# Initial Interpretation and Evaluation of a Profile-Based Classification System for the Anxiety and Mood Disorders: Incremental Validity Compared to *DSM–IV* Categories

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Limitations in anxiety and mood disorder diagnostic reliability and validity due to the categorical approach to classification used by the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) have been long recognized. Although these limitations have led researchers to forward alternative classification schemes, few have been empirically evaluated. In a sample of 1,218 outpatients with anxiety and mood disorders, the present study examined the validity of Brown and Barlow's (2009) proposal to classify the anxiety and mood disorders using an integrated dimensional-categorical approach based on transdiagnostic emotional disorder vulnerabilities and phenotypes. Latent class analyses of 7 transdiagnostic dimensional indicators suggested that a 6-class (i.e., profile) solution provided the best model fit and was the most conceptually interpretable. Interpretation of the classes was further supported when compared with *DSM* diagnoses (i.e., within-class prevalence of diagnoses, using diagnoses to predict class membership). In addition, hierarchical multiple regression models were used to demonstrate the incremental validity of the profiles; class probabilities consistently accounted for unique variance in anxiety and mood disorder outcomes above and beyond *DSM* diagnoses. These results provide support for the potential development and utility of a hybrid dimensional-categorical profile approach to anxiety and mood disorder classification. In particular, the availability of dimensional indicators and corresponding profiles may serve as a useful complement to *DSM* diagnoses for both researchers and clinicians.

*Keywords:* anxiety and mood disorders, dimensional-categorical classification, hybrid classification, latent class analysis

The *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) anxiety and mood disorders (collectively referred to here as *emotional disorders*; Barlow, 2002; Brown, Di Nardo, Lehman, & Campbell, 2001) have undergone extensive changes over the years in order to improve diagnostic reliability and validity. Although favorable diagnostic reliability was largely achieved by *DSM–IV* (American Psychiatric Association, 1994; Brown, Di Nardo, et al., 2001; Janca et al., 1995), several limitations in reliability and validity persist because of *DSM*'s categorical approach to classification. For example, Brown, Di Nardo, et al. (2001) discussed how diagnostic unreliability may occur when clinicians disagree in

(a) applying categorical thresholds to constructs that may actually be continuous in nature (e.g., deciding if a disorder is present or not) and (b) making differential diagnosis decisions because of transdiagnostic phenotypes that are shared across *DSM* categories (e.g., deciding if panic attacks/avoidance are due to panic disorder with or without agoraphobia [PDA], social phobia [SOC], or a specific phobia [SPEC]). In regard to diagnostic validity, high rates of not otherwise specified diagnoses (e.g., falling one symptom short of a diagnosis; Widiger & Samuel, 2005) and taxometric studies (e.g., Ruscio, 2010; Ruscio, Borkovec, & Ruscio, 2001; Ruscio & Ruscio, 2002) suggest that anxiety and depressive disorders may be best conceptualized as dimensional constructs. Moreover, high rates of emotional disorder comorbidity (Brown, Campbell, Lehman, Grisham, & Mancill, 2001) have led some to suggest that *DSM* may excessively discriminate symptoms that actually reflect shared (i.e., transdiagnostic) phenotypes (Andrews, 1996). Along these lines, recently developed treatments focus on transdiagnostic cognitive and behavioral responses shared across disorders (e.g., avoidance, thinking errors) rather than disorder-specific symptoms (Barlow et al., 2011).

Although problems with the reliability and validity inherent to categorical diagnoses are ubiquitous throughout *DSM,* it is equally important to recognize the clinical utility of diagnostic categories (see First, 2005; Shedler et al., 2010). Practitioners typically communicate with one another and make treatment decisions on the basis of diagnostic categories, not dimensions. Likewise, managed health care is accustomed to deciding on coverage and reimburse-

ment based on the presence of a categorical diagnostic code. In other words, although a purely dimensional approach to classifying psychopathology is empirically robust, many clinicians would consider it to be premature to adopt such an approach. As a result, emphasis has been placed on developing hybrid systems that utilize both dimensional and categorical components (Maser et al., 2009; Morey et al., 2012; Trull, 2012; Trull & Widiger, 2008). Hybrid approaches offer advantages over purely dimensional (e.g., a list of scores with no descriptive label) or purely categorical classification (e.g., a descriptive label with no indication of severity) by appreciating the continuous nature of psychopathological constructs as well as the clinical necessity of diagnostic categories. For example, Section III of *DSM–5* (American Psychiatric Association, 2013) outlines an alternative model for classifying the personality disorders in which clinicians can diagnose six disorders based on relative elevations across an array of different personality traits (i.e., profiles). Moreover, several studies have used mixture modeling to evaluate integrative classification approaches by identifying latent classes (i.e., empirically derived categories) that underlie a broad spectrum of dimensional indicators (e.g., severity of eating/body-image concerns: Eddy et al., 2010; personality traits: Eaton, Krueger, South, Simms, & Clark, 2011). In addition to promoting the more immediate integration of hybrid approaches to classification, such research may also serve as a useful catalyst for the eventual movement toward purely dimensional approaches to classification.

## Profile-Based Anxiety and Mood Classification

Although it has yet to be evaluated, Brown and Barlow (2009) recently proposed a dimensional-categorical approach to anxiety and mood classification in which dimensions are plotted into a profile and subsequently dichotomized into a class (i.e., profile type) using statistically identified cutpoints (e.g., via mixture modeling). Identifying psychopathology categories in this manner is much different than the approach used by *DSM* (i.e., diagnoses defined by imposing an expert consensus cutpoint for total number of dichotomous symptoms). In particular, the Brown and Barlow model emphasizes the empirical and clinical utility of a profile approach that integrates multiple transdiagnostic dimensions. First, two genetically based dimensions of temperament/personality are included: *neurotic temperament* (NT; e.g., neuroticism, behavioral inhibition) and *positive temperament* (PT; e.g., extraversion, behavioral activation). In addition to being highlighted in *DSM–5,* NT and PT have also been underscored in several prominent conceptual models as important factors in predicting the etiology and maintenance of anxiety and mood disorders (e.g., Barlow's triple vulnerabilities theory: Barlow 2002; Clark and Watson's tripartite model: L. A. Clark, Watson, & Mineka, 1994). Indeed, a robust literature has accumulated in support of the importance of NT and PT in the onset (Kendler, Kuhn, & Prescott, 2004), severity (Brown, Chorpita, & Barlow, 1998), and course (Brown, 2007; Kasch, Rottenberg, Arnow, & Gotlib, 2002; Naragon-Gainey, Gallagher, & Brown, 2013; Rosellini, Fairholme, & Brown, 2011) of several anxiety and mood disorders. Collectively, this literature suggests that high NT is associated with the development and maintenance of all emotional disorders, whereas PT is uniquely inversely related to SOC and unipolar depression (DEP).

Although the literature on NT and PT could be used to justify a profile approach to classification based solely on these dimensions, this approach would be too broad for practical use. For example, although a patient with high NT and low PT could presumably have DEP or SOC, additional assessment would be required to obtain a nuanced understanding of the patient's specific treatment needs (e.g., NT and PT cannot distinguish relative severity of DEP vs. SOC). Accordingly, Brown and Barlow's (2009) profile approach also includes several transdiagnostic emotional disorder phenotypes that balance diagnostic parsimony and specificity. For example, in addition to high rates of comorbidity between depressive and anxiety disorders (Brown, Campbell, et al., 2001), consideration of *depressed mood* is necessary in safety planning as it has been positively associated with suicide-related outcomes (Uebelacker, Strong, Weinstock, & Miller, 2010). Although (uncued) panic attacks are the defining feature of PDA, elevated *autonomic arousal* may also occur in posttraumatic stress disorder (PTSD; Brown & McNiff, 2009) and several other emotional disorders (i.e., panic due to worry, obsessions, social situations; see *DSM–5*). *Somatic anxiety* may be most salient to hypochondriasis but is also related to PDA (e.g., cardiac concerns; D. M. Clark, 1986), obsessive-compulsive disorder (OCD; e.g., contamination concerns; Abramowitz, Brigidi, & Foa, 1999), and generalized anxiety disorder (GAD; e.g., diffuse worries including health; Lee, Ma, & Tsang, 2011). Both *DSM* and research suggest that *intrusive cognitions* (thoughts and images) are shared by PTSD, OCD, and GAD (Shipherd & Salters-Pedneault, 2008; Tallis, 1999). *Social evaluation concerns* have been found across the spectrum of anxiety disorders (i.e., most obviously SOC, but also GAD, PTSD, and PDA; Adkins, Weathers, McDevitt-Murphy, & Daniels, 2008; Rapee, Sanderson, & Barlow, 1988).

In addition to appreciating the clinical necessity of diagnostic categories, adopting a profile approach such as Brown and Barlow's (2009) would address several of the limitations in reliability and validity that stem from *DSM*'s categorical system. For example, the use of dimensional profile indicators could reduce diagnostic unreliability due to threshold disagreements because fewer decisions would be made surrounding the presence/absence of a symptom/criterion; information pertaining to indicator severity could always be included in an individual's profile. Utilization of dimensional indicators would also increase diagnostic validity by recognizing the plethora of studies that have supported the dimensional (rather than categorical) nature of emotional disorder constructs. Including profile indicators that cut across several of the current emotional disorder categories may also increase diagnostic reliability and validity. For instance, rather than assigning a diagnosis of panic disorder, hypochondriasis, or both, a patient reporting recent out-of-the-blue panic attacks, lifelong worry about heart disease that triggers panic attacks, and reassurance-seeking behaviors (e.g., going to the emergency room when having cued and uncued attacks) could be characterized by a single profile type with elevated levels of autonomic surges and somatic anxiety. Use of a profile approach based on shared emotional disorder features could reduce such unreliability due to differential diagnosis decisions (e.g., no longer having to decide to assign panic disorder, hypochondriasis, or both) as well improve discriminant validity (e.g., the autonomic surges/somatic anxiety profile characterizes the shared underlying processes rather than splitting the features into diagnoses of panic disorder and hypochondriasis).

## Present Study

A significant amount of research is needed before a profile approach to anxiety and mood disorder classification could be feasibly implemented (cf. the hybrid approach to personality diagnoses being relegated to Section III in *DSM–5*). Accordingly, the goal of the present study was to provide an initial evaluation of a profile-based approach to classification using empirically identified shared emotional disorder vulnerability and phenotype dimensions (i.e., a follow-up empirical study of Brown & Barlow, 2009). The profiles were developed in a sample of outpatients with anxiety and depressive disorders using a subset of the transdiagnostic dimensions presented by Brown and Barlow (2009): NT, PT, depressed mood, autonomic arousal, somatic anxiety, social evaluation concerns, and intrusive cognitions. Although it was hypothesized that individuals would be grouped into several different interpretable profile types, the exploratory nature of the present study precluded specific predictions about the types of profiles that would be derived. Nonetheless, it was hypothesized that the derived classes would demonstrate incremental validity over *DSM–IV* nosology.

## Method

The sample consisted of 1,218 adults seeking treatment at a large emotional disorder outpatient treatment clinic located in the northeast. The sample was predominately female (60.0%), Caucasian (88.7%), and of non-Hispanic ethnicity (93.9%), with smaller percentages identifying as African American (4.9%) and Asian (5.7%). The average age was 32.14 years ($SD = 11.99$, range = 18–87). Individuals were assessed by doctoral students or doctoral-level clinical psychologists using the Anxiety Disorders Interview Schedule: Lifetime Version (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994). The ADIS-IV-L is a semistructured interview that assesses *DSM–IV* anxiety, mood, somatoform, and substance use disorders and also includes prompts that screen for the presence of other disorders (e.g., psychosis). The ADIS-IV-L has been shown to demonstrate good-to-excellent reliability for the majority of anxiety and mood disorders (Brown, Di Nardo, et al., 2001). Rates of the most common disorders were SOC (46.8%), GAD (32.6%), DEP (i.e., major depression, dysthymia, depressive disorder not otherwise specified; 30.4%), PDA (25.6%), SPEC (14.2%), and OCD (14.0%). Study exclusionary criteria included current suicidal/homicidal intent and/or plan, psychotic symptoms, or significant cognitive impairment (e.g., dementia, mental retardation).

### Measures

A combination of self-report measures and clinician ratings were used to develop the profiles and evaluate their validity. Questionnaires included several well-validated measures of emotional disorder vulnerabilities and transdiagnostic phenotypes that were completed prior to the diagnostic interview. Clinician ratings were made during and immediately after administration of the ADIS-IV-L. During the clinical interview, diagnosticians made dimensional ratings for key disorder features assessed by the ADIS-IV-L. Following ADIS-IV-L administration, diagnosticians made additional ratings for specific *DSM* disorder criteria. These

ratings were obtained regardless of presenting difficulties or if the disorder was actually assigned at a clinical level.

### Indicators Used in the Latent Profile Analysis

Self-report measures were used as indicators in the profile analysis because (a) clinician-rated measures were not available for all constructs of interest (e.g., temperament) and (b) a profile approach to emotional disorder classification would likely require a self-reported assessment in order to avoid excessive clinician time demands (e.g., a complete profile would preclude a partial assessment or skip-out of any dimension; Brown & Barlow, 2009). Measures were selected on the basis of their psychometric properties and ability to broadly assess the profile constructs of interest; if multiple self-report data were available for a particular indicator, the scale with the largest number of nonredundant items was used. Six questionnaires were used to assess the seven latent profile indicators (coefficient alphas are in parentheses): (a) NT and PT—the 20-item Behavioral Inhibition/Activation Scales (BIS/BAS; Carver & White, 1994) were used to represent NT (BIS, $\alpha$ = .73) and PT (BAS, $\alpha$ = .84) because they are believed to assess trait levels of NT and PT and have been associated with reduced susceptibility to mood-state distortion compared to other available temperament/personality questionnaires (Brown, 2007), (b) depressed mood (DM)—the 10-item Cognitive/Affective factor of the Beck Depression Inventory-II (BDI; Beck & Steer, 1996) was used because of its unique relationship with unipolar DEP (BDI total score includes somatic items that could overlap with other indicators; Brown, 2007; Brown et al., 1998) and offered the broadest assessment of DM relative to other self-report data that were available ($\alpha$ = .88), (c) autonomic arousal (AA)—the 21-item Beck Anxiety Inventory (BAI; Beck & Steer, 1990) has been previously used as an indicator of AA (Brown et al., 1998; Brown & McNiff, 2009) and was used here because it offered the broadest assessment of AA relative to other self-report data that were available ($\alpha$ = .93), (d) somatic anxiety (SOM)—the eight-item Physical Concerns subscale of the Anxiety Sensitivity Index (ASI-P; Peterson & Reiss, 1992) was used because it has been shown to be uniquely related to disorders characterized by high SOM (e.g., PDA, hypochondriasis; Otto, Pollack, Sachs, & Rosenbaum, 1992; Zinbarg, Brown, Barlow, & Rapee, 2001) and was the only self-report measure of SOM available ($\alpha$ = .88), (e) intrusive cognitions (IC)—the four-item Obsessing scale of the Revised Obsessive-Compulsive Inventory (OCI-O; Foa et al., 2002) was used because it has been associated with several disorders characterized by intrusive thoughts/images (Abramowitz & Deacon, 2006) and offered the broadest assessment of IC relative to other self-report data that were available ($\alpha$ = .84), and (f) social evaluation concerns (SEC)—the 20-item Social Interaction Anxiety Scale (SIAS; Mattick, Peters, & Clarke, 1989) was used because it is uniquely related to disorders characterized by high SEC (Safren, Turk, & Heimberg, 1998) and offered the broadest assessment of SEC relative to other self-report data that were available ($\alpha$ = .96). The unidimensional structure of each profile indicator has strong psychometric support in similar clinical samples (BIS/BAS: Campbell-Sills, Liverant, & Brown, 2004; BDI: Quilty, Zhang, & Bagby, 2010; BAI: Joiner et al., 1999; ASI: Zinbarg, Barlow, & Brown, 1997, OCI: Abramowitz & Deacon, 2006; SIAS: Safren et al., 1998).

## Predictors in the Incremental Validity Analyses

After selecting the final profile solution, conditional class probabilities estimated for each participant were used to evaluate the incremental validity of the profiles compared to *DSM–IV* diagnoses (established using the ADIS-IV-L).

## Incremental Validity Outcomes

Incremental validity outcomes were selected based on their purported associations with the most prevalent *DSM–IV* diagnoses in the sample; outcomes were used if expected to be strongly predicted by diagnoses of PDA (e.g., panic symptoms, situational avoidance), SOC (e.g., social avoidance), GAD (e.g., worry), OCD (e.g., obsessions/compulsions), or DEP (e.g., depressed mood). This approach was used because the incremental validity analyses aimed to test the ability of the profiles to predict anxiety and mood disorder outcomes above and beyond *DSM–IV* diagnoses. When possible, both clinician-rated and self-reported outcomes were evaluated.

**Clinician ratings.** The ADIS-IV-L requires interviewers to provide a number of reliable (Brown, Di Nardo, et al., 2001) dimensional ratings for *DSM–IV* criteria and associated features of various anxiety and depressive disorders using 0–8 Likert-type scales (anchors vary by section). Several ratings were used as dependent variables in the incremental validity analyses (multi-item outcomes were scored as sum composites): (a) ADIS-Agoraphobia—avoidance ratings for the 22 situations included in the agoraphobia section (e.g., driving, crowds, elevators; $\alpha = .92$), (b) ADIS-Social Avoidance—avoidance ratings for the 13 situations included in the SOC section (e.g., presentations, initiating/maintaining conversations with others; $\alpha = .90$), (c) ADIS-Obsessions/Compulsions—fear/distress ratings for nine forms of obsessive thoughts (e.g., contamination fears, intrusive images) combined with the frequency ratings for six common compulsions (e.g., washing, counting) included in the OCD section ($\alpha = .82$), (d) ADIS-Depression—severity ratings for the nine symptoms of major depression and seven symptoms of dysthymia ($\alpha = .92$), (e) ADIS-Panic—rating for the *DSM–IV* recurrent/unexpected panic attack criterion of PDA (single rating), and (f) ADIS-Worry—rating for the *DSM–IV* excessive/uncontrollable worry criterion of GAD (single rating).

**Self-report questionnaires.** The Depression ($\alpha = .92$) and Anxiety ($\alpha = .82$) subscales of the 21-item Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995), and the Social ($\alpha = .91$) and Agoraphobia ($\alpha = .86$) subscales of the Albany Panic and Phobia Questionnaire (APPQ; Rapee, Craske, & Barlow, 1994) were also used to evaluate the incremental validity of the profiles. The factor structure, reliability, and validity of the DASS (Brown, Chorpita, Korotitsch, & Barlow, 1997) and APPQ (Brown, White, & Barlow, 2005) have been supported in similar samples.

## Data Analysis

Latent profile analyses (LPAs) were conducted in Mplus 7.1 (Muthén & Muthén, 1998–2013). Competing solutions were compared on model fit and conceptual interpretability of the derived profile types. Fit statistics under consideration included the log-likelihood, Akaike information criteria (AIC), Bayes information criteria (BIC), entropy, and Lo-Mendell-Rubin adjusted likelihood ratio test (LMR). The literature suggests choosing a solution with smaller values of log-likelihood, AIC, and BIC; higher entropy; and nonsignificant LMR (Kline, 2005; Lo, Mendell, & Rubin, 2001; Raftery, 1995). BIC and LMR were prioritized given evidence they are the most robust parameters of LPA model fit (Nylund, Asparouhov, & Muthén, 2007).

## Results

## Latent Profile Analyses

LPA solutions ranging from two to 14 classes were evaluated (see Table 1).[1] The six-class solution was ultimately determined to be the best fitting model because (a) it was the solution with the largest number of classes while still having a significant LMR value, (b) BIC values began to plateau in models specified to have six or more classes (model fit may not be substantively improved if the BIC is reduced by roughly 10 points or fewer when adding an additional class; Raftery, 1995), and (c) it was the solution with the most interpretable profile types.[2] The mean probabilities of class membership suggested adequate discriminant among the classes: 85% for Class 1, 77% for Class 2, 75% for Class 3, 80% for Class 4, 85% for Class 5, and 77% for Class 6. In order to foster interpretability (because of different indicator metrics), indicator means within each class were converted to T scores and plotted into visual profiles (see Figure 1). The six classes were labeled

1. *Negligible-Mild* (NEG-MLD) because of below-average (i.e., subclinical) scores across all seven indicators (lowest T score = NT [32.42]; highest T score = PT [51.76]);

2. *Panic-Somatic* (PAN-SOM) because of elevations on AA (62.08) and SOM (58.90);

3. *Social Depressed* (SEC-DM) because of elevations on NT (54.46), DM (58.10), and SEC (57.77) and low levels of PT (42.74);

4. *Mildly Neurotic* because of average levels of NT (50.35) and PT (50.99) and below-average scores on the remaining five indicators (T score range = 44.68–48.29; i.e., the present sample mean for NT would reflect mildly elevated NT in a nonclinical population);

5. *Severe-Comorbid* (SEV-COM) because of below average PT (46.17) and high NT, DM, AA, SOM, SEC, and IC (T score range = 56.91–66.29; pathological levels across all seven indicators); and

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[1] Bootstrap likelihood ratio tests (BLRTs) were also estimated for all 13 solutions as it is sometimes recommended to select the largest class solution with a significant BLRT (McLachlan & Peel, 2000). Although we intended to present BLRT values in text and Table 1, we opted against doing so because this test statistics remained significant at $p < .001$ across all 13 solutions, thus making this goodness-of-fit statistic uninterpretable.

[2] For example, although the 11-class solution had the lowest BIC value, visual examination of the corresponding profiles revealed that several of the classes were characterized by nonpathological elevations across all seven indicators.

Table 1
*Fit Statistics for Latent Profile Analyses*

| Model | Log-likelihood | BIC | Adj. BIC | AIC | Entropy | LMR |
|---|---|---|---|---|---|---|
| 2 class | −20,709.26 | 41,574.83 | 41,504.95 | 41,462.52 | .65 | .00 |
| 3 class | −20,557.81 | 41,328.77 | 41,233.47 | 41,175.62 | .70 | .11 |
| 4 class | −20,456.51 | 41,183.01 | 41,062.31 | 40,989.02 | .70 | .04 |
| 5 class | −20,381.12 | 41,089.06 | 40,942.95 | 40,854.24 | .70 | .02 |
| **6 class** | **−20,329.68** | **41,043.04** | **40,871.51** | **40,767.37** | **.70** | **.02** |
| 7 class | −20,294.60 | 41,029.71 | 40,832.78 | 40,713.21 | .70 | .67 |
| 8 class | −20,261.69 | 41,020.73 | 40,798.38 | 40,663.39 | .72 | .30 |
| 9 class | −20,224.61 | 41,010.41 | 40,755.65 | 40,605.22 | .74 | .07 |
| 10 class | −20,194.53 | 41,000.08 | 40,726.91 | 40,561.05 | .75 | .55 |
| 11 class | −20,162.21 | 40,992.29 | 40,693.70 | 40,512.42 | .75 | .30 |
| 12 class | −20,133.90 | 40,992.51 | 40,668.52 | 40,471.80 | .74 | .29 |
| 13 class | −20,106.50 | 40,994.54 | 40,645.13 | 40,432.99 | .76 | .20 |
| 14 class | −20,085.30 | 41,008.99 | 40,634.17 | 40,406.60 | .74 | .55 |

*Note.* The bolded solution was determined to be the best fitting and most interpretable. BIC = Bayesian information criterion; Adj. BIC = Adjusted Bayesian information criterion; AIC = Akaike information criterion; LMR = Lo-Mendell-Rubin adjusted likelihood ratio test *p* value.

6. *Obsessed-Worried* (OBS-WOR) because of slightly elevated levels of NT (53.75) and DM (53.73) and a larger elevation on IC (63.46).[3]
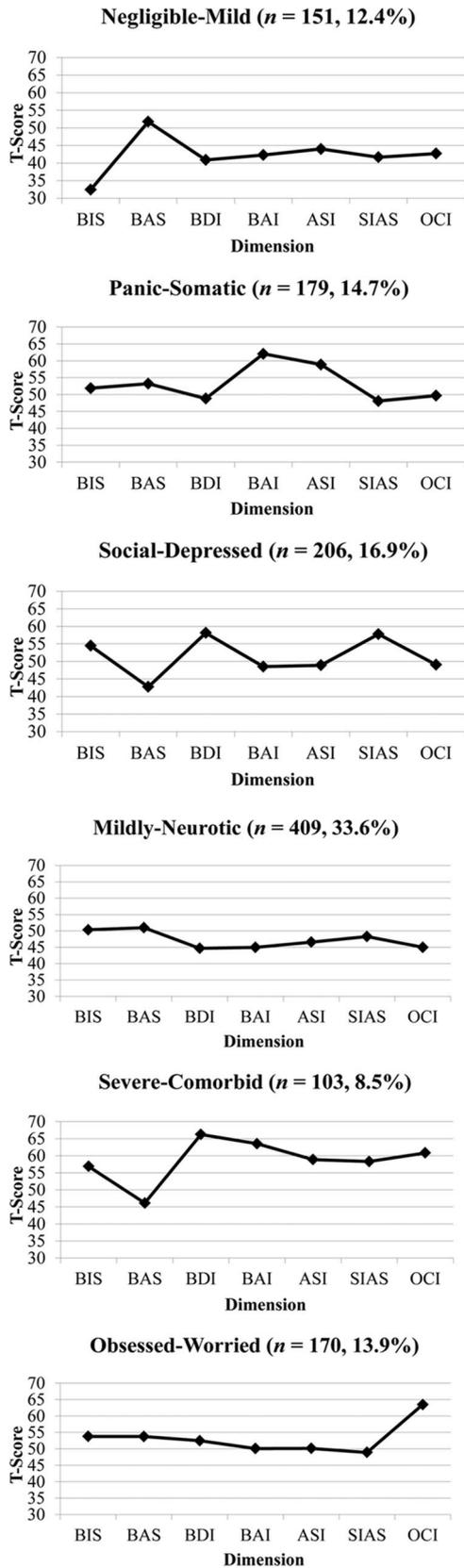
## Profile Interpretation Using *DSM–IV* Diagnosis

In order to further interpret the nature of the classes, their associations with seven *DSM–IV* diagnoses were evaluated (PDA, SOC, SPEC, GAD, OCD, PTSD, and DEP). First, data pertaining to most-likely class membership were linked to *DSM* diagnoses, and cross-tabs were used to evaluate the extent to which the seven *DSM–IV* diagnoses were represented within the six profile types (see Table 2). Overall, the profile types demonstrated concordance with *DSM* diagnoses in many ways. For example, whereas PDA was the most represented diagnosis in the PAN-SOM class (i.e., 55.7% of individuals in this class carried a PDA diagnosis, compared to 25.6% of the total sample carrying a PDA diagnosis), SOC (76%) and DEP (58.7%) were the most prevalent diagnoses among individuals classified into the SEC-DM profile type (vs. 46.8% and 30.4% of the total sample having SOC or DEP diagnoses, respectively).

Because data pertaining to most likely class membership do not account for the degree of classification uncertainty, the profile types were further evaluated by regressing the latent classes onto *DSM* diagnoses using the three-step approach available in Mplus 7.1. This method involves estimating the latent class model (Step 1), creating a variable that represents most-likely class membership (Step 2), and entering covariates into the model while also adjusting for classification uncertainty (Step 3). Whereas the one-step approach (i.e., regressing covariates onto the latent classes in Step 1) causes alterations in the structure of the latent classes because covariates are treated as class indicators, the three-step approach performs equally well without affecting class structure (Asparouhov & Muthén, 2012). Separate models were evaluated specifying each latent class as the reference class. Results from these multinomial logistic regressions (see Table 3) overwhelmingly found that *DSM–IV* diagnoses were associated with significantly increased odds of being classified by a convergent profile type. For example, individuals with PDA were significantly more

likely to be classified by PAN-SOM compared to NEG-MLD (odds ratio [OR] = 9.35), SEC-DM (OR = 7.25), MLD-NRT (OR = 23.88), and OBS-WOR (OR = 14.41).

## Incremental Validity of the Profiles

Hierarchical regression models were used to examine if the posterior probabilities of class membership uniquely predicted variance in relevant anxiety and depressive disorder outcomes while controlling for *DSM–IV* diagnoses that were expected to strongly predict the outcomes of interest. Outcomes included self-report and clinician-rated measures of panic, agoraphobia, social anxiety, obsessions/compulsions, worry, and depression. Whereas *DSM–IV* diagnoses were entered in Step 1, conditional class probabilities for profile types most likely to be related to the particular outcome were entered in Step 2. For example, diagnoses of PDA, agoraphobia without a history of panic, and PTSD were entered in Step 1 of the two models predicting panic outcomes (i.e., because all three of these disorders are associated with panic-related outcomes; see Brown et al., 1998; Brown & McNiff, 2009), while the conditional probability for PAN-SOM was entered in Step 2 (i.e., because this profile had elevated AA and was thus likely to be associated with panic outcomes). Relatedly, diagnoses of PDA and agoraphobia were entered in Step 1 of the two models predicting situational avoidance (i.e., because PDA and agoraphobia are characterized by avoiding situations associated with panic-like symptoms) and compared to the PAN-SOM conditional probabil-

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[3] In an attempt to replicate the six classes extracted from the total sample, six-class solutions were also estimated in randomly split subsamples. In general, the six classes were visually consistent across the split samples and with the total sample; labels used to describe the classes from the total sample remained applicable. Although there were some differences in the within-class indicator means across the split samples (as expected), they were collectively negligible. That is, although the indicator means differed across samples, characteristic/relative elevations used to label the profiles were consistent. Results of these additional analyses are available by request.

## Negligible-Mild (*n* = 151, 12.4%)



## Panic-Somatic (*n* = 179, 14.7%)



## Social-Depressed (*n* = 206, 16.9%)



## Mildly-Neurotic (*n* = 409, 33.6%)



## Severe-Comorbid (*n* = 103, 8.5%)



## Obsessed-Worried (*n* = 170, 13.9%)



ity (entered in Step 2). Whereas diagnoses of SOC and DEP were entered in Step 1 of the models predicting the two social anxiety and two depression outcomes (i.e., because SOC and DEP are highly comorbid and both are characterized by high NT and low PT; Brown, Campbell, et al., 2001; Brown et al. 1998), the conditional probability for the SEC-DM class was entered in Step 2 (i.e., because this profile had elevated DM and SEC). Finally, diagnoses of GAD and OCD were entered in Step 1 of the models predicting worry and obsessions/compulsions (i.e., because worry and obsessions are not always easily discriminated; Langlois, Freeston, & Ladouceur, 2000), while the OBS-WOR class probability was entered in Step 2 (i.e., because this profile had elevated IC). Importantly, the SEV-COM conditional class probabilities were entered in Step 2 in all of the incremental validity models because this class was associated with elevations across *all* indicators (i.e., the SEV-COM class could potentially account for a significant amount of the variance in any of the outcomes of interest).

Results from the incremental validity hierarchical regression models are presented in Table 4. With the exception of OBS-WOR predicting ADIS-Worry, all of the class probabilities entered in Step 2 demonstrated incremental validity. That is, the class probabilities consistently accounted for a significant proportion of the variance in the anxiety and depression outcomes while controlling for their most closely related *DSM–IV* diagnoses. For example, the PAN-SOM profile type significantly predicted both ADIS-Panic ($B = 0.79$, $p < .01$) and DASS-Anxiety ($B = 7.23$, $p < .001$) while controlling for *DSM–IV* diagnoses of PDA, agoraphobia, and PTSD, as well as both clinician-rated (ADIS-Agoraphobia; $B = 4.07$, $p < .01$) and self-reported (APPQ-Agoraphobia; $B = 9.41$, $p < .001$) agoraphobia severity while controlling for *DSM–IV* diagnoses of PDA and agoraphobia. Similarly, the SEC-DM class probability predicted both clinician ($B = 7.88$, $p < .001$) and self-report ($B = 6.09$, $p < .001$) depression severity while controlling for *DSM–IV* diagnoses of MDD and dysthymia.

## Discussion

### Profile Type Interpretation

In contrast to *DSM*'s polythetic criteria sets and expert-defined cutpoints, the six emotional disorder classes were defined in the present sample using person-centered statistical methods. In other words, it could be argued that the six classes are inherently more valid than *DSM* categories because their cutpoints (i.e., T scores) were empirically derived. Consistent with prior applications of mixture modeling on personality and psychopathology constructs (e.g., Eaton et al., 2011; Eddy et al., 2010), both a negligible (i.e.,

*Figure 1.* Plotted latent profiles from the six-class solution. Indicator means within each profile type were converted to T scores for presentational clarity (i.e., indicators scaled in different metrics). BIS = Behavioral Inhibition Scale; BAS = Behavioral Activation Scale; BDI = Beck Depression Inventory–Cognitive/Affective scale; BAI = Beck Anxiety Inventory; ASI = Anxiety Sensitivity Index–Physical Concerns scale; SIAS = Social Interaction Anxiety Scale; OCI = Obsessive-Compulsive Inventory–Obsessions scale.

Table 2
*Cross-Tabulation of DSM–IV Diagnoses Represented Within Each Profile Type and the Total Sample*

| Diagnosis (% of total sample) | Percentage of diagnosis within profile type | | | | | |
|---|---|---|---|---|---|---|
| | NEG-MLD | PAN-SOM | SEC-DM | MLD-NRT | SEV-COM | OBS-WOR |
| PDA (25.60) | **27.80** | **55.70** | 15.80 | 15.80 | 42.30 | 17.30 |
| SOC (46.80) | **25.00** | **37.20** | **76.00** | **43.30** | **66.00** | **39.30** |
| SPEC (14.20) | **24.30** | 12.60 | 9.20 | **18.10** | 8.20 | 7.10 |
| GAD (32.60) | 16.70 | **37.20** | **50.00** | **35.20** | **60.80** | **57.10** |
| OCD (14.00) | 6.20 | 9.80 | 12.80 | 9.50 | 25.80 | **31.50** |
| PTSD (3.60) | 2.80 | 5.50 | 2.60 | 1.40 | 11.30 | 4.80 |
| DEP (30.40) | 7.60 | 22.40 | **58.70** | 13.00 | **70.10** | 28.60 |

*Note.* The three diagnoses most represented within each profile type are in bold. *DSM–IV = Diagnostic and Statistical Manual of Mental Disorders* (4th ed.); NEG-MLD = negligible-mild; PAN-SOM = panic-somatic; SEC-DM = social-depressed; MLD-NRT = mildly-neurotic; SEV-COM = severe-comorbid; OBS-WOR = obsessed-worried; PDA = panic disorder with or without agoraphobia; SOC = social phobia; SPEC = specific phobia; GAD = generalized anxiety disorder (without adhering to mood disorder hierarchy); OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; DEP = unipolar depression (major depressive disorder or dysthymic disorder).

NEG-MLD; above-average PT and below-average scores across the remaining indicators) and a severe (i.e., SEV-COM; pathological scores across all indicators) class were extracted. Cross-tabulations and multinomial logistic regression models examined as part of the profile interpretation analyses were also consistent with these labels. No diagnosis was overwhelmingly prevalent among individuals in NEG-MLD, and *DSM* disorders were virtually never associated with increased odds of NEG-MLD membership. In contrast, several *DSM* diagnoses were well represented within SEV-COM and *DSM* diagnoses were nearly always associated with increased odds of being classified by SEV-COM. These results indicate that NEG-MLD likely represents individuals with mild or subclinical and noncomorbid PDA, SOC (likely a circumscribed subtype), SPEC, and GAD, while SEV-COM consists of individuals with severe, comorbid, and diffuse emotional disorder symptoms.

SEC-DM was characterized by low PT and elevated NT, SEC, and DM; this profile is in line with structural models suggesting that high NT and low PT are uniquely predictive of SOC and DEP (Brown et al., 1998; Naragon-Gainey et al., 2013), as well as comorbidity studies that have found high rates of SOC and DEP co-occurrence (Brown, Campbell, et al., 2001). Likewise, whereas cross-tabulations indicated that a large proportion of individuals classified by the SEC-DM class had diagnoses of SOC (76%) and DEP (58.7%), multinomial regression models demonstrated that SOC and DEP diagnoses were associated with significantly increased odds of SEC-DM membership. Importantly, SOC was one of the most prevalent diagnoses across all six classes. In addition to being the most common diagnosis in SEC-DM and MLD-NRT, it was the second most common diagnosis in NEG-MLD, PAN-SOM, SEV-COM, and OBS-WOR. The ubiquity of SOC across classes was likely due to SOC being the most common diagnosis in the sample (nearly half of the sample had a SOC diagnosis).

Nonetheless, interpretation analyses also supported the PAN-SOM and OBS-WOR labels. PDA was the most common diagnosis among individuals classified in PAN-SOM, and GAD and OCD

were two of the most represented diagnoses among individual in OBS-WOR. These relations were further supported by results of the multinomial regression models. The findings for OBS-WOR are also in line with research that has suggested conceptual overlap between GAD and OCD (Brown, Dowdall, Côté, & Barlow, 1994), particularly in the form of intrusive thoughts (Tallis, 1999).

Interpretation of the MLD-NRT class was less intuitive; although the indicator T scores were average (for NT and PT) or below average (for the other five indicators), the average NT score in our clinical sample is likely slightly higher than that of the general population (hence labeling this class *mildly neurotic*). SOC, GAD, and SPEC were the most prevalent diagnoses in MLD-NRT; however, only GAD was associated with increased odds of MLD-NRT membership (but only when using NEG-MLD as the reference class). It is plausible that the MLD-NRT class reflects individuals who had slight elevations on a single dimension (i.e., a single disorder?) and were thus better classified by a profile characterized by average scores across dimensions rather than multiple indicator elevations (as seen in PAN-SOM, SEV-COM, SEC-DM, and OBS-WOR).

## Profile Type Incremental Validity

Results from the incremental validity analyses are the first to demonstrate partial but promising support for the utility of a dimensional-categorical approach to the classification of anxiety and depression (i.e., dimensional indicators and empirically derived categorical profile types). In particular, the PAN-SOM, SEC-DM, OBS-WOR, and SEV-COM class probabilities ubiquitously accounted for unique variance in both self-reported and clinician-rated outcomes while controlling for associated dichotomous *DSM–IV* diagnoses. Although the statistical significance of these findings may have been influenced by the study's large sample size (i.e., the study may have been overpowered), it is noteworthy that large effects were observed for certain profile types on some of the outcomes (e.g., incremental validity of the PAN-SOM profile type in predicting self-reported panic symptoms). Whereas the largest effects for the profile types were typically limited to

Table 3

*Multinomial Logistic Regression Models of Latent Profiles on DSM–IV Diagnoses*

| Comparison class | Predictor | NEG-MLD B | OR | PAN-SOM B | OR | SEC-DM B | OR | MLD-NRT B | OR | OBS-WOR B | OR | SEV-COM B | OR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEG-MLD | PDA | | | −2.24*** | 0.11 | −0.25 | 0.78 | 0.94* | 2.55 | 0.43 | 1.54 | −2.03*** | 0.13 |
| | GAD | | | −1.14** | 0.32 | −1.47* | 0.23 | −1.37*** | 0.25 | −2.49*** | 0.08 | −1.99*** | 0.14 |
| | SPEC | | | 0.02 | 1.02 | 0.72 | 2.06 | 0.25 | 1.28 | 1.07* | 2.90 | 0.64 | 1.89 |
| | SOC | | | −1.46*** | 0.23 | −3.43*** | 0.03 | −0.85** | 0.43 | −0.85* | 0.43 | −2.92*** | 0.05 |
| | PTSD | | | −0.78 | 0.46 | 2.36 | 10.61 | 1.98 | 7.24 | 0.27 | 1.31 | −0.45 | 0.64 |
| | OCD | | | −1.18 | 0.31 | −1.32 | 0.27 | −0.79 | 0.45 | −2.82*** | 0.06 | −2.61*** | 0.07 |
| | DEP | | | −1.29* | 0.27 | −3.59*** | 0.03 | −0.12 | 0.88 | −1.19* | 0.31 | −3.81*** | 0.02 |
| PAN-SOM | PDA | 2.24*** | 9.35 | | | 1.98*** | 7.25 | 3.17*** | 23.88 | 2.67*** | 14.41 | 0.21 | 1.23 |
| | GAD | 1.14** | 3.14 | | | −0.33 | 0.72 | −0.23 | 0.79 | −1.35** | 0.26 | −0.84* | 0.43 |
| | SPEC | −0.02 | 0.98 | | | 0.70 | 2.02 | 0.23 | 1.25 | 1.05 | 2.85 | 0.62 | 1.86 |
| | SOC | 1.46*** | 4.30 | | | −1.98*** | 0.14 | 0.61 | 1.84 | 0.61 | 1.84 | −1.46** | 0.23 |
| | PTSD | 0.78 | 2.18 | | | 3.14 | 23.15 | 2.76* | 15.78 | 1.05 | 2.85 | 0.33 | 1.39 |
| | OCD | 1.18 | 3.26 | | | −0.14 | 0.87 | 0.39 | 1.48 | −1.64** | 0.19 | −1.42* | 0.24 |
| | DEP | 1.29* | 3.65 | | | −2.29*** | 0.10 | 1.17* | 3.22 | 0.11 | 1.11 | −2.52*** | 0.08 |
| SEC-DM | PDA | 0.25 | 1.29 | −1.98*** | 0.14 | | | 1.19* | 3.29 | 0.69 | 1.99 | −1.77*** | 0.17 |
| | GAD | 1.47** | 4.35 | 0.33 | 1.39 | | | 0.10 | 1.10 | −1.02* | 0.36 | −0.52 | 0.60 |
| | SPEC | −0.72 | 0.49 | −0.70 | 0.50 | | | −0.48 | 0.62 | 0.34 | 1.41 | −0.08 | 0.92 |
| | SOC | 3.43*** | 30.97 | 1.98*** | 7.21 | | | 2.59*** | 13.26 | 2.58*** | 13.25 | 0.51 | 1.67 |
| | PTSD | −2.36 | 0.09 | −3.14 | 0.04 | | | −0.38 | 0.68 | −2.09 | 0.12 | −2.81 | 0.06 |
| | OCD | 1.32 | 3.75 | 0.14 | 1.15 | | | 0.53 | 1.70 | −1.50** | 0.22 | −1.28** | 0.28 |
| | DEP | 3.59*** | 36.05 | 2.29*** | 9.88 | | | 3.46*** | 31.88 | 2.40*** | 11.00 | −0.23 | 0.80 |
| MLD-NRT | PDA | −0.94* | 0.39 | −3.17*** | 0.04 | −1.19* | 0.30 | | | −0.51 | 0.60 | −2.97*** | 0.05 |
| | GAD | 1.37*** | 3.95 | 0.23 | 1.26 | −0.10 | 0.91 | | | −1.12*** | 0.33 | −0.61 | 0.54 |
| | SPEC | −0.25 | 0.78 | −0.23 | 0.80 | 0.48 | 1.61 | | | 0.82 | 2.27 | 0.39 | 1.48 |
| | SOC | 0.85** | 2.33 | −0.61 | 0.54 | −2.59*** | 0.08 | | | 0.00 | 1.00 | −2.07*** | 0.13 |
| | PTSD | −1.98 | 0.14 | −2.76* | 0.06 | 0.38 | 1.47 | | | −1.71 | 0.18 | −2.43 | 0.09 |
| | OCD | 0.79 | 2.20 | −0.39 | 0.68 | −0.53 | 0.59 | | | −2.03*** | 0.13 | −1.82*** | 0.16 |
| | DEP | 0.12 | 1.13 | −1.17* | 0.31 | −3.46*** | 0.03 | | | −1.06** | 0.35 | −3.69*** | 0.02 |
| OBS-WOR | PDA | −0.43 | 0.65 | −2.67*** | 0.07 | −0.69 | 0.50 | 0.51 | 1.66 | | | −2.46*** | 0.09 |
| | GAD | 2.49*** | 12.10 | 1.35* | 3.86 | 1.02* | 2.78 | 1.12*** | 3.06 | | | 0.51 | 1.66 |
| | SPEC | −1.07* | 0.34 | −1.05 | 0.35 | −0.34 | 0.71 | −0.82 | 0.44 | | | −0.43 | 0.65 |
| | SOC | 0.85* | 2.34 | −0.61 | 0.54 | −2.58*** | 0.08 | 0.00 | 1.00 | | | −2.07*** | 0.13 |
| | PTSD | −0.27 | 0.76 | −1.05 | 0.35 | 2.09 | 8.11 | 1.71 | 5.53 | | | −0.72 | 0.49 |
| | OCD | 2.82*** | 16.83 | 1.64** | 5.16 | 1.50** | 4.49 | 2.03*** | 7.64 | | | 0.22 | 1.24 |
| | DEP | 1.19* | 3.28 | −0.11 | 0.90 | −2.40*** | 0.09 | 1.06** | 2.90 | | | −2.63*** | 0.07 |
| SEV-COM | PDA | 2.03*** | 7.60 | −0.21 | 0.81 | 1.77*** | 5.89 | 2.97*** | 19.41 | 2.46*** | 11.72 | | |
| | GAD | 1.99*** | 7.29 | 0.84* | 2.33 | 0.52 | 1.68 | 0.61 | 1.85 | −0.51 | 0.60 | | |
| | SPEC | −0.64* | 0.53 | −0.62 | 0.54 | 0.08 | 1.09 | −0.39 | 0.68 | 0.43 | 1.53 | | |
| | SOC | 2.92* | 18.52 | 1.46** | 4.31 | −0.51 | 0.60 | 2.07*** | 7.93 | 2.07*** | 7.92 | | |
| | PTSD | 0.45 | 1.57 | −0.33 | 0.72 | 2.81 | 16.66 | 2.43 | 11.36 | 0.72 | 2.05 | | |
| | OCD | 2.61*** | 13.54 | 1.42* | 4.15 | 1.28** | 3.61 | 1.82*** | 6.15 | −0.22 | 0.80 | | |
| | DEP | 3.81* | 45.29 | 2.52*** | 12.42 | 0.23 | 1.26 | 3.69*** | 40.04 | 2.63*** | 13.82 | | |

*Note.* Multinomial logistic regression coefficients were estimated using the three-step procedure available in Mplus Version 7.1, as recommended by Asparouhov and Muthén (2012). A positively signed coefficient indicates that the diagnosis predicted membership in the comparison class. A negatively signed coefficient indicates that the diagnosis predicted membership in the reference class. *DSM–IV = Diagnostic and Statistical Manual of Mental Disorders* (4th ed.); OR = odds ratio; NEG-MLD = negligible-mild; PAN-SOM = panic-somatic; SEC-DM = social-depressed; MLD-NRT = mildly-neurotic; OBS-WOR = obsessed-worried; SEV-COM = severe-comorbid; PDA = panic disorder with or without agoraphobia; GAD = generalized anxiety disorder (no *DSM* hierarchy rule); SPEC = specific phobia; SOC = social phobia; PTSD = posttraumatic stress disorder; OCD = obsessive-compulsive disorder; DEP = unipolar depression (major depressive disorder or dysthymic disorder).
* *p* < .05.   ** *p* < .01.   *** *p* < .001.

those outcomes assessed via self-report, the class probabilities generally had small-to-medium sized effects in predicting clinician-rated outcomes.

Although preliminary, findings from the present study suggest that a hybrid dimensional-categorical approach to anxiety and depression classification may serve as a useful adjunct to the current categorical approach. In particular, the use of *DSM* diag- noses concurrently with dimensional indicators plotted into a visual profile could provide researchers and clinicians with additional information regarding emotional disorder severity and prognosis. The incremental validity analyses suggest that knowledge of a patient's emotional disorder profile may provide clinicians with important knowledge of symptom severity that is not captured solely by *DSM* diagnoses. The extant literature also

Table 4

*Hierarchical Regressions of DSM–IV Diagnoses and Posterior Probabilities of Profile Membership Predicting Emotional Disorder Outcomes*

| Step and predictor variable | $B$ | $SE$ | β | $R^2$ | $f^2$ | $B$ | $SE$ | β | $R^2$ | $f^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Panic o | utcomes | | | | |
| | | ADIS-Pani | c rating | | | | DASS- | Anxiety | | |
| Step 1 | | | | .77*** | 3.35 | | | | .17*** | 0.20 |
| PDA | 4.26*** | 0.07 | .88 | | | 4.13*** | 0.28 | .39 | | |
| AG | 0.33 | 0.24 | .02 | | | 2.23* | 1.01 | .06 | | |
| PTSD | 0.46** | 0.16 | .04 | | | 3.33*** | 0.66 | .13 | | |
| Constant | 0.31*** | 0.04 | | | | 5.04 | 0.15 | | | |
| Step 2 | | | | .78*** | 0.05 | | | | .50*** | 0.66 |
| PAN-SOM | 0.79*** | 0.11 | .10 | | | 7.23*** | 0.37 | .44 | | |
| SEV-COM | 0.42** | 0.12 | .05 | | | 9.40*** | 0.41 | .48 | | |
| Constant | 0.22*** | 0.04 | | | | 3.87*** | 0.12 | | | |
| | | | | | Situational avo | idance outcomes | | | | |
| | | ADIS-Agorap | hobia ratings | | | | APPQ-Ag | oraphobia | | |
| Step 1 | | | | .43*** | 0.75 | | | | .19*** | 0.230 |
| PDA | 24.85*** | 0.84 | .64 | | | 12.58*** | 0.79 | .42 | | |
| AG | 25.50*** | 3.03 | .18 | | | 16.44*** | 2.84 | .15 | | |
| Constant | 1.11* | 0.43 | | | | 11.73*** | 0.40 | | | |
| Step 2 | | | | .45*** | 0.04 | | | | .30*** | 0.16 |
| PAN-SOM | 4.07** | 1.38 | .07 | | | 9.41*** | 1.22 | .20 | | |
| SEV-COM | 9.86*** | 1.55 | .14 | | | 17.43*** | 1.37 | .31 | | |
| Constant | 0.10 | 0.45 | | | | 9.76 | 0.40 | | | |
| | | | | | Social anx | iety outcomes | | | | |
| | | ADIS-Social Av | oidance ratings | | | | APPQ-So | cial Anxiety | | |
| Step 1 | | | | .55*** | 1.22 | | | | .36*** | 0.56 |
| SOC | 24.26*** | 0.67 | .71 | | | 18.81*** | 0.76 | .58 | | |
| DEP | 5.28*** | 0.75 | .14 | | | 4.41*** | 0.84 | .12 | | |
| Constant | 4.83*** | 0.48 | | | | 12.62*** | 0.54 | | | |
| Step 2 | | | | .58*** | 0.07 | | | | .47*** | 0.21 |
| SEC-DM | 11.52*** | 1.29 | .19 | | | 16.08*** | 1.39 | .28 | | |
| SEV-COM | 10.39*** | 1.47 | .14 | | | 20.09*** | 1.59 | .29 | | |
| Constant | 4.12*** | 0.47 | | | | 11.53*** | 0.50 | | | |
| | | | | | Obsessive-compulsiv | e and worry outcomes | | | | |
| | | ADIS-Obsessions/Co | mpulsions ratings | | | | ADIS-Wo | rry rating | | |
| Step 1 | | | | .41*** | 0.69 | | | | .47*** | 0.88 |
| OCD | 8.83*** | 0.31 | .64 | | | 0.25* | 0.12 | .04 | | |
| GAD | 1.02*** | 0.22 | .10 | | | 2.71*** | 0.08 | .69 | | |
| Constant | 1.41*** | 0.15 | | | | 2.41*** | 0.05 | | | |
| Step 2 | | | | .43*** | 0.04 | | | | .48* | 0.02 |
| OBS-WOR | 2.34*** | 0.41 | .13 | | | 0.29 | 0.16 | .04 | | |
| SEV-COM | 1.60*** | 0.45 | .08 | | | 0.34* | 0.17 | .04 | | |
| Constant | 1.16*** | 0.15 | | | | 2.38*** | 0.06 | | | |
| | | | | | Depressio | n outcomes | | | | |
| | | ADIS-Depres | sion ratings | | | | DASS-De | epression | | |
| Step 1 | | | | .51*** | 1.04 | | | | .35*** | 0.54 |
| MDD | 24.11*** | 0.75 | .65 | | | 6.95*** | 0.31 | .53 | | |
| DYS | 15.63*** | 1.61 | .20 | | | 4.66*** | 0.66 | .17 | | |
| SOC | 4.37*** | 0.66 | .14 | | | 1.66*** | 0.27 | .15 | | |
| Constant | 10.67*** | 0.47 | | | | 4.59*** | 0.19 | | | |
| Step 2 | | | | .54*** | 0.07 | | | | .51*** | 0.33 |
| SEC-DM | 7.88*** | 1.27 | .14 | | | 6.09*** | 0.46 | .30 | | |
| SEV-COM | 11.39*** | 1.45 | .17 | | | 9.34*** | 0.52 | .39 | | |
| Constant | 10.08*** | 0.46 | | | | 4.13*** | 0.17 | | | |

*Note.* Class probabilities were used as predictors in Step 2. $R^2$ values refer to effects for the total model, $f^2$ values refer to effects for the specific step. *DSM–IV = Diagnostic and Statistical Manual of Mental Disorders* (4th ed.); ADIS = Anxiety Disorders Interview Schedule; PDA = panic disorder with or without agoraphobia; AG = agoraphobia without a history of panic disorder; PTSD = posttraumatic stress disorder; PAN-SOM = panic-somatic profile type; SEV-COM = severe-comorbid profile type; DASS = Depression Anxiety and Stress Scales; APPQ = Albany Panic and Phobia Questionnaire; SOC = social phobia; DEP = unipolar depression (major depression or dysthymic disorder); SEC-DM = social-depressed profile type; OCD = obsessive-compulsive disorder; GAD = generalized anxiety disorder; OBS-WOR = obsessed-worried profile type; MDD = major depressive disorder; DYS = dysthymic disorder.
* $p < .05$. ** $p < .01$. *** $p < .001$.

suggests that NT and PT predict a more stable temporal course of PDA, SOC, GAD, and DEP (e.g., Brown, 2007; Kasch et al., 2002; Naragon-Gainey et al., 2013; Rosellini et al., 2011). Therefore, information pertaining to levels of NT and PT may also be useful for treatment planning (e.g., identifying who needs more intensive intervention). In contrast, the extent of *DSM* anxiety and depressive disorder comorbidity (e.g., number of diagnoses) does not appear to always predict treatment response (e.g., Allen et al., 2010; Shavitt et al., 2010).

Categorical *DSM* diagnoses are also limited by not providing information pertaining to the relative severity of various emotional disorder phenotypes (e.g., principal/secondary/tertiary diagnoses). The availability of emotional disorder profiles (i.e., knowledge of indicator elevation) could overcome this limitation by providing information regarding the differential severity of various presenting problems that could subsequently be used to develop a hierarchy of treatment targets. In other words, interventions could be prioritized on the basis of elevated T scores (e.g., identifying what types of exposure would be most salient for an individual). In contrast, reliance on *DSM* diagnoses alone can obfuscate a broad understanding of a patient's presenting symptoms (i.e., missing a diagnosis by one symptom, forcing a diagnosis because of differential diagnosis guidelines, neglecting a diagnosis because of hierarchy rules). For example, information pertaining to subthreshold levels of comorbid depression (i.e., slightly elevated DM), somatic worries (i.e., high SOM) within the context of PDA, OCD, or GAD, and intrusive images (i.e., high IC) related to GAD or PDA are not reflected in the diagnostic labels currently used by *DSM*. In contrast, the availability of a visual profile that includes these shared phenotypes could allow clinicians to have a broader knowledge of a patient's presenting problems (e.g., understanding the full expression/foci of a patient's symptoms). Although the clinician acceptability of a hybrid classification system remains an empirical question (cf. Morey, Skodol, & Oldham, 2014), our findings collectively suggest promising clinical utility in assessing the emotional disorder indicators and profile types studied here.

## Limitations, Conclusions, and Future Directions

Although the present study has a number of strengths (e.g., first application of mixture modeling on an array of transdiagnostic dimensions in a large outpatient sample), several limitations must be acknowledged. First, although fairly common for an outpatient clinic specializing in emotional disorders (Dalrymple & Zimmerman, 2011; Sunderland, Carragher, Wong, & Andrews, 2013), the sample was primarily composed of Caucasian females. There are also limitations associated with the treatment-seeking nature of our sample, including the possibility that certain profile types may have been influenced by levels of nonspecific general distress (e.g., mood-state distortion may have obfuscated clearer indicator elevations in the SEV-COM and MLD-NRT classes; Brown, 2007). Thus, in addition to there being a need to replicate the current profile types in more demographically diverse clinical samples, studies in nonclinical (e.g., epidemiological) samples could reveal several additional profile types. For instance, profiles characterized by mild elevations on only one or two dimensions could be extracted within a larger sample that also included nondisordered individuals. In the present sample, these individuals may have been forced into the MLD-NRT class because indicator

elevations were not pronounced/prevalent enough to form a distinct class. A further limitation is that indicators were unavailable for several other transdiagnostic phenotypes that were delineated by Brown and Barlow (2009), including trauma, mania, and avoidance. Had such additional indicators been available, it is possible that additional profile types would have been extracted.

There are also limitations associated with our use of self-reported profile indicators. First, it is possible that response biases may have influenced patient self-reports (e.g., minimized or exaggerated symptom reports). Second, potential method effects were observed between self-reported predictors (LPA indicators) and self-reported outcomes used in the incremental validity analyses; profile probabilities always explained a larger proportion of the variance in self-reported outcomes. Despite these limitations, the conditional class probabilities were still overwhelmingly predictive of the clinician-rated outcomes (i.e., in all but one of the incremental validity models). Nonetheless, future studies may aim to further evaluate the validity of hybrid approaches to emotional disorder classification compared to current *DSM* nomenclature by utilizing diagnoses and outcomes assessed using other self-report measures. Relatedly, additional research is also needed to empirically compare alternative approaches to emotional disorder classification using other units of analysis (e.g., comparing profiles based on the presence/absence of certain polymorphisms).[4]

The six classes derived from the mixture model in the present study may reflect empirically derived prototypes that offer increased validity over *DSM–IV* diagnoses. However, these classes must be replicated using person-centered analytic approaches (e.g., LPA, factor mixture modeling) with data gathered in other clinical and community-based samples. In particular, research should aim to replicate and refine the profiles derived here. For instance, it is possible that the six classes derived in the present study are specific to outpatient clinics specializing in anxiety and depressive disorders, or that only a subset of the six classes might replicate in a similar sample. Additionally, even if six visually similar profiles are replicated in other samples, T scores on individual dimensions may slightly differ (i.e., similar profiles but defined by different cutpoints). Although the generalizability of the classes derived here must be empirically examined prior to the indicators/classes being implemented in clinical practice, our findings nonetheless suggest that the profile approach used here warrants further consideration from classification researchers.

Nonetheless, self-reported assessments of the vulnerability and transdiagnostic phenotype dimensions of interest were successfully used to extract interpretable classes. This is particularly important given that implementation of profile-based classification will likely require self-reported assessment; a full clinical interview assessment of all dimensions of interest would require a significant amount of clinician time (Brown & Barlow, 2009). However, it is also necessary to be cognizant of the burden that would fall on patients if required to complete a disparate array of self-reported assessments in order to ascertain severity of all dimensions of interest (e.g., 116 items from six different question-

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[4] Several more general limitations of the present hybrid dimensional-categorical approach to emotional disorder classification must also be considered. For example, Brown and Barlow's (2009) approach does not include a method of representing past diagnoses, recurrent diagnoses, or the temporal sequencing of specific symptoms.

naires were used to assess the seven indicators of interest here). Accordingly, the implementation of profile approaches to classification will likely eventually require the simultaneous development of psychometrically sound and streamlined multidimensional questionnaires (e.g., assessing all indicators of interest using as few items as possible).

Relatedly, future research is also needed to examine how the dimensions and profile types from the present study relate to a broader spectrum of *DSM* disorders. For example, illness anxiety disorder and somatic symptom disorder might be characterized by elevations on NT, AA, and SOM and be well represented by the PAN-SOM profile. Importantly, however, the expansion of profile approaches to classifying other disorders would likely necessitate the inclusion of additional transdiagnostic dimensions that were not assessed in the present study. For instance, individuals with body dysmorphic disorder or an eating disorder might display heighted levels of NT and IC (i.e., intrusive thoughts and images about their appearance or weight) but would also be characterized by elevations on an additional *body-image concerns* phenotype dimension. Conversely, a profile approach to substance use or impulse control disorder classification might include a more comprehensive assessment of temperament/personality (e.g., NT and PT but also disinhibition and sensation seeking) and several additional phenotype (e.g., anger, deceitfulness, drug/alcohol use) dimensions (Andrews et al., 2009; Markon, 2010). Thus, future studies conducted at specialized treatment facilities are needed in order to clarify (a) how the dimensions and profiles from the present study may relate to disorders that were underrepresented or not assessed in the present sample and (b) what other dimensions should be included in order to derive additional empirically based profile types.

Despite the aforementioned limitations and necessity of additional research, the present study is the first to examine a profile approach to emotional disorder classification. The mixture model solution and subsequent validity analyses provide compelling initial evidence for the potential development and validity of a hybrid dimensional-categorical approach to emotional disorder classification. Although *DSM–5* does not include an alternate hybrid model for anxiety and mood disorder classification, additional research is needed to continue to evaluate the validity and clinical utility of dimensional-categorical approaches to classification. In particular, such research may serve to support the integration of a hybrid model for anxiety and mood disorder classification (e.g., in Section III of *DSM*) and potentially the ultimate adoption of a purely dimensional approach to classification in future editions of *DSM*.

## References

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