.33	.765	.736	.088	.063	230226.10
3-factor	1314	10436.03	.804	.771	.082	.051	228177.80
4-factor	1261	8619.68	.842	.807	.075	.040	226448.80
5-factor	1209	7396.93	.867	.831	.070	.033	225282.50
6-factor	1158	6481.63	.886	.848	.066	.029	224472.46
7-factor	1108	5687.87	.902	.863	.063	.026	223920.48
7-factor revised ^a	1105	4793.04	.921	.890	.057	.025	223009.14

Note. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; BIC = Bayesian information criterion. ^aThis model included three residual covariances: Externalizing Spectrum Index (ESI) Marijuana use and Marijuana problems, ESI Alcohol use and Alcohol problems, and ESI Excitement seeking and Personality Inventory for DSM-5 Risk taking.

TABLE 2. Best-Fitting Exploratory Structural Equation Model of the Inventory of Depression and Anxiety Symptoms, Externalizing Spectrum Inventory, and Personality Inventory for DSM-5 Scales

Trait	Factor						
	Core Internalizing	Antagonism	Core Externalizing	Impulsivity	Suspiciousness	Dutifulness	Detachment
ESI							
Alcohol problems	.063	-.011	.533	.222	-.178	.013	.049
Alcohol use	-.155	.150	-.002	.451	-.052	-.205	-.035
Alienation	.667	.004	-.123	.097	.466	-.053	.031
Blame externalization	.489	.081	.145	-.015	.338	.037	-.054
Boredom proneness	.586	.039	-. 325	.296	-.006	.023	.246
Dependability	-.003	-.051	-. 528	-.110	-.003	.466	.050
Destructive aggression	-.002	.023	.757	-.057	-.036	.045	.178
Empathy	.104	-.101	-. 431	-.038	-.033	.279	-. 467
Excitement seeking	.010	.055	.225	.538	.031	.120	.057
Fraud	.060	.379	.494	.010	-.099	-.048	.041
Honesty	.053	-. 487	-.282	.014	-.030	.506	.030
Impatient urgency	.481	.195	-.142	.360	-.001	.003	.016
Irresponsibility	.139	.058	.617	.106	-.143	-.061	.027
Marijuana problems	.005	.004	.571	.150	-.151	-.011	.023
Marijuana use	-.049	.029	.177	.427	-.063	-.180	-.044
Physical aggression	-.036	.098	.539	.028	.132	.004	.249
Planful control	-.047	.015	-. 353	-. 369	-.046	.532	-.081
Problematic impulsivity	.381	.044	.282	.378	-.043	.008	.016
Rebelliousness	.047	.067	.367	.487	.041	-.205	-.074
Relational aggression	.200	.383	.207	.004	.069	.047	.231
Theft	-.016	.056	.729	-.043	-.141	.028	-.074
IDAS							
Dysphoria	.879	-.016	-.136	.128	-.029	-.086	-.025
Lassitude	.686	.014	-.162	.128	-.111	.092	.004
Insomnia	.566	.036	-.047	.075	.053	.080	-.026
Suicidality	.492	-.111	.464	-.033	.048	-.123	.031
Appetite loss	.471	.043	.055	.019	.080	-.010	-.017
Ill temper	.446	.054	.136	.122	.192	.036	.113
Social anxiety	.802	.000	.004	-.081	-.010	-.003	-.030
Panic	.587	.003	.319	-.017	.084	.028	-.067
Traumatic intrusions	.599	-.085	.214	.018	.241	.061	-.049
Well-being	-. 425	.010	.007	.023	-.014	.679	-.072

PID-5								
Anhedonia	.768	-.058	.100	-.081	-.083	-.382	.258	
Anxiousness	.924	.096	-.267	-.083	.010	-.042	-.019	
Depressivity	.817	-.050	.255	-.039	-.040	-.242	.048	
Emotional lability	.746	.054	.015	.031	.109	.044	-.119	
Hostility	.409	.271	.001	.093	.119	.069	.330	
Perseveration	.757	.077	.095	.067	-.051	.120	-.033	
Rigid perfectionism	.471	.129	.064	-.219	.064	.367	.047	
Separation insecurity	.631	.124	.082	.003	-.035	.014	-.107	
Submissiveness	.536	.091	-.026	-.039	-.243	.161	-.039	
Suspiciousness	.607	.098	-.024	-.041	.424	-.135	.145	
Withdrawal	.696	-.067	.020	-.102	-.024	-.046	.392	
Attention seeking	.060	.392	.159	.183	-.002	.363	-.139	
Callousness	.087	.179	.468	.030	.041	-.003	.480	
Deceitfulness	.178	.790	.085	-.003	-.070	-.031	.074	
Grandiosity	.003	.250	.293	-.007	.091	.370	.228	
Manipulativeness	.037	.605	.011	.146	.008	.215	.106	
Intimacy avoidance	.353	-.142	.345	-.060	-.021	-.010	.277	
Restricted affectivity	.267	.007	.006	.075	-.098	.156	.509	
Distractibility	.721	-.048	-.024	.303	-.152	-.007	.032	
Eccentricity	.623	.008	.060	.200	.042	.132	-.035	
Perceptual dysregulation	.598	-.001	.383	.072	.089	.129	-.032	
Risk taking	-.202	-.017	.148	.684	.147	.044	.038	
Unusual beliefs	.397	.003	.445	.010	.224	.260	-.077	
Impulsivity	.286	-.033	.197	.586	.030	.005	.000	
Irresponsibility	.338	.097	.523	.156	-.137	-.138	-.013	

Note. Factor loadings $\geq .130$ are in boldface. IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); ESI = Externalizing Spectrum Index (Krueger et al., 2007); PID-5 = Personality Inventory for DSM-5 (Krueger et al., 2012)

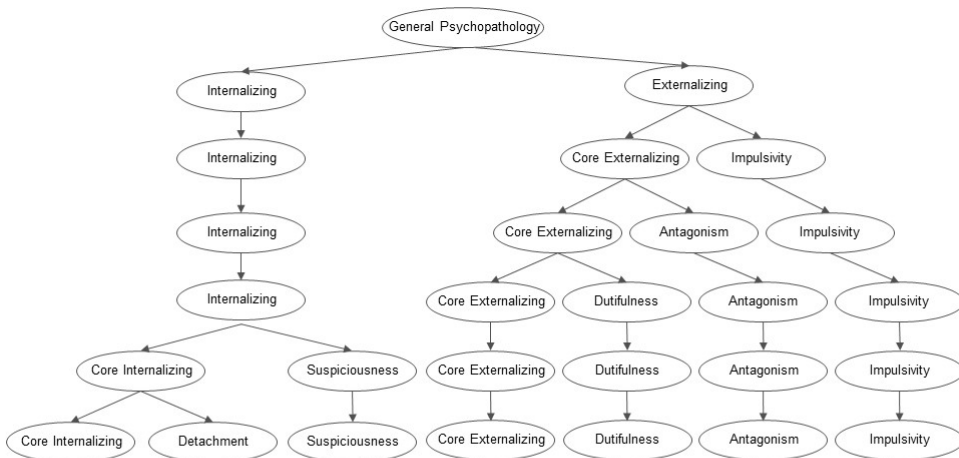


FIGURE 1. A conceptual diagram of the series of factor models leading up to the best-fitting, seven-factor solution. For instance, at the transition from a two- to a three-factor model, the strongest indicators of the Externalizing factor were divided between Core Externalizing and Impulsivity factors. The hierarchical structure illustrates that more homogeneous factors can be considered facets of broader, more heterogeneous dimensions.

Core Externalizing. In the five-factor model, a Dutifulness dimension (ESI Planful control, IDAS Well-being) was divided from Core Externalizing. A Suspiciousness factor (PID-5 Suspiciousness, ESI Alienation) emerged from Internalizing in the six-factor model, as did a Detachment factor (PID-5 Restricted affectivity, PID-5 Callousness) in the seven-factor model. Thus, we labeled the seven dimensions of this final model: Core Internalizing, Core Externalizing, Antagonism, Impulsivity, Dutifulness, Suspiciousness, and Detachment. Figure 1 presents a conceptual diagram of this sequence of factor models, illustrating that the more fine-grain dimensions from the best-fitting model can be considered facets of broader, higher-order constructs, such as Internalizing and Externalizing.

Table 2 shows the factor-loading matrix for the final seven-factor solution. Each factor featured statistically significant and substantial (i.e., standardized loading $> .30$) loadings of scales from multiple assessment instruments (i.e., IDAS, ESI, PID-5). The Core Internalizing dimension was robustly defined by scales across all three surveys. The IDAS markers were expected, but there were also strong indicators from the ESI (e.g., Boredom proneness, Impatient urgency) and PID-5 Detachment and Psychoticism domains (e.g., Submissiveness, Eccentricity). In particular, Core Internalizing may have absorbed pathology reflecting unusual beliefs and perceptual dysregulation because no discrete psychoticism dimension emerged in our sample. Core Externalizing also had markers spread across the various surveys, although the predominant indicators derived from the ESI (e.g., Theft, Alcohol problems), which targeted externalizing pathology with greatest precision. Antagonism was predictably associated with some of the PID-5 trait scales predominantly

linked to antisocial and borderline personality disorders (e.g., Deceitfulness, Manipulativeness), but more behavioral indices on the ESI were also relevant (e.g., Fraud). Similarly, Impulsivity was an amalgam of ESI and PID-5 Disinhibition indicators, with almost no relation to IDAS scales. Dutifulness combined adaptive elements of inhibitory control (e.g., ESI Planful control), prosociality (e.g., ESI Honesty and Dependability), and motivational states conducive to rule following (IDAS Well-being, PID-5 Anhedonia). Our Detachment factor transcended the PID-5 Detachment domain (e.g., Restricted affectivity, Withdrawal) to include antagonistic attitudes and diminished empathy. Finally, the Suspiciousness factor was comparatively circumscribed, reflecting hostile attribution biases (e.g., ESI Blame externalizing) and mistrust for others (e.g., PID-5 Suspiciousness).

These seven substantive factors were constrained to be orthogonal to our four confirmatory method factors. The standardized loadings on the ESI method factor ranged from $-.05$ to $.48$ (median $\lambda = .32$). Loadings for the other method factors were in a similar range: IDAS from $.08$ to $.50$ (median $\lambda = .41$); PID-5 from $-.30$ to $.40$ (median $\lambda = .01$); and the reverse-keyed method factor from $.25$ to $.53$ (median $\lambda = .45$).

DISCUSSION

Dimensional models of mental disorder stand to improve etiological research and treatment development because they better reflect the empirical organization of psychopathology (Kotov et al., 2017). Although factor analytic research has identified fundamental pieces of a dimensional framework, prior work has been limited in scope, potentially overlooking key architectural components that bridge internalizing, externalizing, and personality disorders. Moreover, previous research has focused largely on categorical disorder indicators, which are coarse representations of psychopathological constructs and inherently limit the precision of resulting structural models. The current study is the first to our knowledge to examine the joint structure of common dimensional indicators of clinical (internalizing and externalizing) and personality pathology using a factor-analytically derived dimensional framework. These indicators jointly delineated a set of seven transdiagnostic dimensions that form a comprehensive meta-structure of diverse psychiatric syndromes.

The dimensions extracted here align predictably with those recovered from previous joint analyses of clinical and personality disorders. Our Core Internalizing, Core Externalizing, and Detachment constructs overlap with three of the four superordinate dimensions (Internalizing, Externalizing, Pathological Introversion) identified in Markon's (2010) symptom-level analysis in an epidemiological sample. Additionally, the Internalizing, Externalizing, and Antagonism factors reported by Kotov and colleagues' (2011) analysis of diagnostic data match ones observed here. In contrast, we did not recover Kotov and colleagues' Somatoform or Thought Disorder dimensions, likely because our indicator set did not include diverse representation of somatic or thought disorder concerns. Indeed, thought disorder symptoms

in our study (e.g., unusual beliefs, perceptual dysregulation) were split across the internalizing and externalizing spectra, and did not cohere into a discrete dimension of their own. Despite these divergences in factor structure across studies—attributable perhaps to differences in sampling and disorder coverage—the appearance of core Internalizing and Externalizing spectra across these studies reflects the reliability of these dimensions over decades of structural modeling of psychiatric problems in children, adolescents, and adults (e.g., Achenbach, 1966; Krueger & Markon, 2006). Thus, our study echoes key results from prior structural studies and strengthens the validity of these latent dimensions.

Novel dimensions in our solution, relative to prior combined factor analyses of clinical and personality disorder domains, likely reflect differences in input data. Most notable was our denser representation of the externalizing spectrum between the 23 Externalizing Spectrum Inventory facets and the 10 Personality Inventory for DSM-5 facets in the Disinhibition and Antagonism domains. This in-depth coverage likely explains the extraction of detailed elements of externalizing psychopathology (e.g., Dutifulness and Impulsivity dimensions)—which did not emerge in prior work—in the present study. In a similar vein, our study is the first to delineate the joint structure of these conditions at the level of transdiagnostic symptom components. This approach, as compared to parsing diagnostic correlations, eliminates the problem of diagnostic heterogeneity and, in turn, improves the precision of our dimensional framework (e.g., Wright & Simms, 2015).

Aside from providing more valid disorder phenotypes, the main promise of dimensional classification systems is making research and intervention efforts more efficient. Instead of designing studies to investigate one disorder category at a time, researchers theoretically can target the transdiagnostic dimension(s) that form the building blocks for several related *DSM*-defined conditions (e.g., Nolen-Hoeksema & Watkins, 2011). This approach has the potential to simplify the hunt for etiological processes, clinical assessment, and psychiatric treatment. First, however, the utility of these latent dimensions, compared to categorical diagnoses, must be demonstrated empirically with respect to theoretically important causes and correlates of psychopathology (see Krueger, Tackett, & MacDonald, 2016).

This process has already begun. Latent variable modeling studies of disorder comorbidity have linked Internalizing and Externalizing factors with key clinical outcomes and causal agents, such as suicide risk, stress reactivity, childhood maltreatment, and genetic variation (e.g., Sunderland & Slade, 2015; Vachon, Krueger, Rogosch, & Cicchetti, 2015). This line of research generally demonstrates that, after the effects of transdiagnostic factors (e.g., Internalizing) are taken into account, their constituent disorders (e.g., panic disorder) generally have very small associations with those same external correlates (Kotov et al., 2017). Also, treatment programs that target the common diatheses of related disorders (e.g., Internalizing liability) have shown promising results for enhancing the efficiency of treatment delivery (Farchione et al., 2012; see also Waszczuk et al., 2017). Thus, a logical ex-

tension of the current study will be to examine our latent dimensions in relation to theoretically relevant correlates of internalizing, externalizing, and personality pathology.

LIMITATIONS

First, we caution that the generalizability of these findings should be tested and not assumed. We expect that our results apply to the young adult population, and probably to adults more generally. The racial/ethnic diversity of this undergraduate sample (66% non-White) builds confidence that these results are widely applicable. Also, our sample was predominantly (73%) female, and women are known to report higher levels of internalizing complaints and lower levels of externalizing problems, relative to men. This gender imbalance could, therefore, affect the number and nature of factors extracted in structural analyses. We speculate, though, that any such gender influence is minor, based on prior epidemiological research that has shown dimensional models of psychopathology to be invariant across gender (e.g., Eaton et al., 2012). Further, auxiliary analyses in our data confirmed that our best-fitting model was consistent across gender.¹

Along these same lines, the general prevalence of subclinical and syndromal psychopathology in university student populations suggests sufficient individual differences in psychopathology to uncover latent dimensions of common mental disorders (Auerbach et al., 2016; Conway, Tackett, & Skodol, 2017). Nevertheless, this model awaits replication in clinical samples, where symptom frequency and severity can differ widely. For instance, the Thought Disorder spectrum documented by Markon (2010) and Kotov and colleagues (2011) in patient samples was not detected in our (non-clinical) data, very likely due to sampling differences across studies.

Second, although this is the most comprehensive integration of transdiagnostic symptom dimensions to date, our model could be extended further. Pathological eating, somatization, and sexual problems are among the common pathologies not covered here. Third, we examined various latent structures (i.e., measurement models) for mental disorder, but we did not validate the extracted dimensions with respect to etiological markers or clinically significant outcomes. Empirical work along these lines will be needed to confirm the utility of this dimensional framework, relative to categorical classification systems. Fourth, our data were cross-sectional, and longitudi-

1. In a test of configural invariance, we examined the consistency of the factor structure across gender. This initial multiple group confirmatory factor analysis (CFA) fit the data acceptably, $\chi^2(2, 312) = 6722.28, p < .001, CFI = .92, TLI = .89, RMSEA = .058, SRMR = .023$. Next, we constrained factor loadings to equality across gender to test metric invariance. Although this metric invariant model fit worse according to the chi-square difference test, $\chi^2(408) = 592.44, p < .001$, this test is well known to be overpowered in large samples to detect even minor decrements in model fit. Thus, we relied primarily on the change in CFI across models to evaluate the acceptability of the loading constraint (see Cheung & Rensvold, 2002). According to this criterion, loadings in our best-fitting model were equivalent across gender (i.e., CFI in the constrained model did not decline—at least to three decimal places—relative to the configural invariance model).

nal data may provide purchase on other aspects of psychopathology, pertaining for example to course and patterning over time, thereby augmenting and refining the model we have articulated here. Finally, we did not model the full range of substance use indicators available to us because of unexpected multicollinearity observed between drug problem scales. Associations among these facets of the externalizing spectrum require continued study across clinical and non-clinical samples to determine whether this feature of our data might be specific to university students and/or racial and ethnic minority groups.

CONCLUSION

We constructed a common quantitative framework (i.e., meta-structure) for psychiatric problems by factor analyzing the transdiagnostic individual differences that form the architecture for diverse mental disorders. This joint structure has the potential to bridge historically disparate research traditions into internalizing, externalizing, and personality pathology and to accelerate etiological research and treatment efforts. Future research is needed to replicate this quantitative nosology and to evaluate its utility, relative to categorical disorders, in research and intervention contexts.

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TABLE S1. Factor Correlations From the 7-Factor Model

	1	2	3	4	5	6
1. Core internalizing						
2. Antagonism	.417***					
3. Core externalizing	.389***	.552***				
4. Impulsivity	.286***	.455***	.362***			
5. Detachment	.208	.358***	.320***	.128		
6. Dutifulness	.212***	.157**	-.064	.116**	.034	
7. Suspiciousness	.033	.185*	.107	.091	.098	.128**

* $p < .05$. ** $p < .01$. *** $p < .001$.

TABLE S2. Two-Factor Exploratory Structural Equation Model of the Inventory of Depression and Anxiety Symptoms, Externalizing Spectrum Inventory, and Personality Inventory for DSM-5 Scales

Trait	Factor	
	Internalizing	Externalizing
ESI		
Alcohol problems	.167	.467
Alcohol use	.015	.098
Alienation	.618	.009
Blame externalization	.512	.269
Boredom proneness	.687	-.067
Dependability	.105	-.562
Destructive aggression	-.003	.794
Empathy	.200	-.854
Excitement seeking	.295	.294
Fraud	.155	.681
Honesty	.100	-.605
Impatient urgency	.683	.007
Irresponsibility	.181	.598
Marijuana problems	.075	.499
Marijuana use	.081	.181
Physical aggression	-.014	.742
Planful control	-.004	-.375
Problematic impulsivity	.553	.300
Rebelliousness	.196	.493
Relational aggression	.314	.567
Theft	-.003	.703
IDAS		
Dysphoria	.897	-.167
Lassitude	.774	-.191
Insomnia	.638	-.072
Suicidality	.407	.373
Appetite loss	.489	.058
Ill Temper	.539	.214
Social anxiety	.768	-.062
Panic	.606	.207
Traumatic intrusions	.622	.097
Well-being	-.149	-.169
PID-5		
Anhedonia	.544	.284
Anxiousness	.903	-.250
Depressivity	.689	.241
Emotional lability	.815	-.103
Hostility	.542	.345
Perseveration	.855	.031
Rigid perfectionism	.563	.029
Separation insecurity	.693	-.003
Submissiveness	.604	-.112
Suspiciousness	.563	.201
Withdrawal	.568	.252
Attention seeking	.418	.146
Callousness	.126	.842
Deceitfulness	.393	.526
Grandiosity	.207	.472
Manipulativeness	.354	.362
Intimacy avoidance	.247	.435
Restricted affectivity	.294	.352
Distractibility	.813	-.044
Eccentricity	.747	.017
Perceptual dysregulation	.670	.294
Risk taking	.106	.202
Unusual beliefs	.505	.313
Impulsivity	.525	.182
Irresponsibility	.383	.505

Note. Factor loadings $\geq |.40|$ are in boldface. IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); ESI = Externalizing Spectrum Index (Krueger et al., 2007); PID-5 = Personality Inventory for DSM-5 (Krueger et al., 2012).

TABLE S3. Three-Factor Exploratory Structural Equation Model of the Inventory of Depression and Anxiety Symptoms, Externalizing Spectrum Inventory, and Personality Inventory for DSM-5 Scales

Trait	Factor		
	Internalizing	Externalizing	Impulsivity
ESI			
Alcohol problems	.102	.408	.218
Alcohol use	-.081	-.004	.453
Alienation	.635	.052	.070
Blame externalization	.461	.320	.000
Boredom proneness	.628	-.050	.180
Dependability	.144	-.536	-.043
Destructive aggression	-.058	.807	-.046
Empathy	.278	-.896	.067
Excitement seeking	.110	.191	.655
Fraud	.072	.683	.078
Honesty	.163	-.609	-.027
Impatient urgency	.589	.001	.307
Irresponsibility	.131	.572	.079
Marijuana problems	.019	.434	.191
Marijuana use	-.002	.062	.441
Physical aggression	-.095	.760	.020
Planful control	.065	-.298	-.276
Problematic impulsivity	.451	.257	.334
Rebelliousness	.052	.417	.450
Relational aggression	.219	.620	.036
Theft	-.039	.668	-.020
IDAS			
Dysphoria	.902	-.138	.027
Lassitude	.764	-.166	.064
Insomnia	.615	-.041	.046
Suicidality	.393	.402	-.069
Appetite loss	.466	.088	.017
Ill temper	.466	.261	.079
Social anxiety	.796	.011	-.154
Panic	.575	.254	-.023
Traumatic intrusions	.593	.142	.001
Well-being	-.216	-.162	.159
PID-5			
Anhedonia	.583	.352	-.251
Anxiousness	.951	-.170	-.168
Depressivity	.701	.290	-.128
Emotional lability	.798	-.045	-.006
Hostility	.440	.446	.017
Perseveration	.814	.104	.004
Rigid perfectionism	.548	.162	-.205
Separation insecurity	.673	.044	-.003
Submissiveness	.610	-.061	-.060
Suspiciousness	.518	.297	-.090
Withdrawal	.577	.368	-.269
Attention seeking	.261	.178	.317
Callousness	-.004	.940	-.036
Deceitfulness	.250	.607	.106
Grandiosity	.072	.588	.014
Manipulativeness	.177	.431	.244
Intimacy avoidance	.228	.505	-.169
Restricted affectivity	.219	.440	-.043
Distractibility	.766	-.033	.161
Eccentricity	.668	.051	.169
Perceptual dysregulation	.590	.352	.059
Risk taking	-.116	.075	.803
Unusual beliefs	.409	.378	.065
Impulsivity	.368	.122	.530
Irresponsibility	.305	.513	.107

Note. Factor loadings $\geq |.40|$ are in boldface. IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); ESI = Externalizing Spectrum Index (Krueger et al., 2007); PID-5 = Personality Inventory for DSM-5 (Krueger et al., 2012).

TABLE S4. Four-Factor Exploratory Structural Equation Model of the Inventory of Depression and Anxiety Symptoms, Externalizing Spectrum Inventory, and Personality Inventory for DSM-5 Scales

Trait	Factor			
	Internalizing	Externalizing	Impulsivity	Antagonism
ESI				
Alcohol problems	.102	.399	.321	.013
Alcohol use	-.114	.029	.527	-.050
Alienation	.599	-.060	.034	.218
Blame externalization	.436	.166	-.029	.295
Boredom proneness	.586	-.151	.154	.190
Dependability	.046	-.642	-.197	-.244
Destructive aggression	-.020	.708	.011	.183
Empathy	.190	-.795	.014	-.165
Excitement seeking	.034	.078	.618	.255
Fraud	.075	.556	.144	.238
Honesty	.092	-.596	-.127	.000
Impatient urgency	.521	-.109	.327	.206
Irresponsibility	.160	.553	.193	.015
Marijuana problems	.034	.443	.295	-.031
Marijuana use	.075	.136	.531	-.144
Physical aggression	.092	.586	.030	.347
Planful control	-.010	-.439	-.422	.301
Problematic impulsivity	.419	.197	.388	.112
Rebelliousness	.048	.390	.527	.054
Relational aggression	.187	.380	.015	.486
Theft	-.002	.636	.071	.080
IDAS				
Dysphoria	.902	-.088	.081	-.112
Lassitude	.732	-.165	.081	-.004
Insomnia	.585	-.074	.046	.065
Suicidality	.465	.460	.010	-.129
Appetite loss	.466	.073	.027	.021
Ill Temper	.435	.144	.079	.260
Social anxiety	.804	.036	-.102	-.062
Panic	.582	.246	.024	.012
Traumatic intrusions	.579	.110	.012	.071
Well-being	-.358	-.344	.024	.413
PID-5				
Anhedonia	.787	.448	-.148	-.234
Anxiousness	.932	-.168	-.131	-.003
Depressivity	.790	.387	-.028	-.218
Emotional lability	.756	-.075	.036	.077
Hostility	.388	.218	-.008	.493
Perseveration	.773	.062	.041	.085
Rigid perfectionism	.467	-.007	-.241	.359
Separation insecurity	.654	.029	.053	.034
Submissiveness	.586	-.062	-.023	.001
Suspiciousness	.513	.180	-.107	.236
Withdrawal	.626	.327	-.250	.057
Attention seeking	.131	-.027	.283	.455
Callousness	.028	.744	-.030	.391
Deceitfulness	.206	.387	.113	.447
Grandiosity	-.011	.305	-.036	.584
Manipulativeness	.068	.158	.195	.578
Intimacy avoidance	.290	.490	-.142	.004
Restricted affectivity	.223	.305	-.096	.259
Distractibility	.752	.002	.213	-.080
Eccentricity	.625	.014	.159	.065
Perceptual dysregulation	.578	.311	.072	.080
Risk taking	-.189	-.003	.728	.199
Unusual beliefs	.362	.274	.031	.221
Impulsivity	.320	.089	.548	.080
Irresponsibility	.347	.538	.225	.065

Note. Factor loadings $\geq |.40|$ are in boldface. IDAS = Inventory of Depression and Anxiety Symptoms (Watson et al., 2007); ESI = Externalizing Spectrum Index (Krueger et al., 2007); PID-5 = Personality Inventory for DSM-5 (Krueger et al., 2012).